



BayWa: *Can you design, develop, implement a Tractor Detection System?*

Bioseco: *Sure we can. Please define main functionalities.*

BayWa: *Detecting large vehicles driving on the fields around wind turbines in the radius of 400m.
Sending a notification email to wind farm operator with a link to a video of detection and live stream.
Recording all detections and archiving the data to be accessible online.*

Bioseco: *That should be no problem, but we need to develop a Neural Network to do this.*

BayWa: *Can you do it in 4 months, including installation in Germany?*

Bioseco: *When can we start.*

That was February 2020. Then Covid happened. Yet Bioseco delivered the solution in June 2020 for 2 turbines.

BayWa: *Wir wollen keine Vögel erkennen, sondern Traktoren, könnt Ihr uns helfen?*

Bioseco: *Sicher! Was genau soll das System können?*

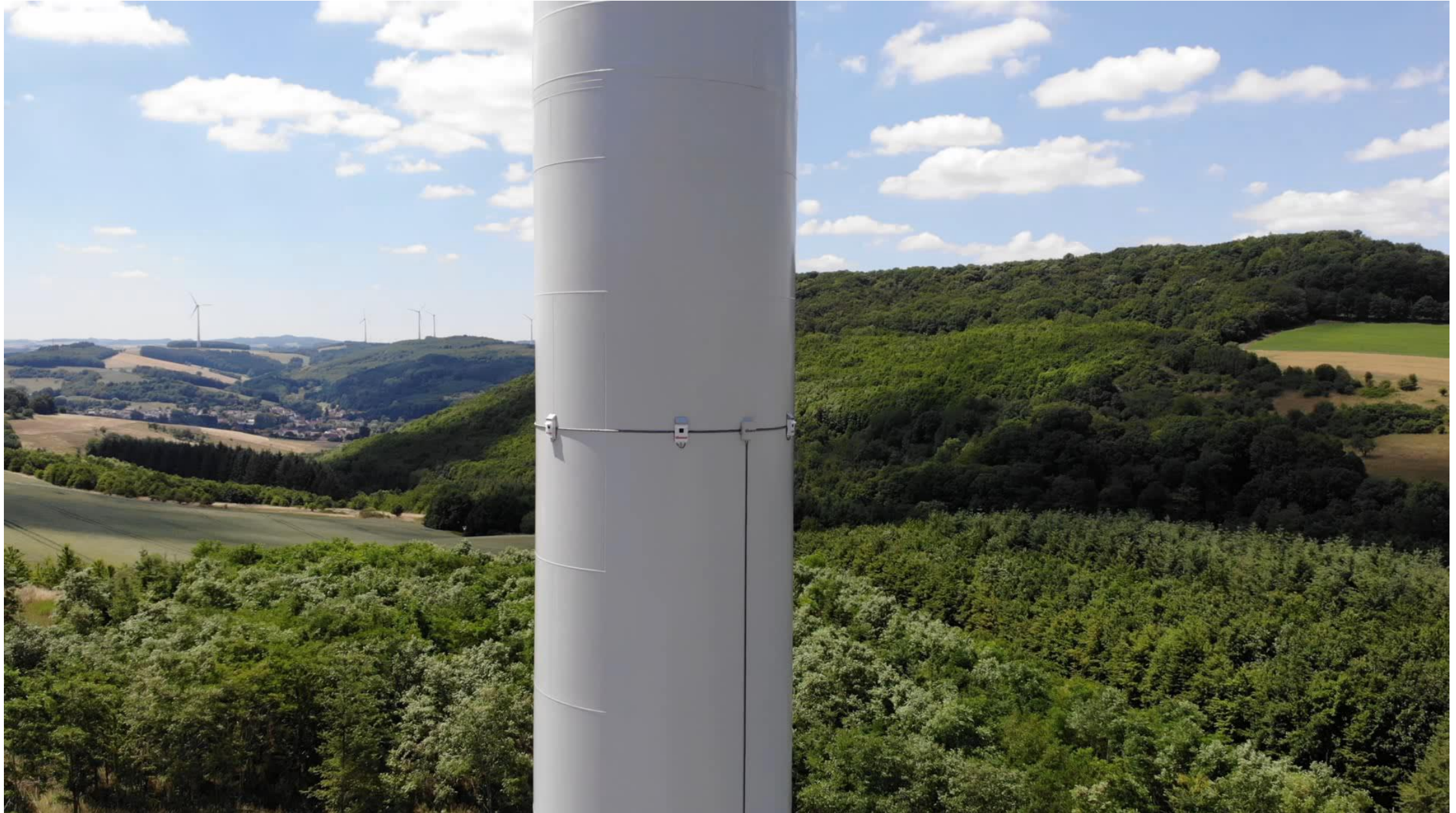
BayWa: *Es soll Traktoren auf den Feldern um die Windkraftanlagen im Radius von 400m erkennen und dem Betriebsführer eine Benachrichtigung per Email mit Videobildern der Erkennung und live stream.
Aufzeichnung aller Erkennungen und online Archivierung der Daten.*

