

# AESA Innovation Report

## (Q1-Q3 2025)

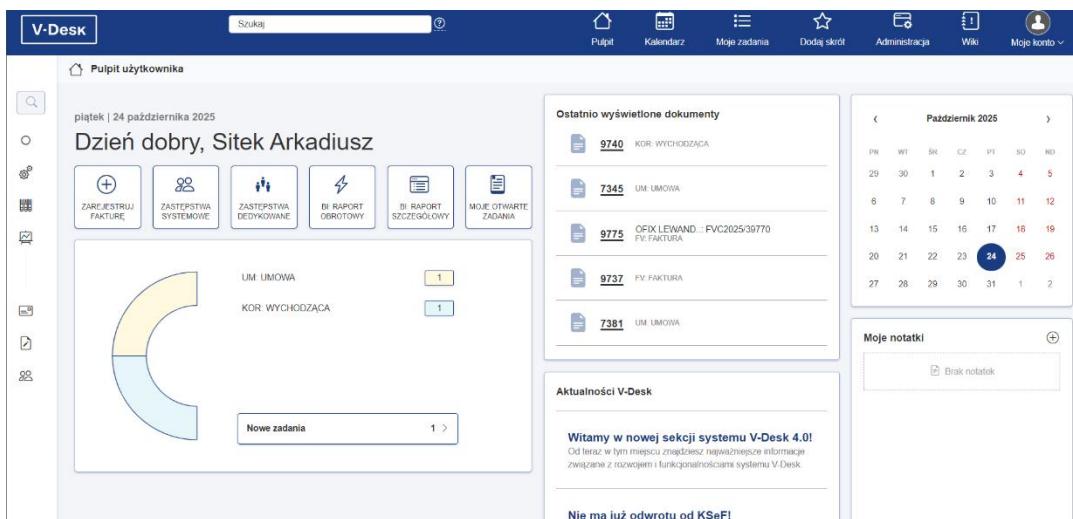
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## Digital Platforms and Technological Independence

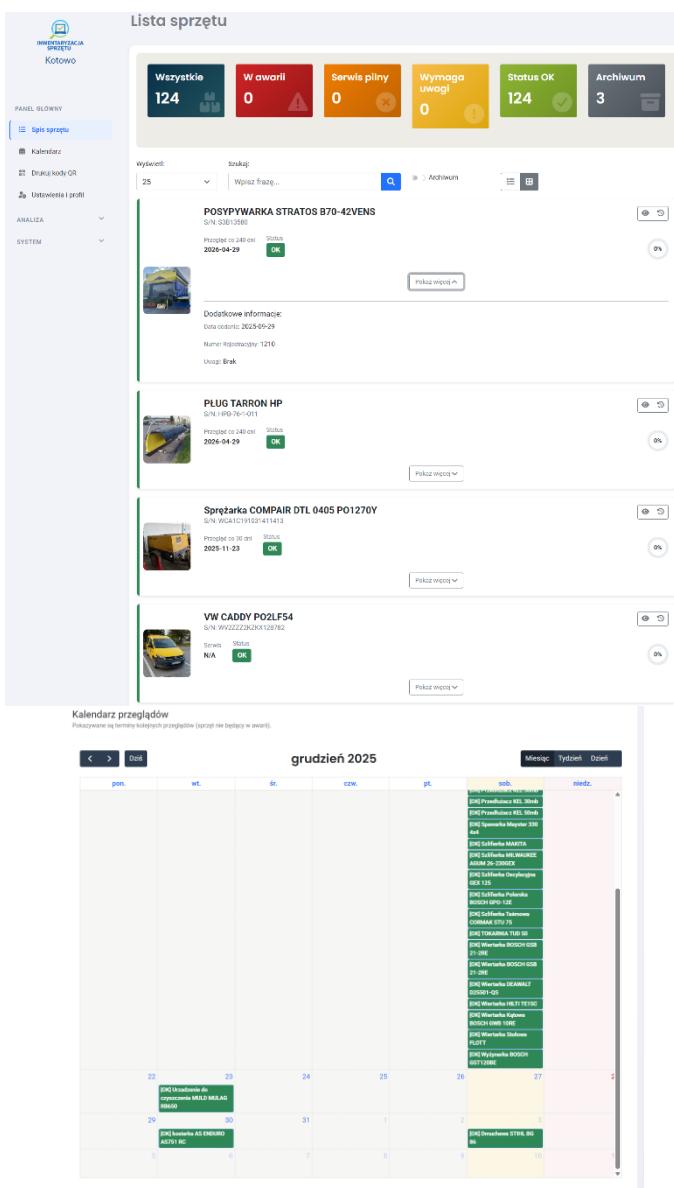
We have built internal development competencies, making our key systems independent from external vendors. This gives us control over development, security, and costs.

