Innovative Technology as a Response to the Bird Strike Risk

CTO

Dawid Gradolewski, Ph.D.

dawid.gradolewski@bioseco.com

WBA

Michał Skakuj, Ph.D.

ekoaviation@michalskakuj.com

www.bioseco.com

Bioseco - Genesis

Solution

Challenges of birds protection on wind farms:

Reduction of negative impact to environment.

Authorities expecting viable solution to bird mortality risk.

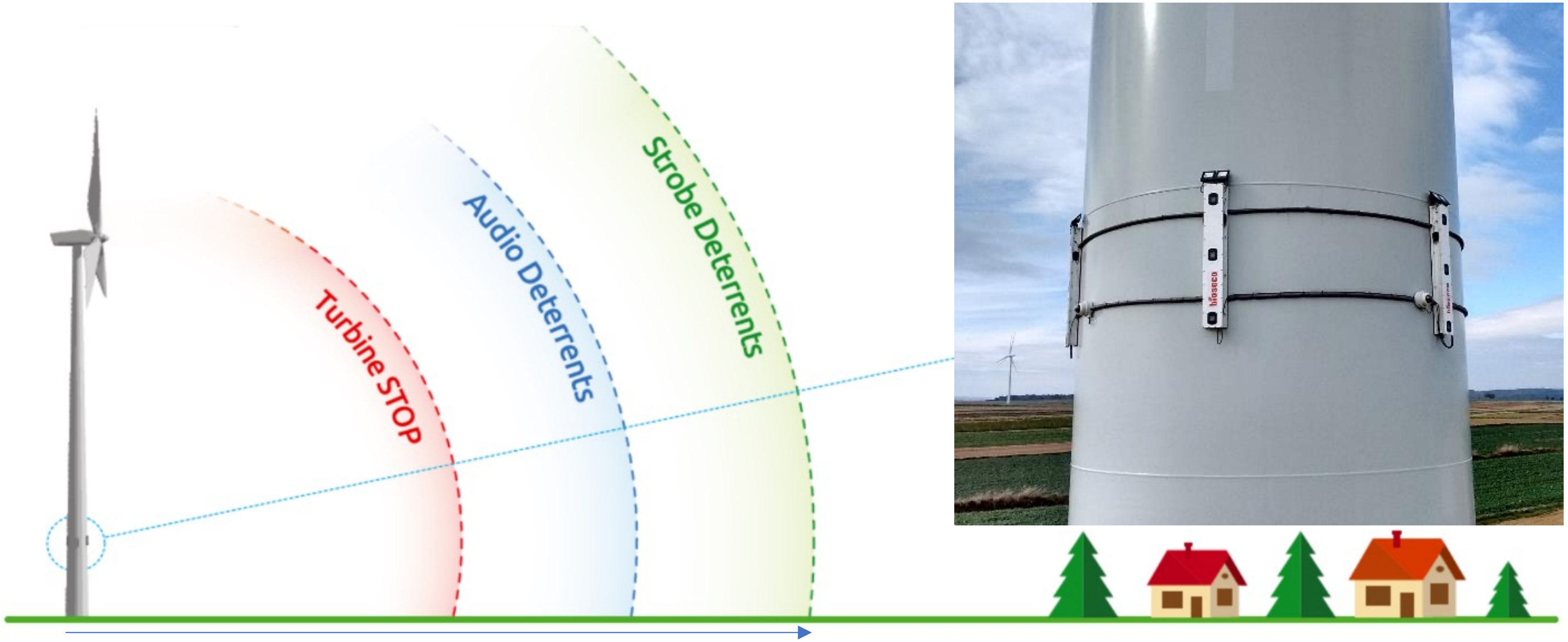
Increased public awareness makes pressure on operators.

Risk of financial penalties or turbine shutdowns.

Bird Protection System - concept

Thanks to use of stereovision Bioseco system allows to estimate the distance to the system and autonomously undertake various action depending on the bird distance and its flight path

Protection area



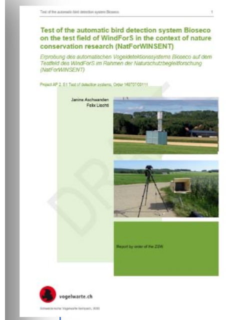
~400-800 m
(detection distance depends on size of birds and BPS versions)

Terrain obstacles

Bird Protection System - implementations

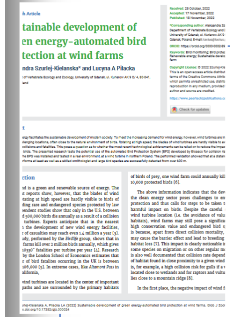
Efficiency proved

System design and validation – scientific approach



"*NatForWINSENT* – Nature Conservation Research at the Wind Energy Test Site„

September – October 2019, 330 LRF track, 4 birds species,



Aleksandra Szurlej-Kielańska,

May – October 2020,
28 observation days, 117 birds

Bio-consult independet tests for PNE.

February – September 2022,
38 observation days, 786 birds detected,
10 063 LRF samples

System design – research

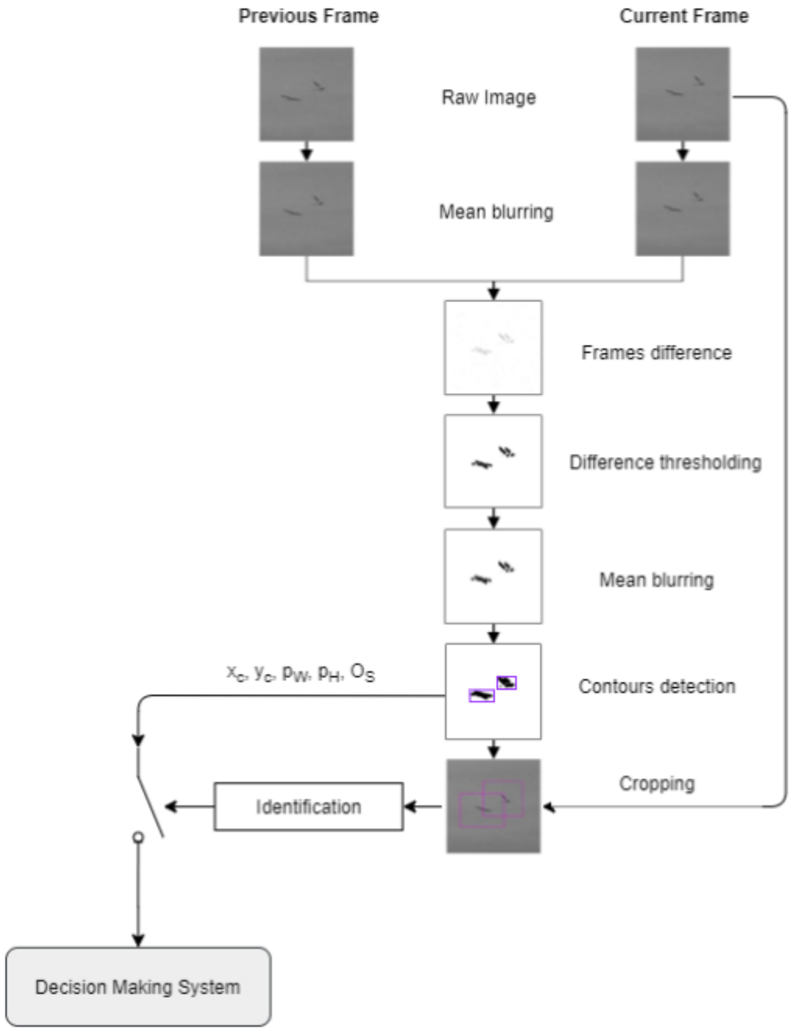
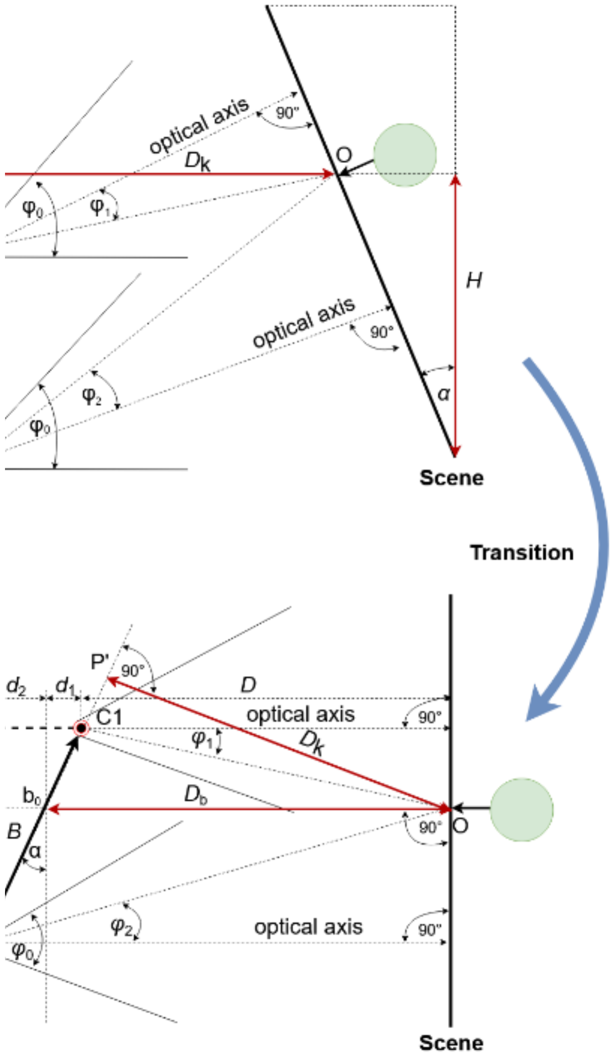
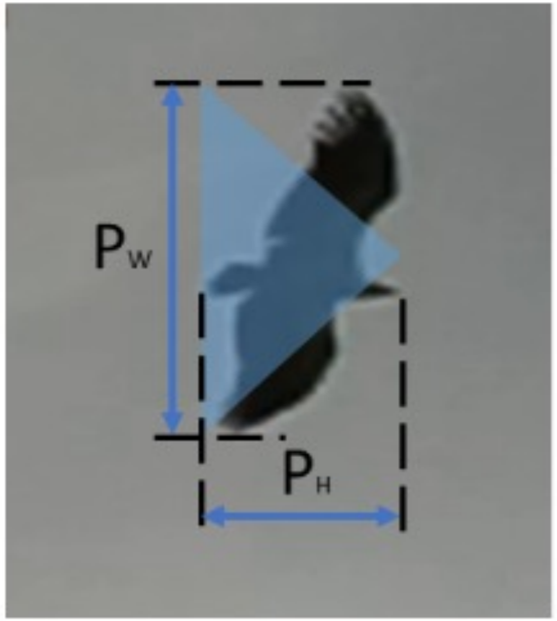
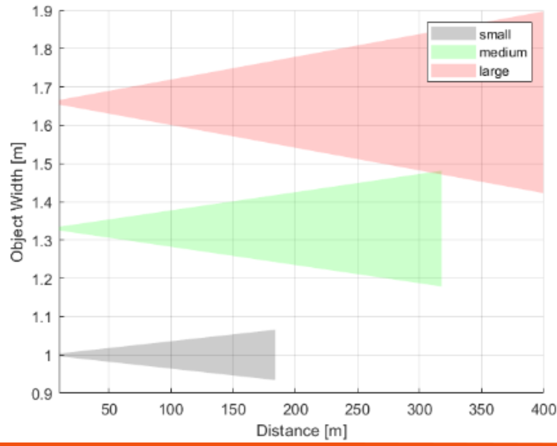