Bioseco: *Das sollte kein Problem sein aber wir müssen ein Neutrales Netzwerk entwickeln.*

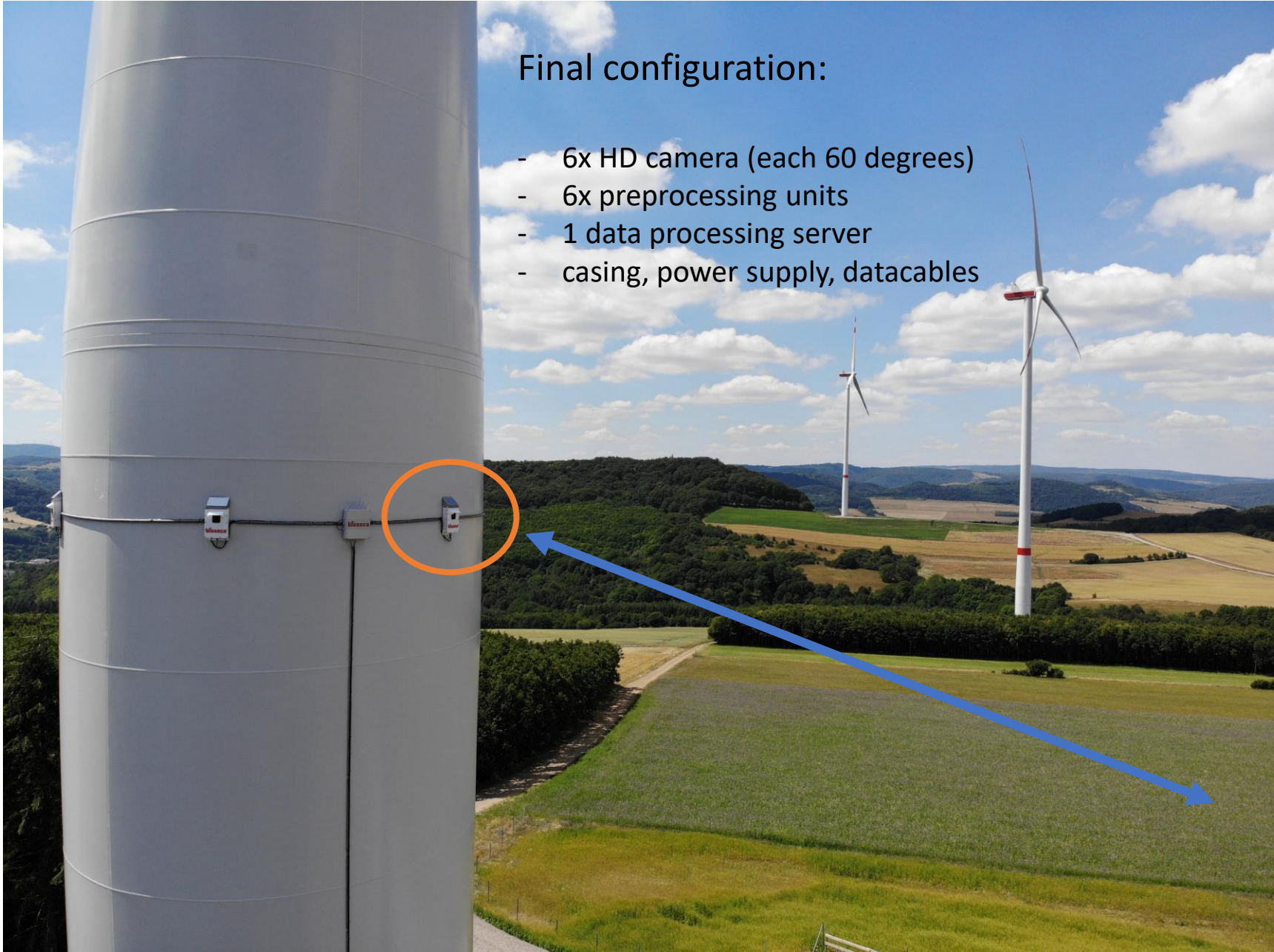
BayWa: *Könnt Ihr es in 4 Monaten Umsetzen, mit Installation in Deutschland?*

Bioseco: *Wann können wir loslegen.*

Das war Februar 2020. Dann kam Covid. Bioseco installierte die Lösung im Juni 2020 für 2 Turbine.