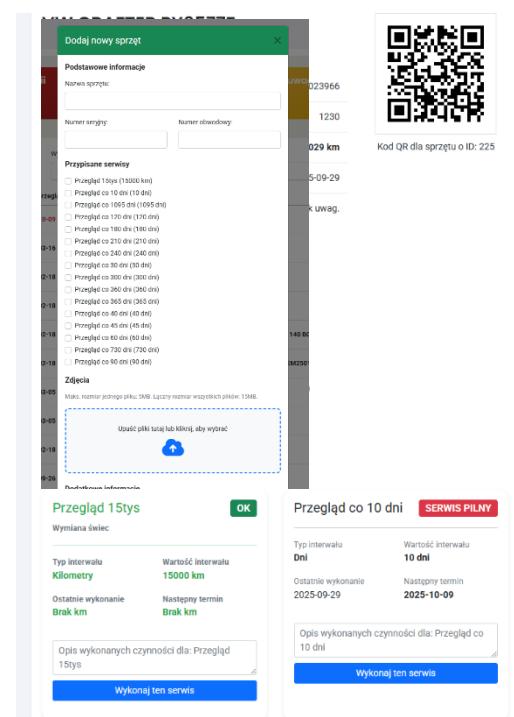
- Digitization of Field Operations (Events Database & Asset Model) We replaced all email and PDF-based work requests (RWN) with a 100% digital, mobile-first platform. The depth of this new system includes:
  - Advanced Planning Module: Staff can now schedule specific work types (e.g., manual mowing, sign straightening) and reserve all necessary vehicles and equipment directly in the app.
  - Automated Conflict Detection: A live engine calculates potential work conflicts and sends real-time alerts to mobile users (in both the Events Database and maintenance apps).
  - Full Subcontractor Integration: We granted subcontractors direct access to mobile apps (EMU/UMU, Service Lens) and forms, integrating them fully into our digital ecosystem.
  - Multi-Level Approval Workflow: A fully digital approval chain that replaces the PDF process, automatically generating and distributing work orders based on defined filters.
  - Enhanced Reporting & Integrations: Launched a suite of new automated reports (OPP Report, Brigade Work Card, Event Card, Collision Card, Maintenance Report with attachments).
  - Deep System Integration: The platform is connected to VoiceBot, ChatBot, Info A2, and Asset Model
  - Detailed Asset Mapping: Added the ability to map the specific number of lanes for any given roadway.
  - Future-Ready: The system is planned for integration with an SMS gateway for mass (SMS and/or email)
- Digital Office
  - We are finalizing the deployment of a comprehensive Electronic Document Workflow system. This platform manages the entire lifecycle of contracts, includes electronic signatures, and digitizes the full invoice and documents workflow.