Figure 12. Bird detection algorithm flowchart illustrated by original images from the system.



. Definition of the variables and basic system settings.





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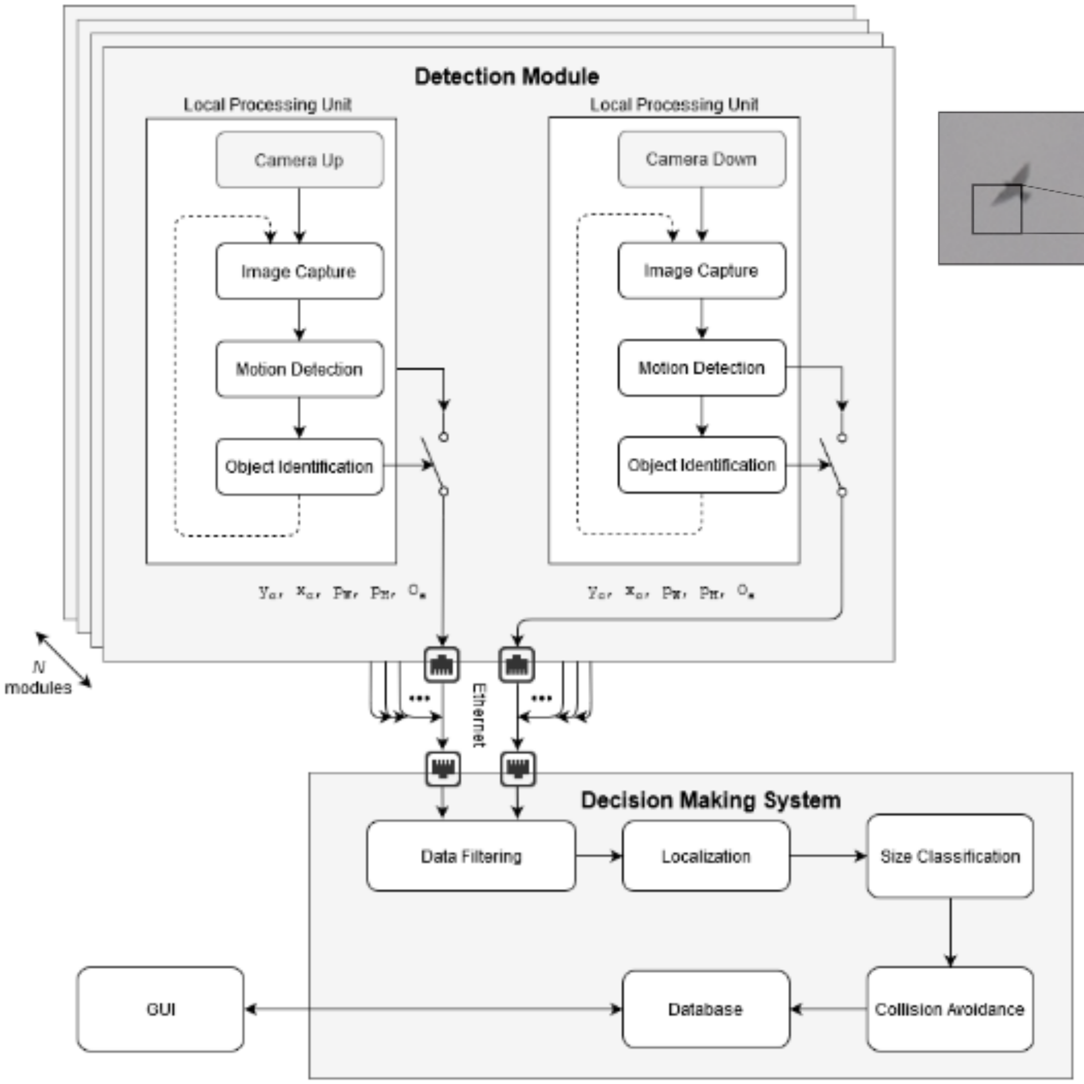
System design – research and scientific approach



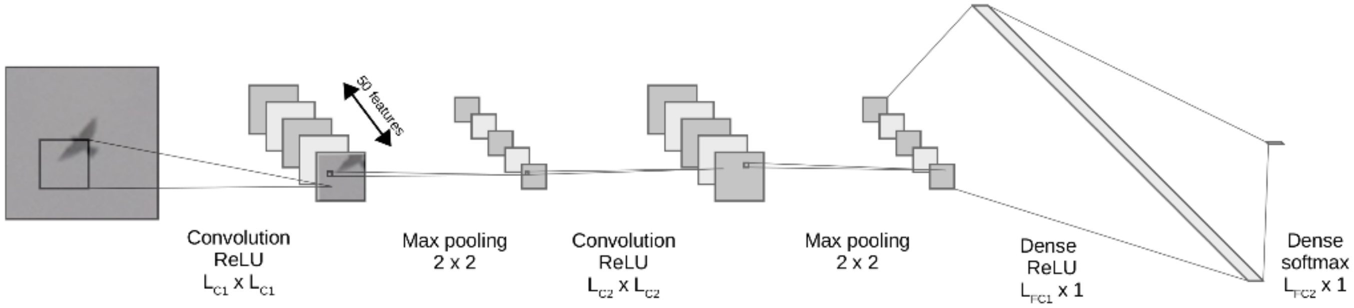


Table 6. Test results of CNN performance evaluation, where the bolded row highlights the selected configuration; the values in red highlight the best values for a given parameter.

CNN Parameters L_{C1}	L_{C2}	L_{FC}	*FF Time [ms]*	*Precision*	*Recall*	*F1*	*Specificity*	*Accuracy*
32	32	32	0.80	0.987	0.989	0.988	0.987	0.988
32	32	64	0.97	0.990	0.989	0.989	0.990	0.989
32	**32**	**128**	**1.09**	**0.996**	**0.989**	**0.993**	**0.996**	**0.993**
32	32	256	1.59	0.995	0.989	0.992	0.995	0.992
32	64	32	1.28	0.995	0.989	0.992	0.995	0.992
32	64	64	1.42	0.998	0.988	0.993	0.998	0.993
32	64	128	1.93	0.995	0.989	0.992	0.995	0.992
32	64	256	2.85	0.998	0.989	0.994	0.999	0.994
64	32	32	1.54	0.979	0.989	0.984	0.979	0.984
64	32	64	1.65	0.961	0.989	0.975	0.960	0.975
64	32	128	1.84	0.997	0.989	0.993	0.997	0.993
64	32	256	2.31	0.987	0.989	0.988	0.987	0.988
64	64	32	2.33	0.997	0.989	0.993	0.997	0.993
64	64	64	2.51	0.994	0.989	0.992	0.994	0.992
64	64	128	3.32	0.987	0.989	0.988	0.987	0.988
64	64	256	3.84	0.998	0.989	0.994	0.998	0.994
	min		0.80	0.961	0.989	0.975	0.960	0.975
	max		3.84	0.998	0.989	0.994	0.999	0.994