Tractor Detection System - outcome



Final configuration:

- 6x HD camera (each 60 degrees)
- 6x preprocessing units
- 1 data processing server
- casing, power supply, datacables

Modular design

6 modules around turbine equipped with 4K cameras powered by CPU + GPU

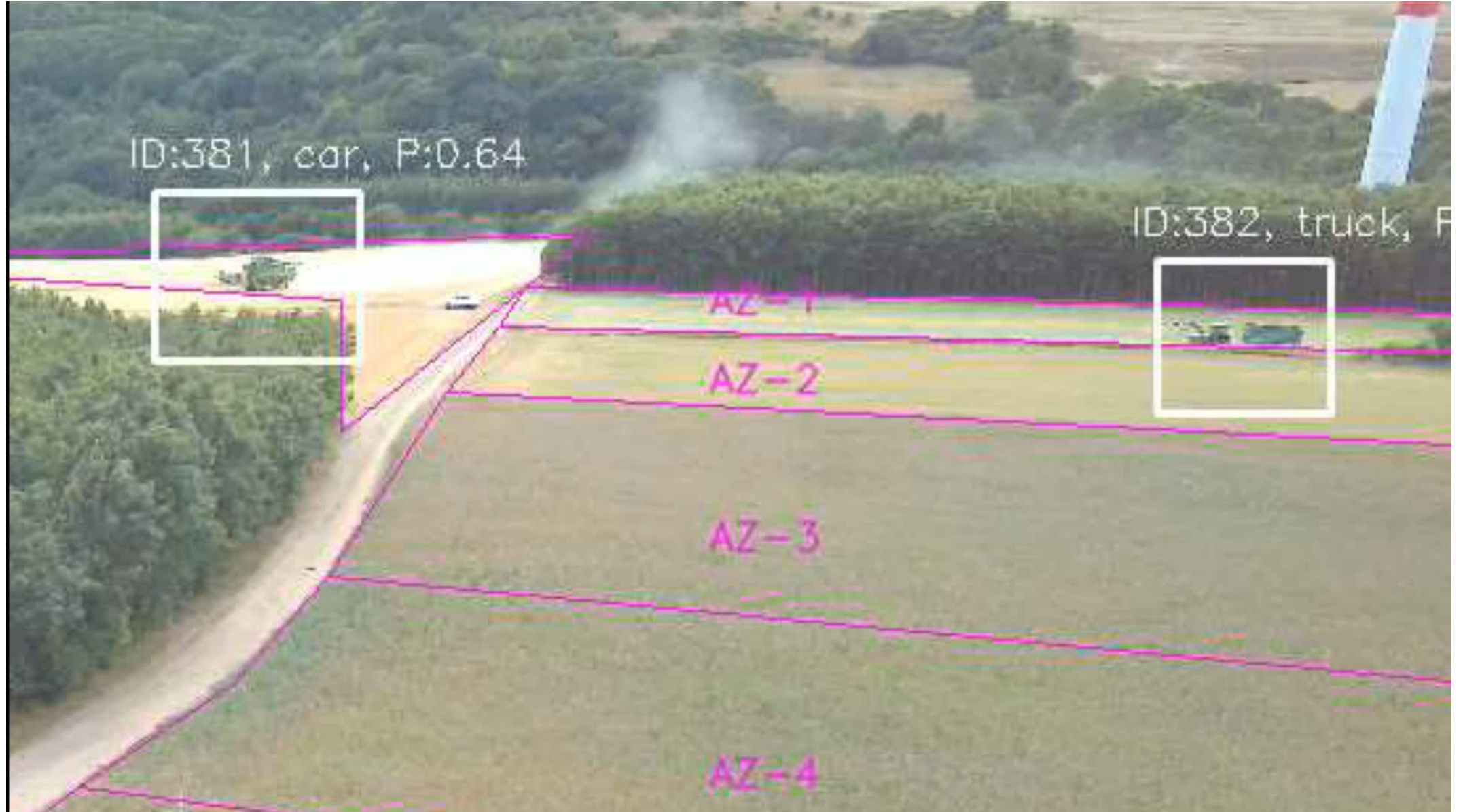
AI based server inside WT

Installation at 15-30 m height

Easy access to online UI application

Real time detection, and notification per email (turbine stop signal possible)

Easy access to historical data







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Dashboard

Reports

Monitoring

English

Baywa TDS
TDS

Time: From: To:

0

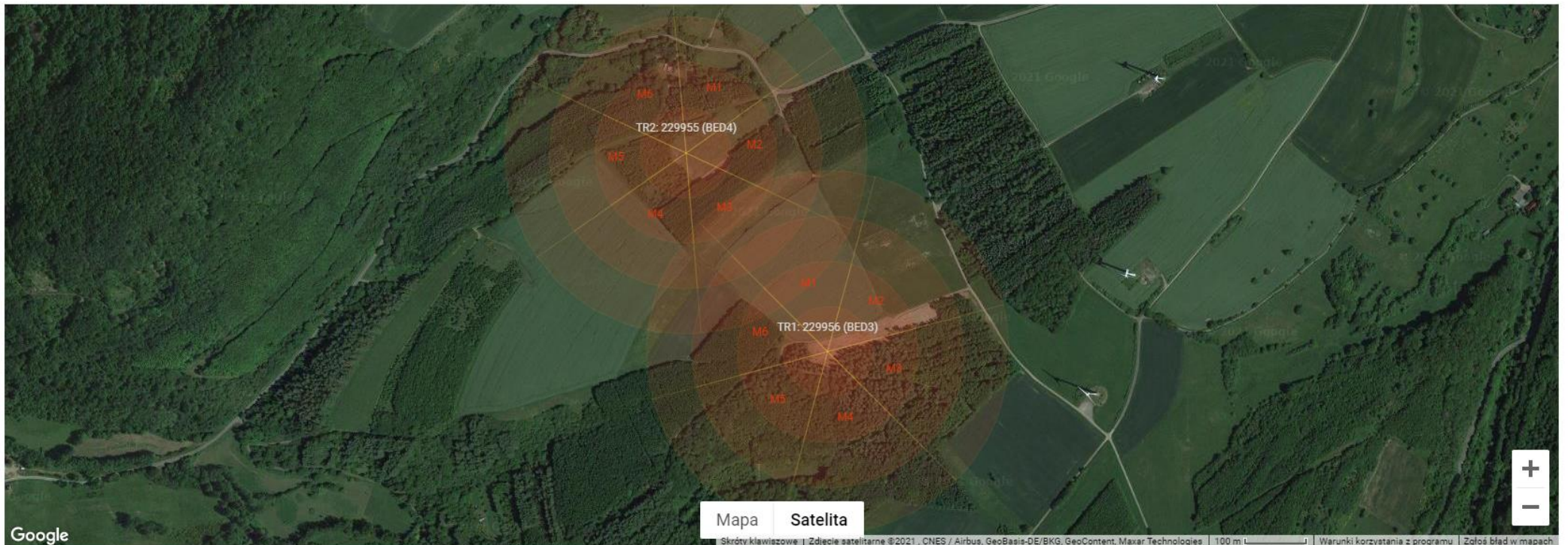
Active detections

63

Detections

54

Notifications sent



Google

Mapa Satelita

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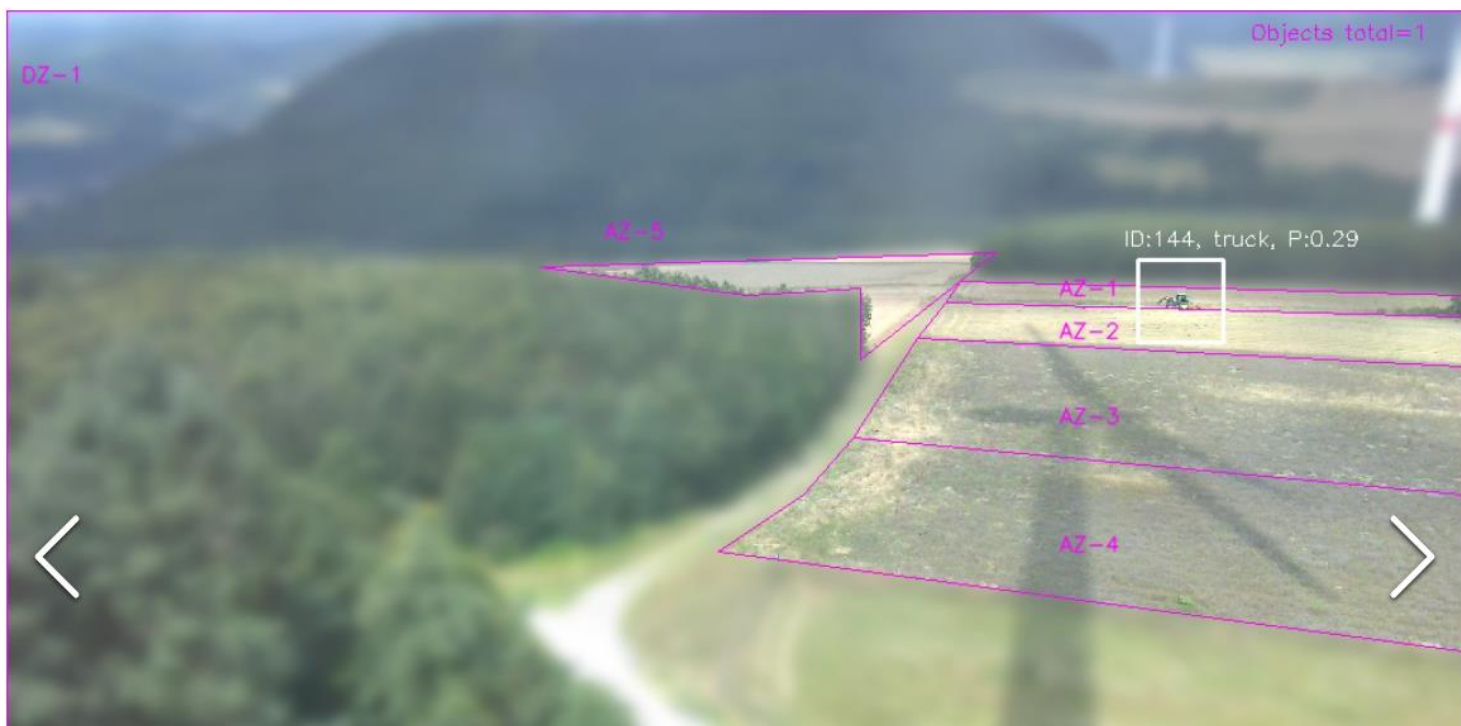
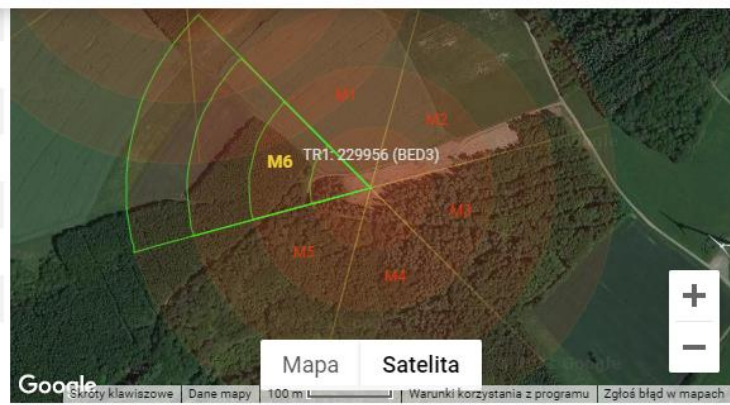
Baywa TDS
TDS

Date desc

ID	TURBINE	MODULES	DATE
373ae	TR1	Module 6	2021-07-20 11:40:08
37386	TR1	Module 1	2021-07-20 11:27:58
371d6	TR1	Module 2	2021-07-20 10:36:12
37176	TR1	Module 1	2021-07-20 10:35:23
36f45	TR1	Module 6	2021-07-19 12:17:20
36867	TR1	Module 2	2021-07-19 10:19:47
367ae	TR1	Module 1	2021-07-19 10:16:55
363c6	TR1	Module 1	2021-07-18 20:00:23
362ff	TR1	Module 3	2021-07-18 13:08:30
362a1	TR1	Module 6	2021-07-18 12:48:50
35e20	TR1	Module 1	2021-07-17 16:33:56
722fd	TR1	Module 1	2021-05-13 17:43:07
0400e	TR1	Module 1	2021-04-03 13:18:21
03f26	TR1	Module 1	2021-04-01 11:20:11
03e02	TR1	Module 2	2021-04-01 11:17:08
03734	TR1	Module 3	2021-03-19 12:19:03
212c6	TR1	Module 1	2021-03-06 14:51:50
20ac8	TR1	Module 1	2021-03-05 14:59:44
209f8	TR1	Module 6	2021-03-05 14:58:51
6faa5	TR1	Module 2	2021-03-04 14:17:55

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Turbine	TR1: 229956 (BED3)
Duration	00:06:12
Modules	Module 6
Zone	AZ-1, A75
Weather	[19°C, NNE, 11km/h]
Start time	2021-07-20 11:40:08
Stop time	2021-07-20 12:02:53