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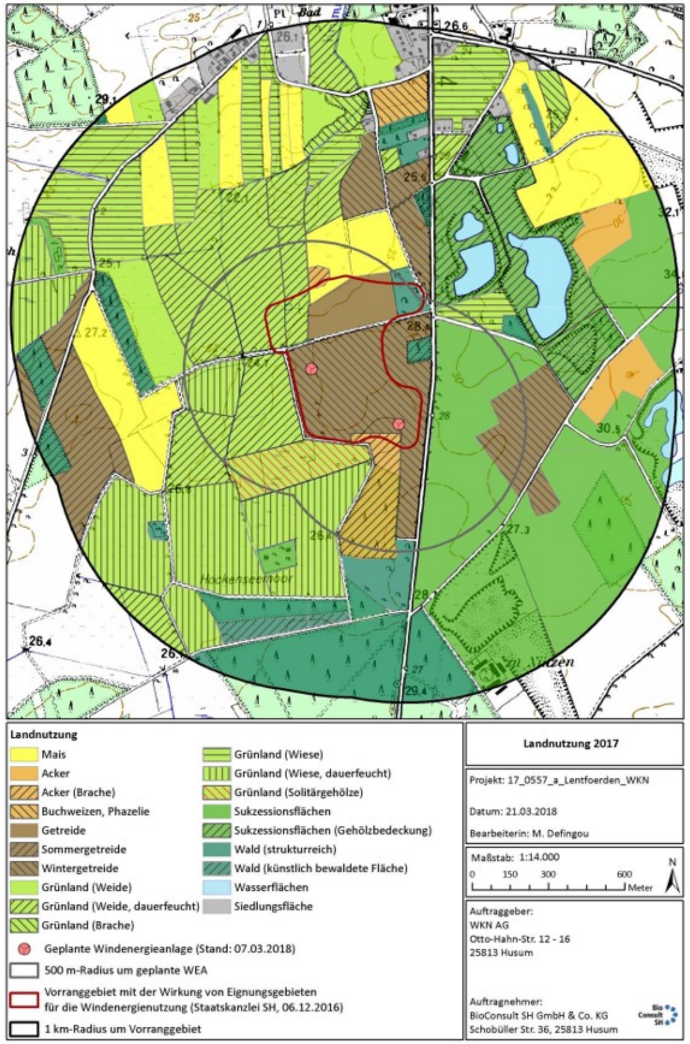
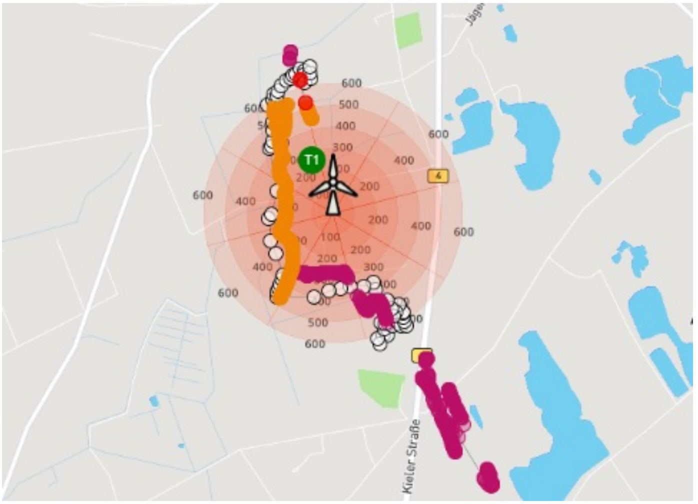
Bird detection - Validation





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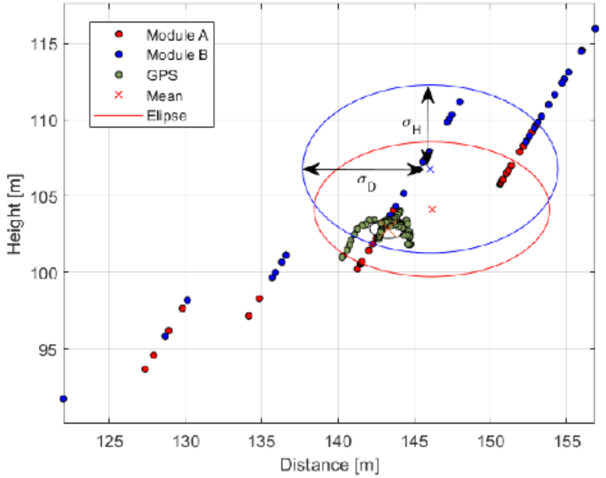
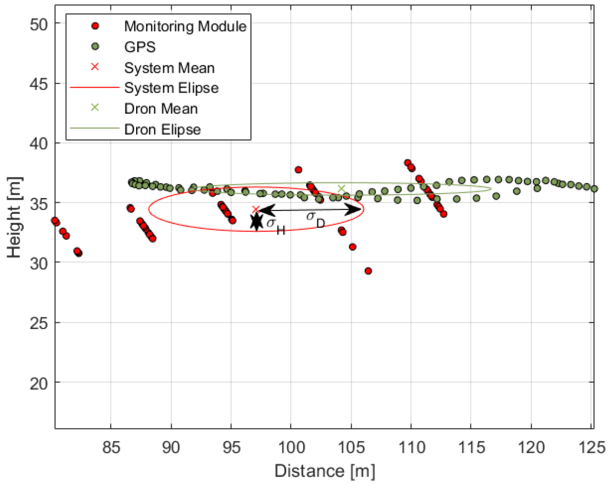
Bird detection - Validation

Detection capabilities

Birds Size	BPS Version	0-100m	100-200m	200-300m	300-400m	400-500m	500-600m	600-700m	700-800m	Source
Small	Standard	92%	50%							[1-3]
	Premium	100%	100%	80%						[4]
	Long Range	data during analysis								
Medium	Standard	66%**	83%	38%						[1-3]
	Premium	100%	92%	100%	90%					[4]
	Long Range	data during analysis (average > 85%)								
Large	Standard	91%	100%	68%	-	-				[1-3]
	Premium	100%	100%	100%	100%	75%				[4]
	Long Range	-	100%	91%	98%	95%	86%	83%	85%	



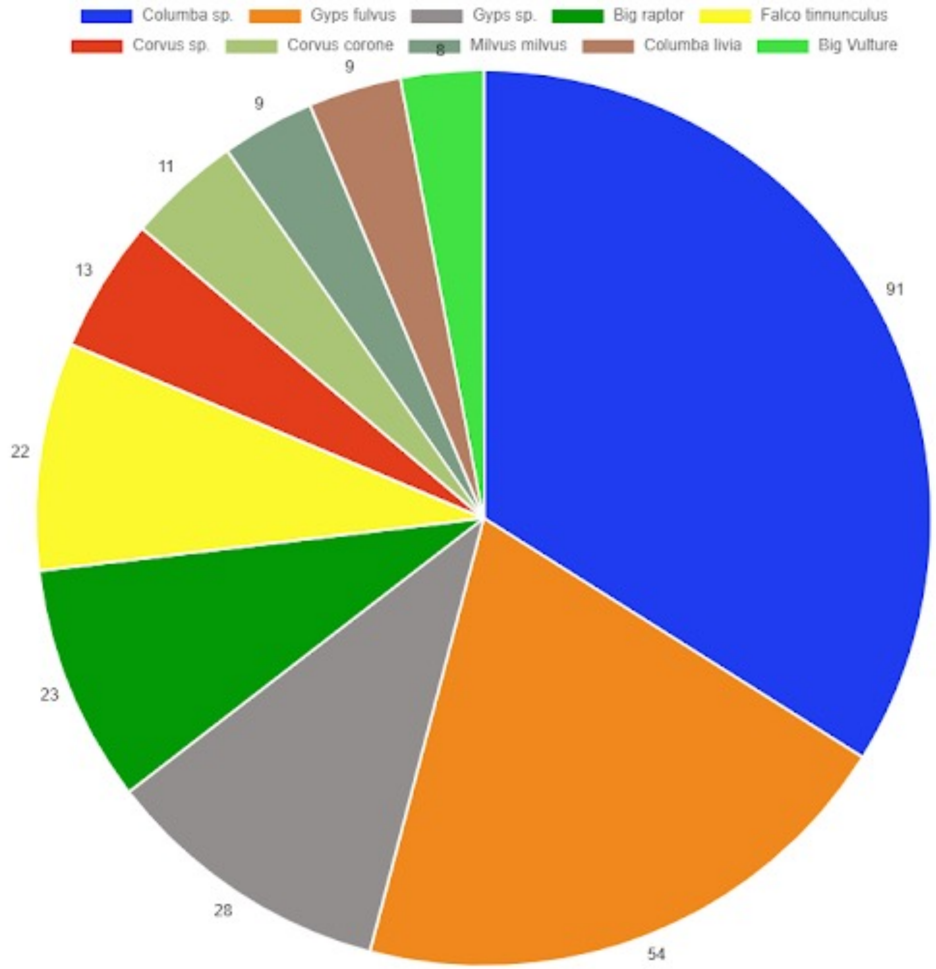


Fixed – wing drone

(b)

Bird Protection System – Bird identification in database

Manual Bird Identification

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Airport Fauna Monitoring System
Artificial eyes for Wildlife Hazard Management
Automated Wildlife detection
Prompt notification and data collection
Bird deterrent system
Automated Big Data analysis

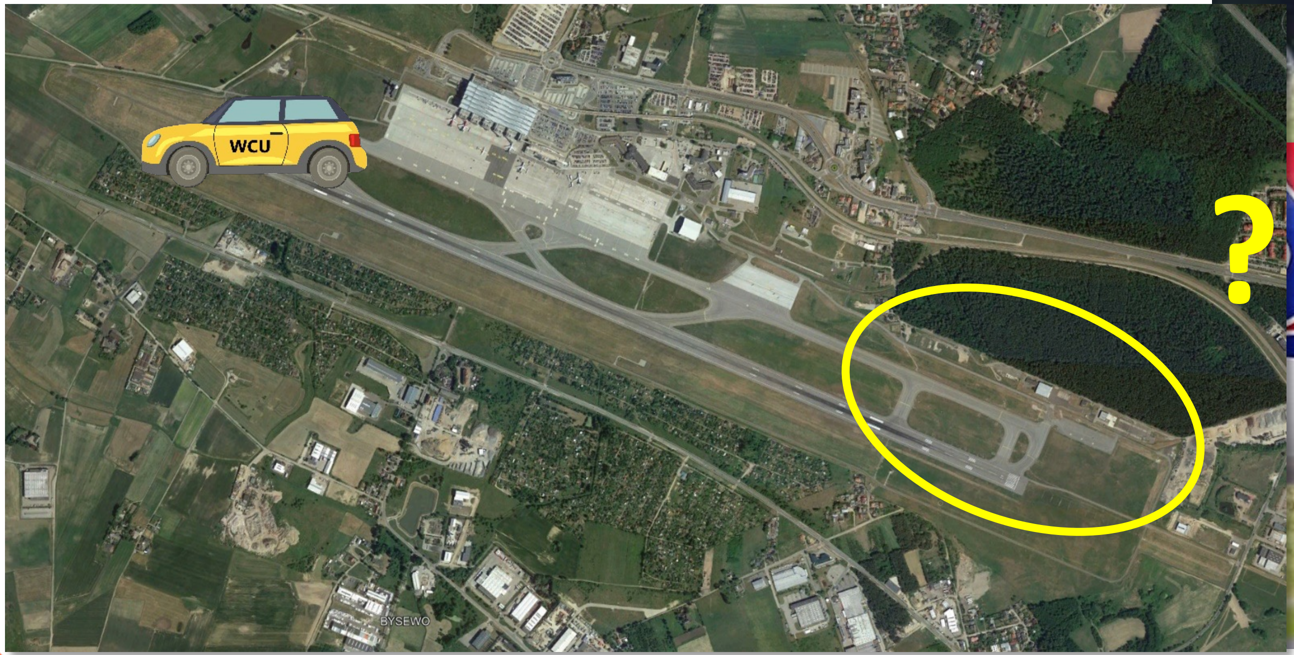
Wildlife Monitoring System – what about aerodromes

Aerodromes – vast areas to be constant monitored

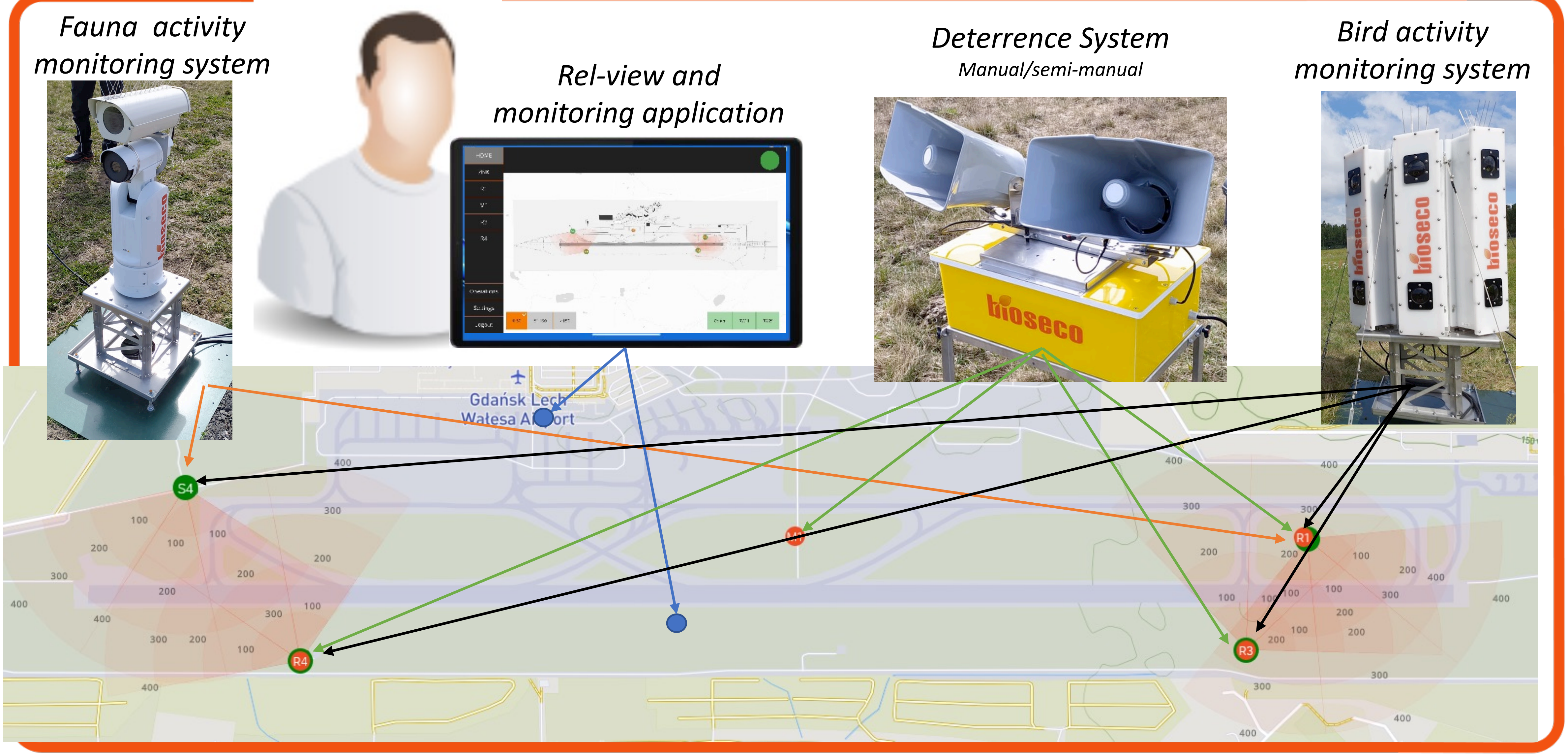
The concept of „Wildlife Control Unit's second eye"

Aerodromes monitoring

Constant collecting data and live fiew



Airport Wildlife Monitoring System - Concept



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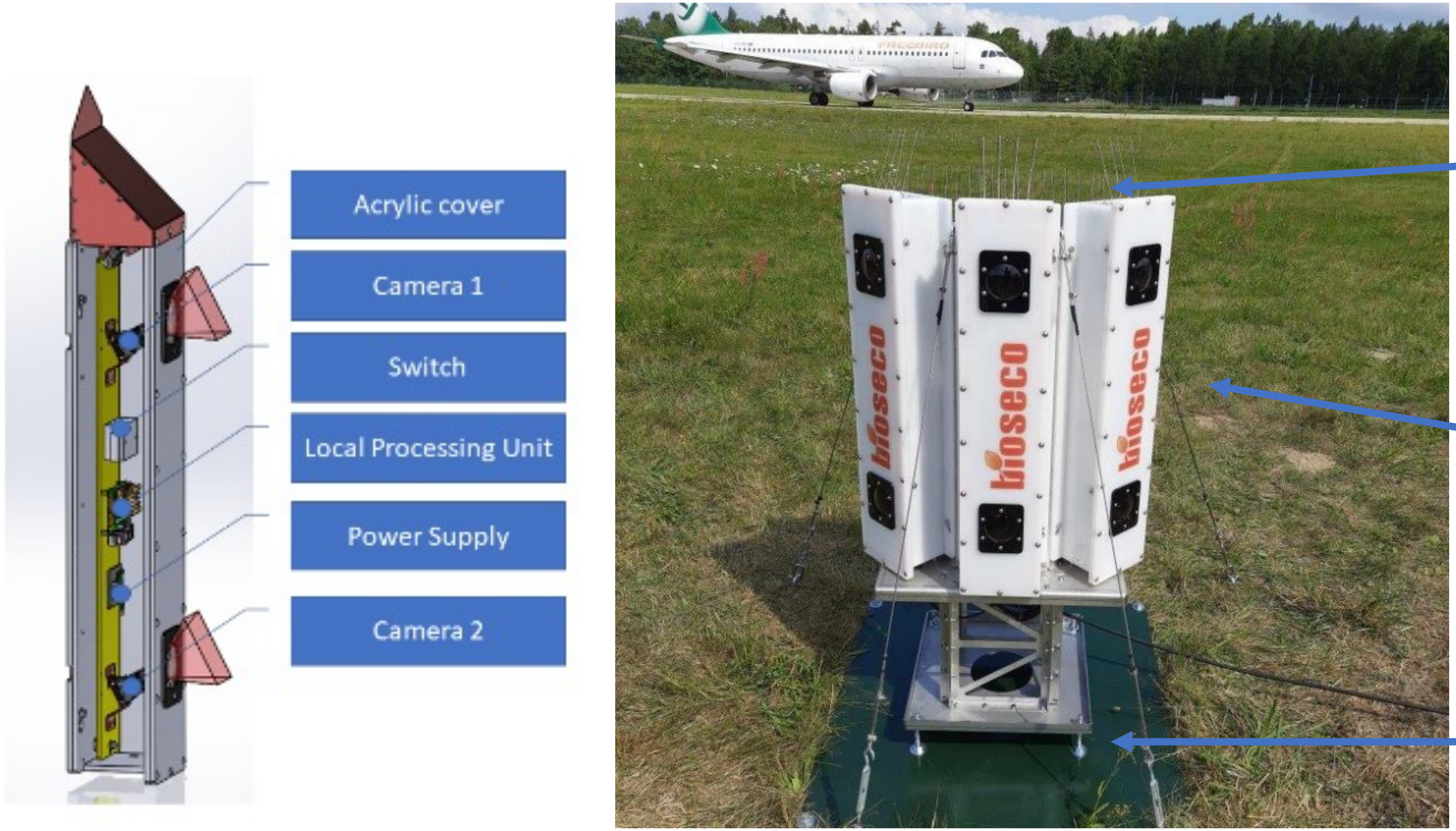
Airport Wildlife Monitoring System – Safety First



(a) (b)

Figure 11. **(a)** The prototype computer drawing of the monitoring module; **(b)** the system installation composed of three monitoring modules and one control unit.