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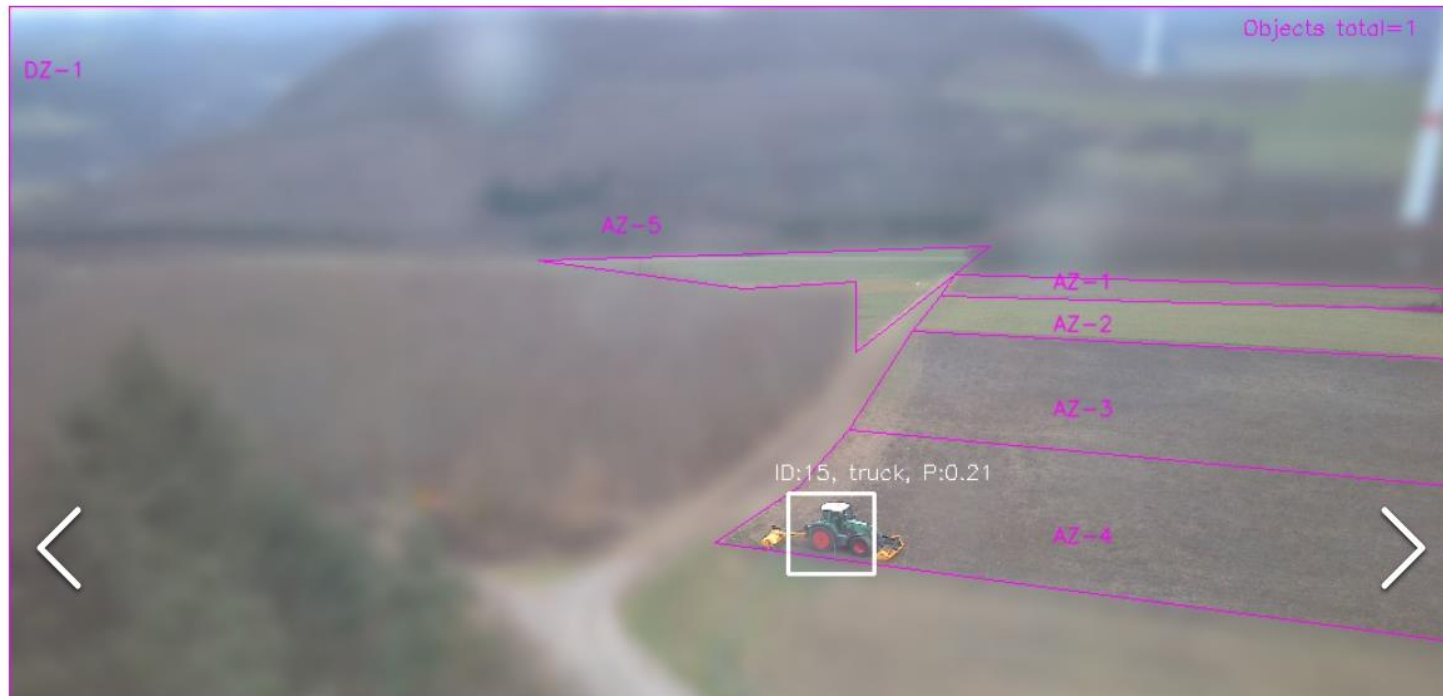
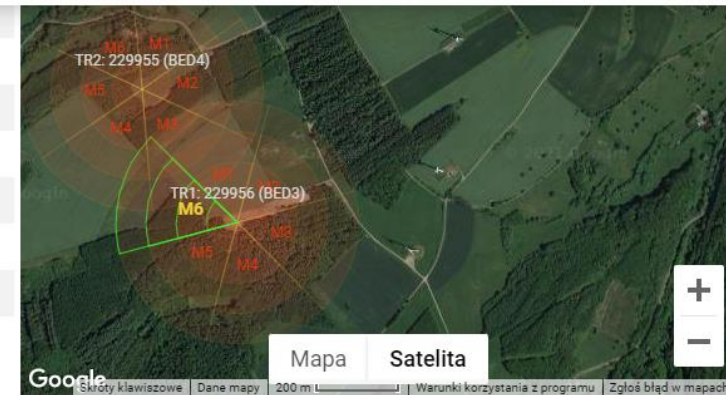
English