Low height

Stable construction

Breakable Stand

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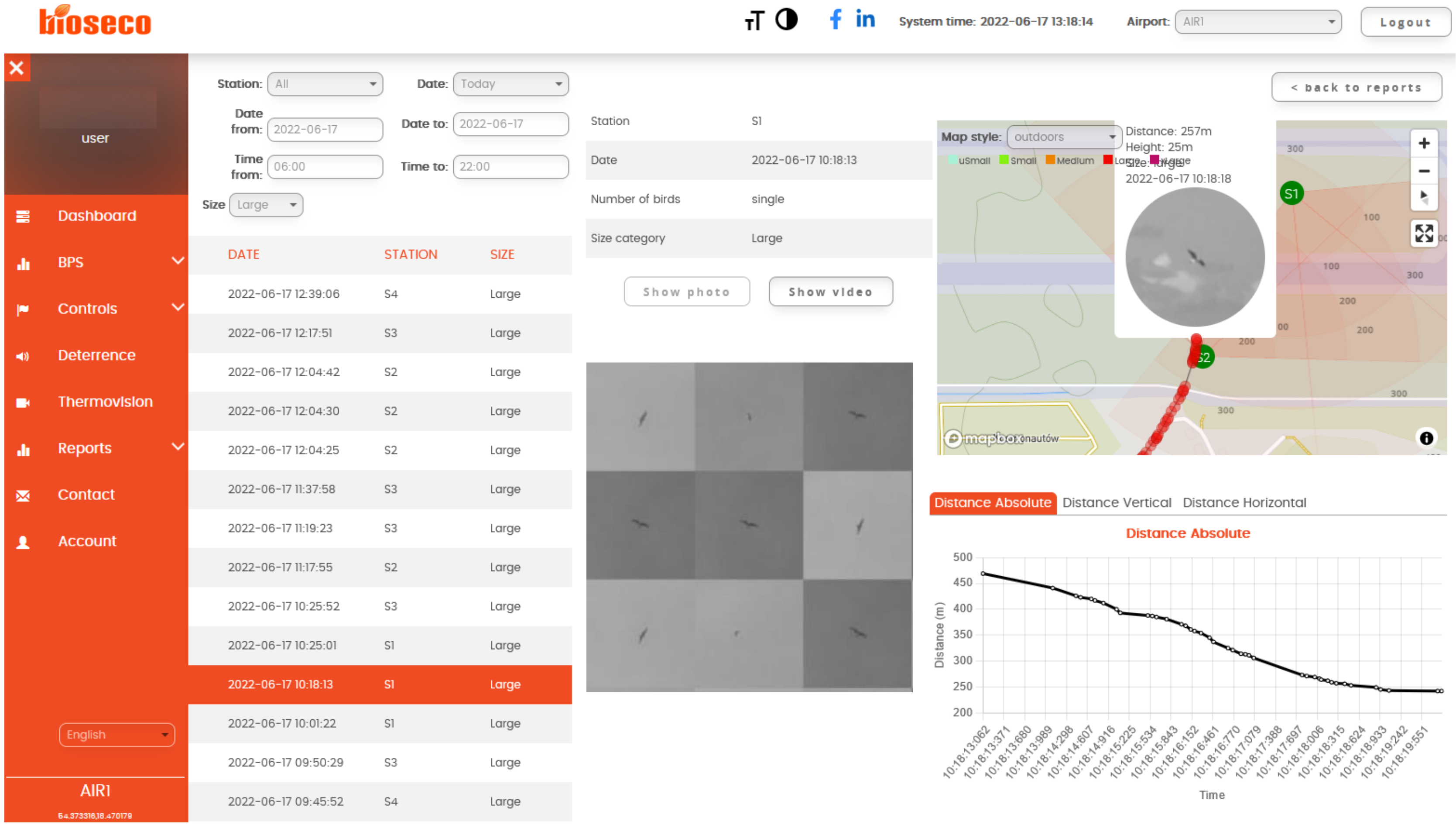
Bird Detection System – data collection and database

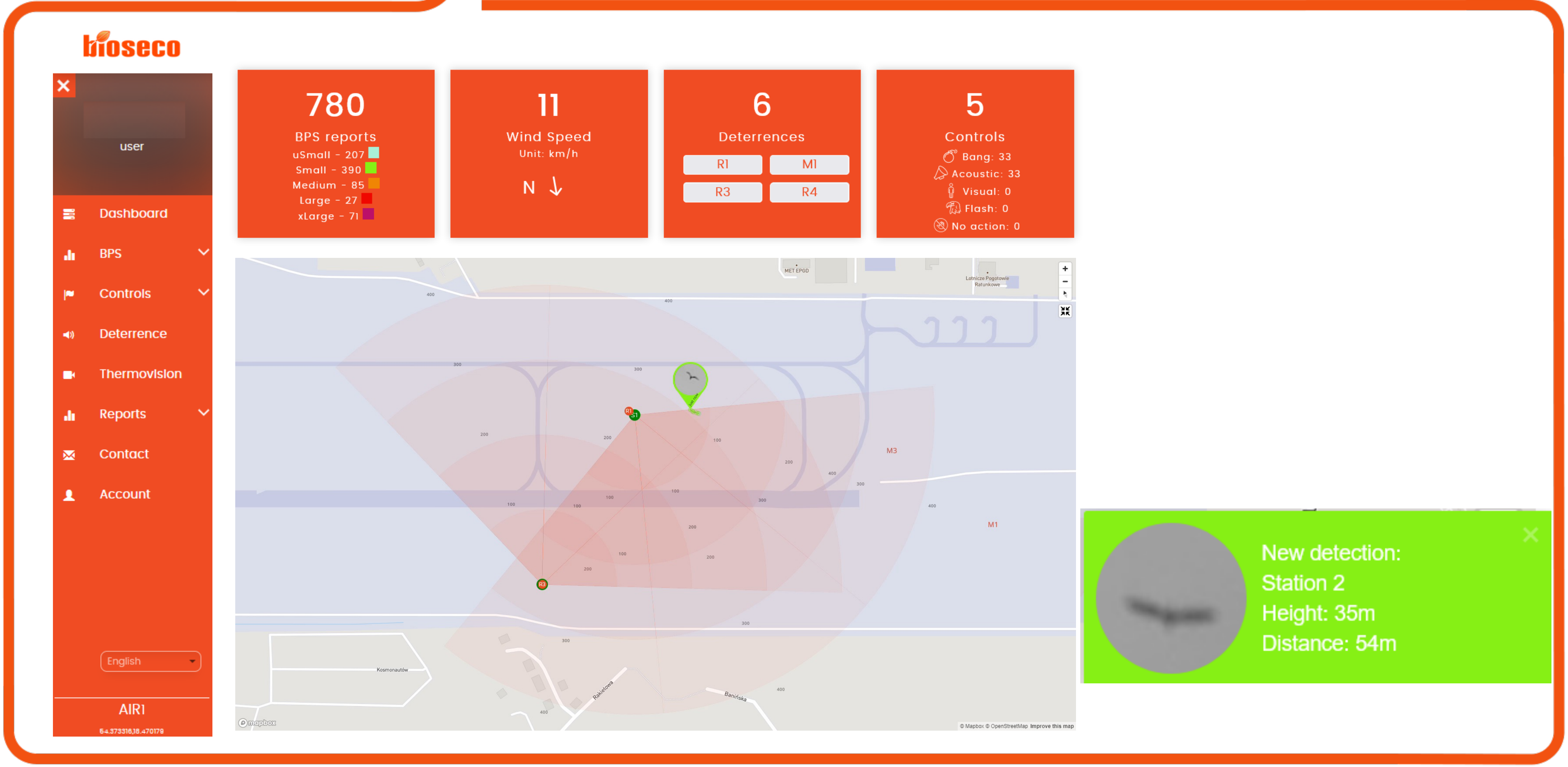


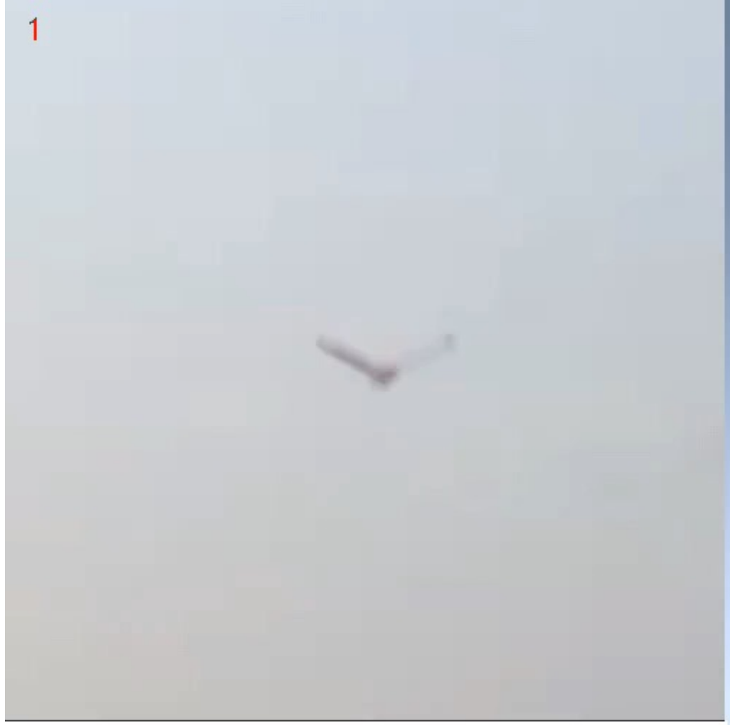
The system is continuously recording data:

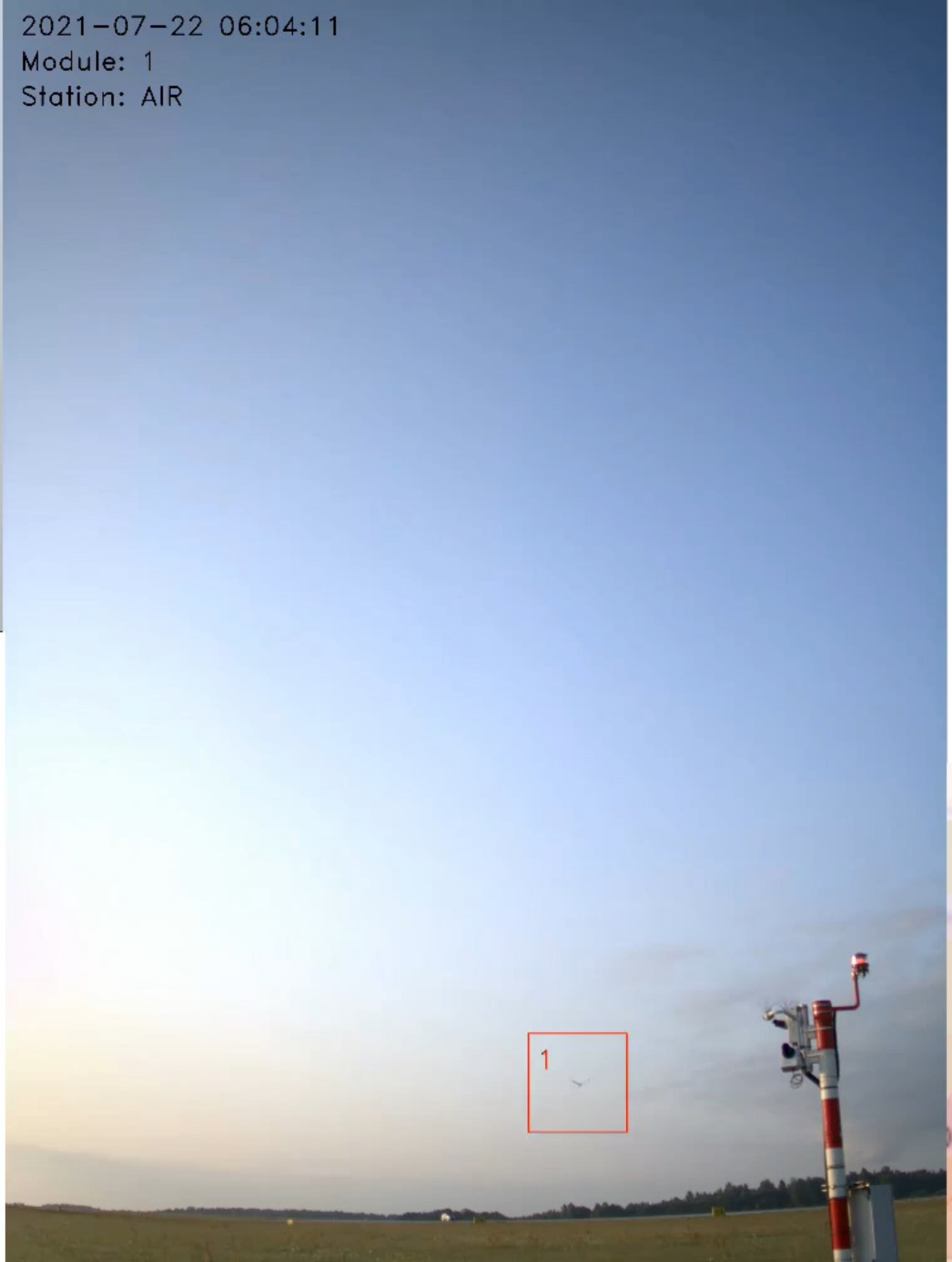
- ✓ Timestamp
- ✓ Location
- ✓ Distance estimation
- ✓ Height estimation
- ✓ Size classification
- ✓ Approximated flightpath
- ✓ Weather conditions
- ✓ Action taken (deterences)
- ✓ Pictures B&W
- ✓ Color 4k Movie

All data is reviewed by online webapplication and used to determine the species.

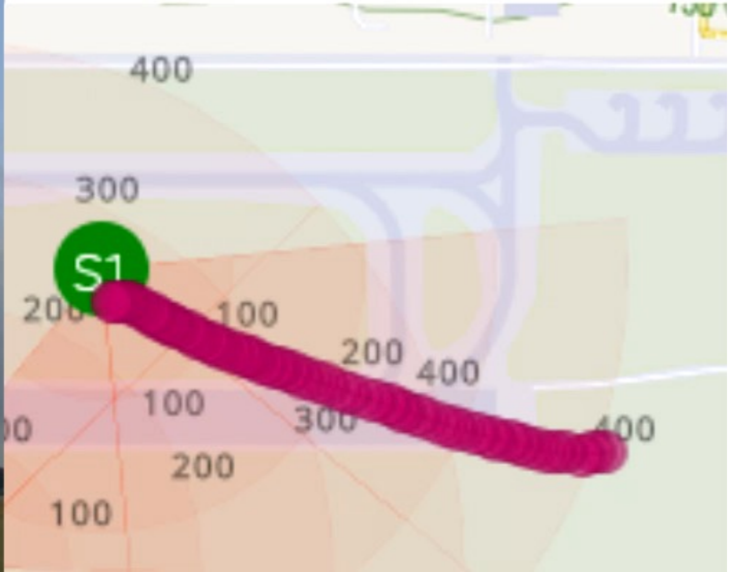
Bird Detection - Real View application







Real Monitoring Detection Example
- Gdańsk Airport -



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Bird Protection System – Bird identification

Aerodromes are attractive to various wildlife
However only some bird species are hazardous
Therefore, it is important to monitor their presence

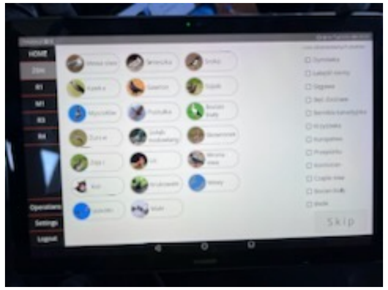






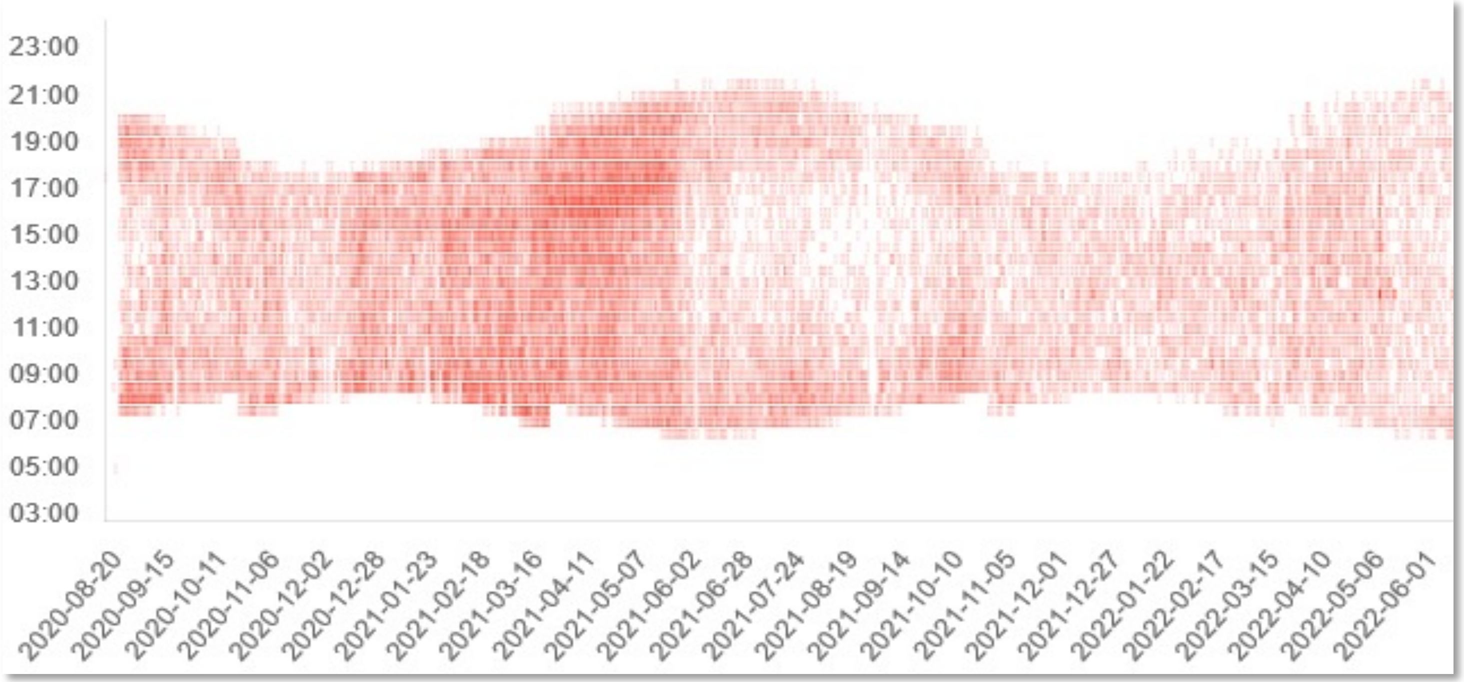
Bird Monitoring and Bird Deterrence Testing in Gdańsk Airport