Baywa TDS
TDS

Date desc

ID	TURBINE	MODULES	DATE
373ae	TR1	Module 6	2021-07-20 11:40:08
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367ae	TR1	Module 1	2021-07-19 10:16:55
363c6	TR1	Module 1	2021-07-18 20:00:23
362ff	TR1	Module 3	2021-07-18 13:08:30
362a1	TR1	Module 6	2021-07-18 12:48:50
35e20	TR1	Module 1	2021-07-17 16:33:56
722fd	TR1	Module 1	2021-05-13 17:43:07
0400e	TR1	Module 1	2021-04-03 13:18:21
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212c6	TR1	Module 1	2021-03-06 14:51:50
20ac8	TR1	Module 1	2021-03-05 14:59:44
209f8	TR1	Module 6	2021-03-05 14:58:51
6faa5	TR1	Module 2	2021-03-04 14:17:55

Turbine	TR1: 229956 (BED3)
Duration	00:04:06
Modules	Module 6
Zone	AZ-4, A75
Weather	[5°C, NE, 11km/h]
Start time	2021-03-05 14:58:51
Stop time	2021-03-05 15:41:44



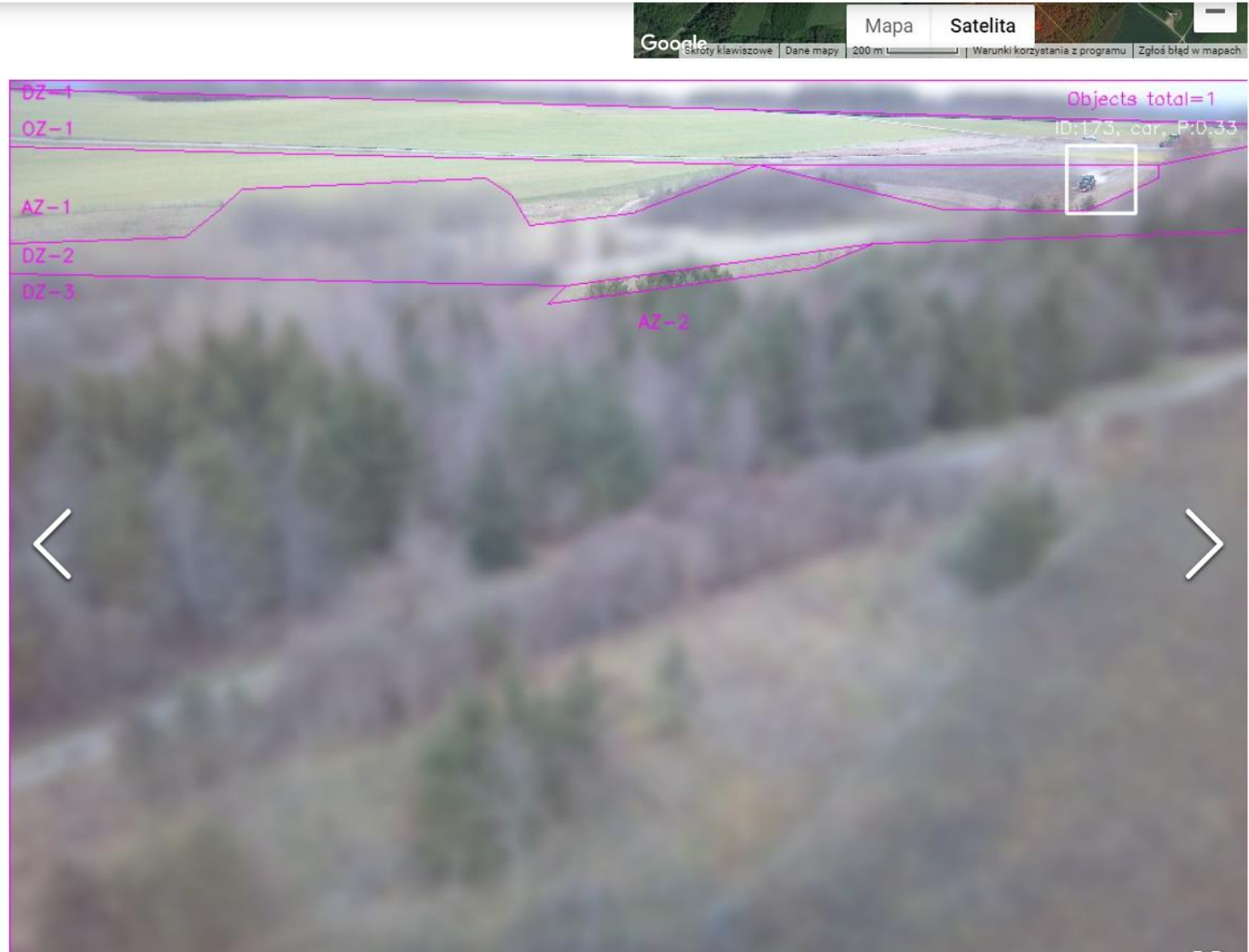
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ebdd5	TR2	Module 1	2021-03-31 15:06:16
eb900	TR2	Module 1	2021-03-26 13:34:24
eb5a6	TR2	Module 1	2021-03-20 14:28:48
eb2f6	TR2	Module 5	2021-03-15 13:02:50
a3e26	TR2	Module 5	2021-03-12 09:10:03
a3d9a	TR2	Module 5	2021-03-11 14:19:13
c52cc	TR2	Module 1	2021-03-07 14:58:37
c5173	TR2	Module 1	2021-03-05 14:38:19
67ea6	TR2	Module 1	2021-03-02 14:32:20
10955	TR2	Module 1	2021-02-28 14:46:14
10874	TR2	Module 1	2021-02-28 13:29:31
10772	TR2	Module 5	2021-02-28 11:36:37
10671	TR2	Module 1	2021-02-27 14:37:35
10502	TR2	Module 6	2021-02-26 16:22:06
1041b	TR2	Module 1	2021-02-26 16:14:26