Solution that includes various tools
The system is focused on efficiency



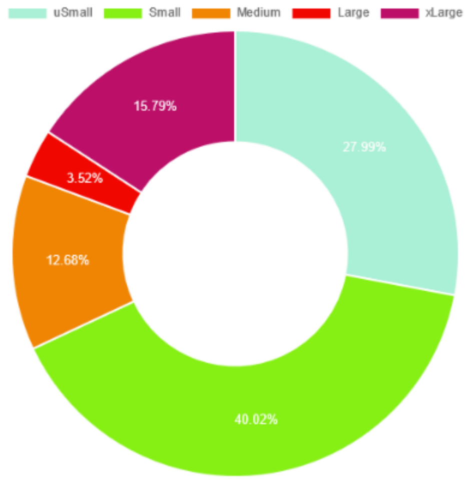
Annual Bird Activity Analysis

Long-term analisys

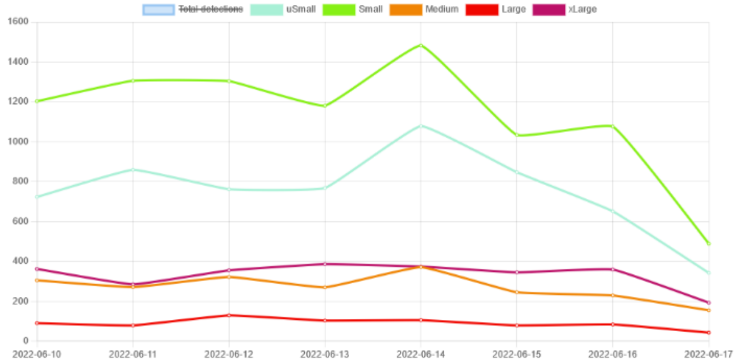


Months/year

Short-term analisys *Day*

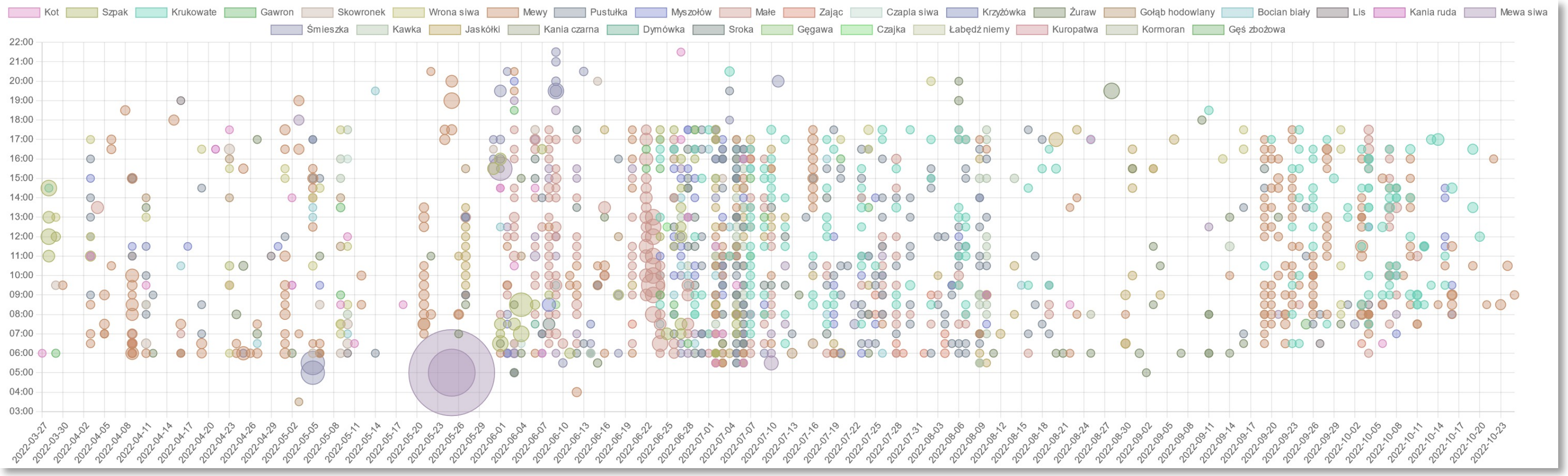


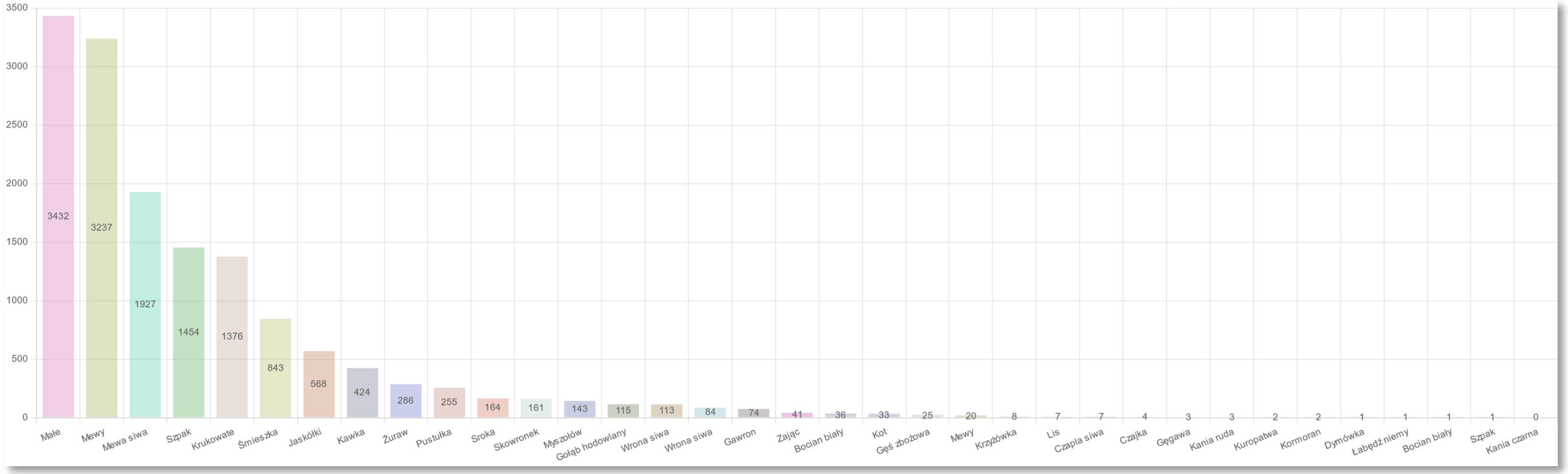
Mid-term analisys *Week*



Birds Activity as Hourly, Daily and Monthly Pattterns

Bird/wildlife species distribution and abundance





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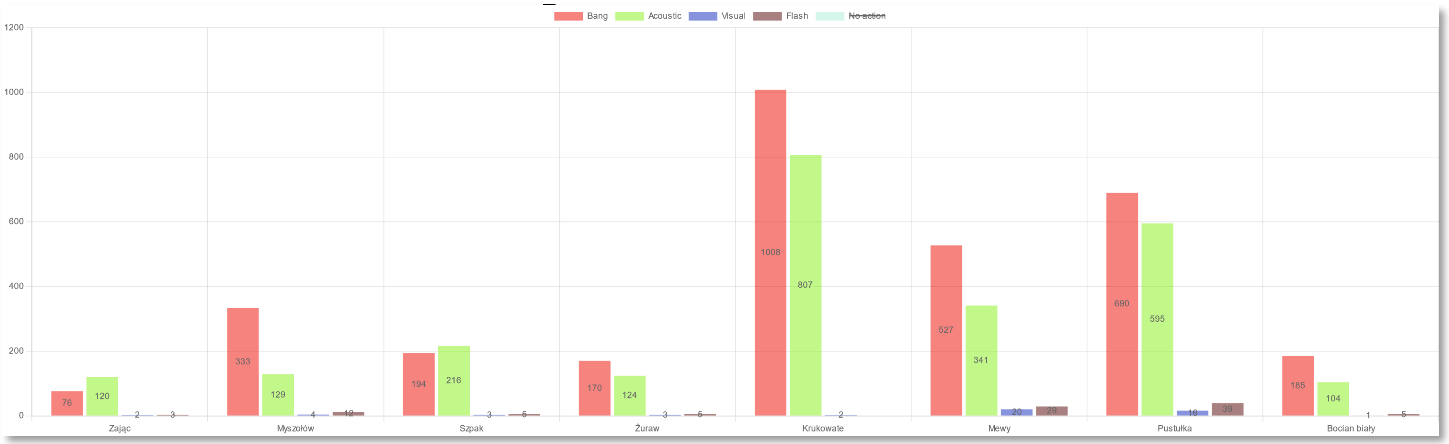
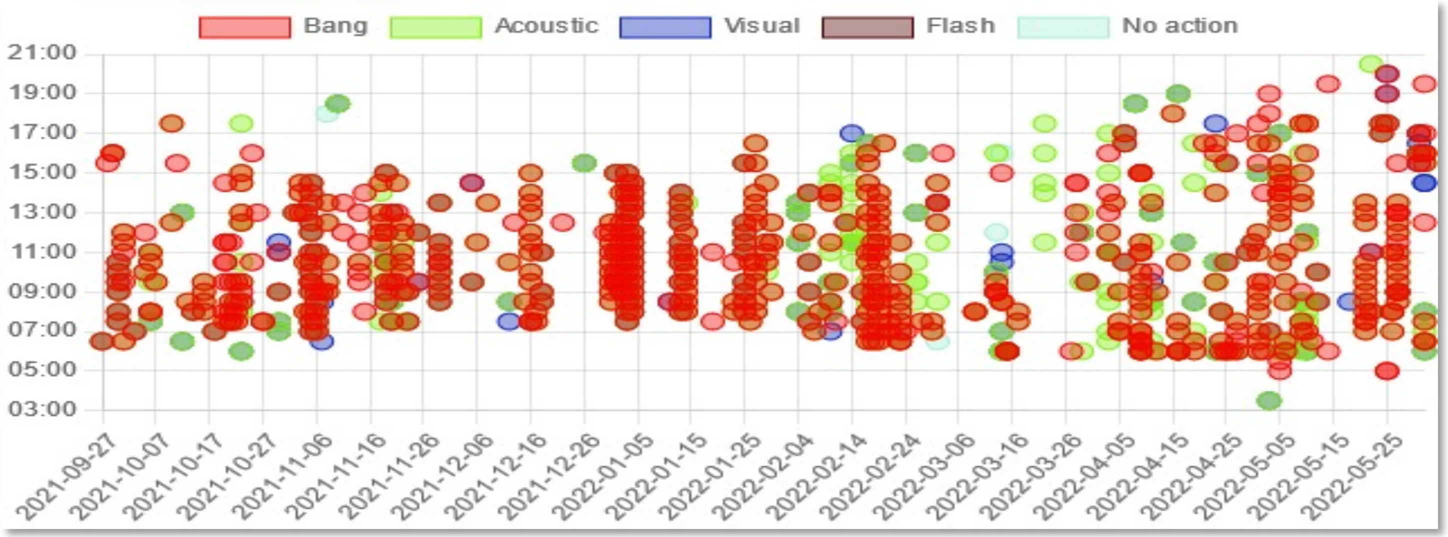
Deterrent efficiency & monitoring