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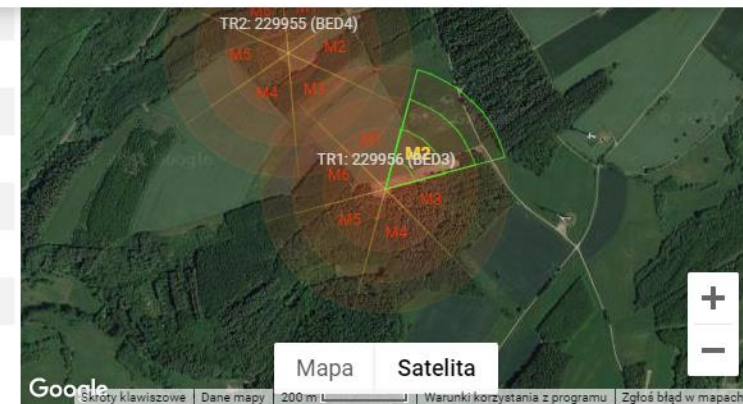
Baywa TDS
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Date desc

ID	TURBINE	MODULES	DATE
3b8f1	TRI	Module 3	2021-08-13 15:12:41
3b8c0	TRI	Module 1	2021-08-13 14:52:21
3b86e	TRI	Module 2	2021-08-13 14:52:00
3b592	TRI	Module 6	2021-08-09 09:41:48
3b029	TRI	Module 3	2021-07-31 15:43:06
3aaed	TRI	Module 6	2021-07-29 13:33:36
3a770	TRI	Module 2	2021-07-29 10:16:50
3a3f9	TRI	Module 2	2021-07-27 11:39:53
39fd0	TRI	Module 1	2021-07-26 14:29:28
39bd0	TRI	Module 6	2021-07-23 16:48:19
39a55	TRI	Module 1	2021-07-23 16:37:29
39698	TRI	Module 6	2021-07-23 15:36:48
39677	TRI	Module 1	2021-07-23 15:34:44
3946a	TRI	Module 1	2021-07-23 14:56:11
38b25	TRI	Module 1	2021-07-23 10:07:48
38aed	TRI	Module 2	2021-07-23 10:07:15
389dc	TRI	Module 1	2021-07-22 11:40:39
38821	TRI	Module 2	2021-07-22 11:36:00
37ddc	TRI	Module 6	2021-07-21 15:41:40
37ca0	TRI	Module 6	2021-07-21 13:42:08

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Turbine	TRI: 229956 (BED3)
Duration	00:02:50
Modules	Module 2
Zone	AZ-1, A75
Weather	[18°C, SW, 7km/h]
Start time	2021-07-29 10:16:50
Stop time	2021-07-29 10:30:02



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Turbine: TRI: 229956 (BED3) Module: Module 1 Notifications active: YES Module status: **OK**



Tractor Detection System – time lapse



Summary:

- 2 Vestas turbines in Germany
- 2 TDS with 6 detection modules covering 360 degrees
- 91 confirmed detections during March – October 2021
- Starting from 20% false positive detections (horses, blade shadows)
- Down to ca. 6,6% FP rate (6 FPs) in 2021

Main features of TDS:

- Efficient vehicles detection up to 400m away
- Easy to configure
- Ability to blurr areas not subject to monitoring
- Intuitive webapplication with all detection events
- Live Stream available from cameras
- Possible to send notifications by email/SMS
- Reliable (no defect since installation)