Deterrence measures and wildlife species





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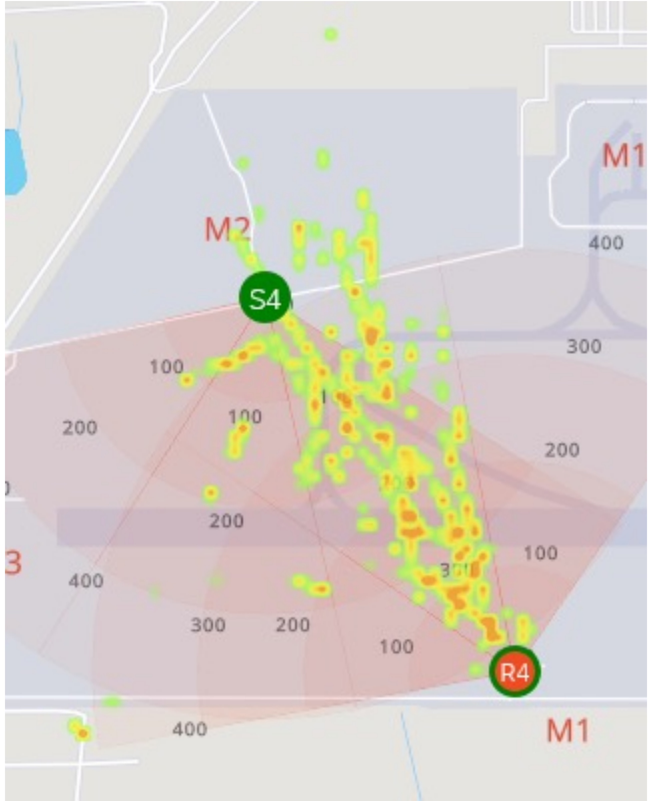
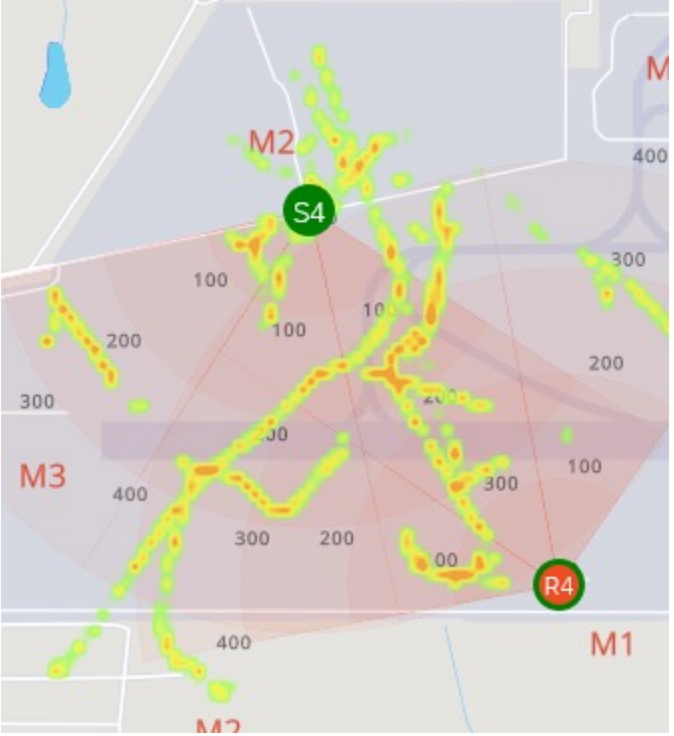
Hot-Spots of Bird Activity

4.00-10.00 → **10.00-16.00** → **16.00-22.00**

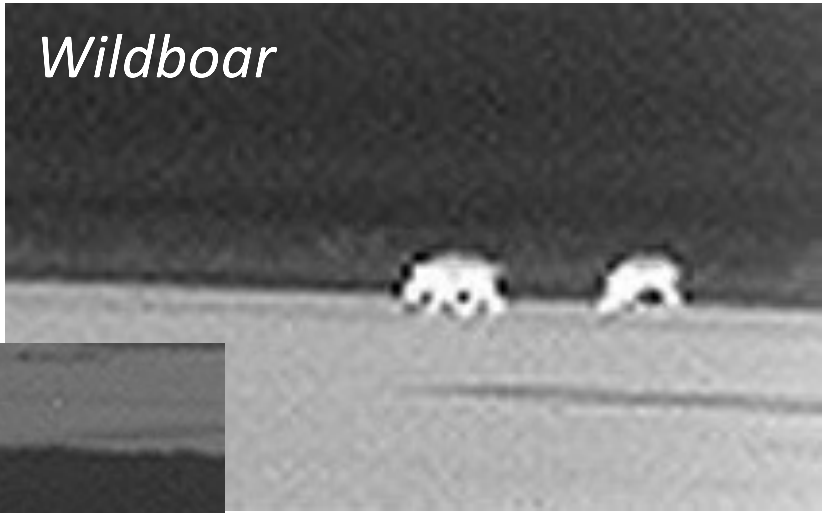




System development – Thermal Vision Wildlife Monitoring

Constant monitorig of critical areas

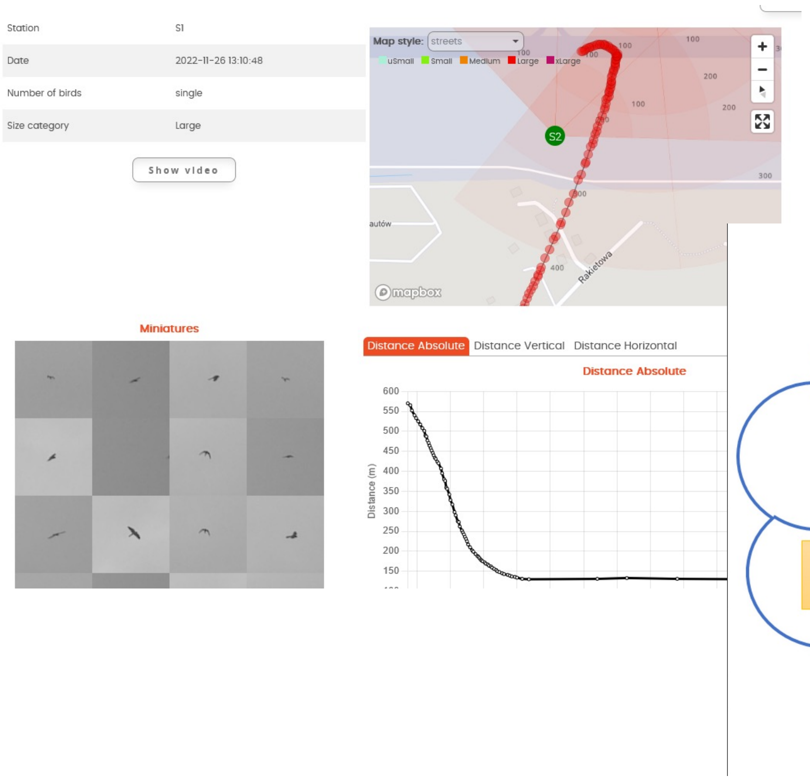
1. *Live fiew day & night*
2. *Data collecting*
3. *Wildlife identification*

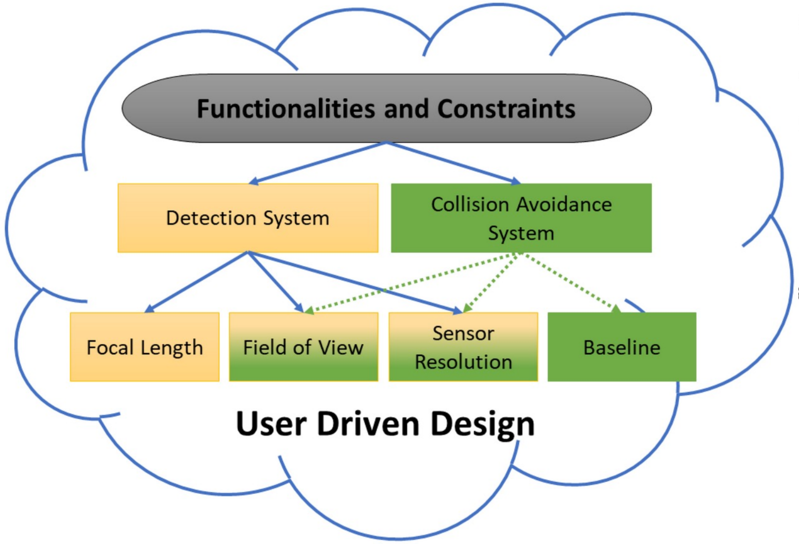


Test pictures <u>not from</u> Gdańsk Airport

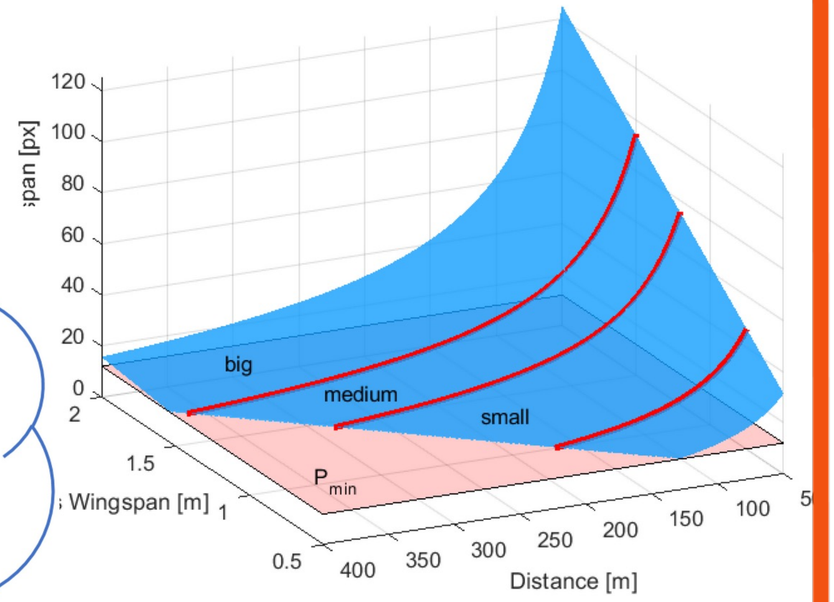
Summary

Site specific customized cost effective solution





External validation based on a scientific approach



User driven design WHM not just sophisticated tool

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Interested in testing bioseco AFMS SYSTEM?

contact me:

Dawid Gradolewski, CTO

Phone number

+ 48 665 802 125

E-mail

dawid.gradolewski@bioseco.com

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