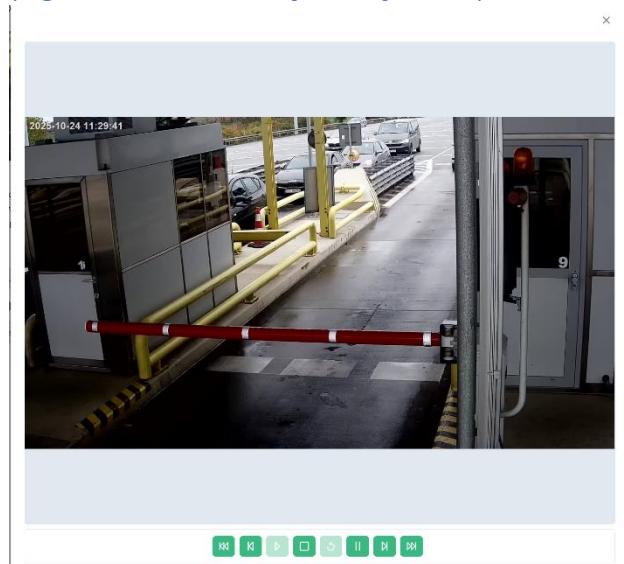
The screenshot displays the V-Desk digital platform interface. The top navigation bar includes links for 'Szukaj' (Search), 'Pulpit' (Dashboard), 'Kalendarz' (Calendar), 'Moje zadania' (My tasks), 'Dodań skrół' (Add shortcut), 'Administracja' (Administration), 'Wiki', and 'Moje konto' (My account). The main dashboard features a 'Pulpit użytkownika' (User Dashboard) with a message 'Dzień dobry, Sitek Arkadiusz' and a date 'piątek | 24 października 2025'. It includes a circular progress bar divided into yellow and light blue segments, with labels 'UM: UMOWA' and 'KOR: WYCHODZĄCA'. Below the dashboard are several buttons: 'ZAREJSTRUJ FAKTURĘ', 'ZASTĘPSTWA SYSTEMOWE', 'ZASTĘPSTWA DĘDKOWANE', 'BI: RAPORT OBROTOWY', 'BI: RAPORT SZCZEGÓLONY', and 'MOJE OTWARTE ZADANIA'. To the right, there's a section titled 'Ostatnio wyświetlone dokumenty' listing items like '9740 KOR: WYCHODZĄCA', '7345 UM: UMOWA', '9775 OFIX LEWAND.: FVC2025/39770', '9737 FV: FAKTURA', and '7381 UM: UMOWA'. Further down is a 'Kalendarz' (Calendar) for 'Październik 2025' showing dates from 29 to 31. At the bottom, there's a 'Moje notatki' (My notes) section with a note 'Brak notatek'.

- International Recognition (SOMA System)
  - Our in-house SOMA (Motorway Monitoring and Operation System) has been officially recognized and added to the European Road Safety Charter's list of good practices, validating its quality and impact on safety at an international level. <https://road-safety-charter.ec.europa.eu/pl/content/system-obslugi-i-monitorowania-autostrady-soma-0>
- Dedicated Equipment & Fleet Management App
  - We developed a separate application for managing equipment inspections (required by ISO 45001 compliance), integrated with our automatic fuel stations (automatic mileage retrieval) and QR codes generation and reading for equipment identification.





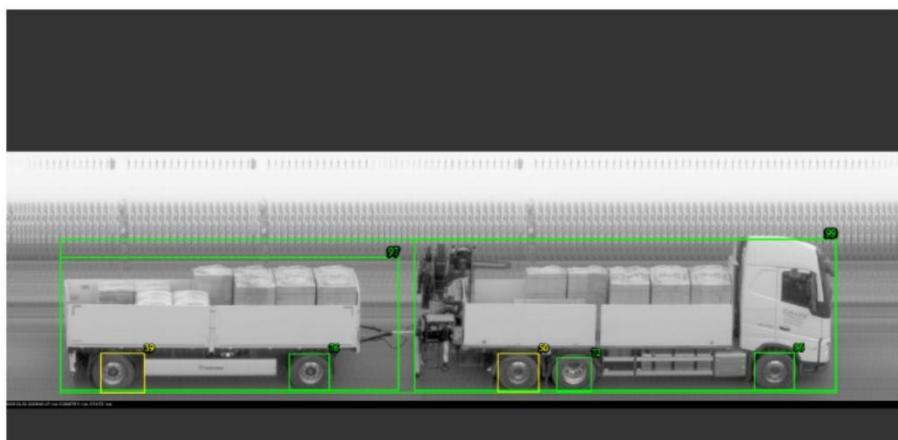
- Full Independence (In-House)
  - We migrated our VoiceBot and ChatBot to our own servers. We are independent of vendors, pay no per-interaction fees, and control 100% of the data.
  - We implemented a local (offline) audio-to-text transcription system (supports 100 languages), guaranteeing complete data security (nothing leaves the company).
- Intelligent Architecture (API)
  - We developed a universal, internal API for handling video camera recordings. This allows us to instantly connect a feed from any camera to any application (e.g., BackOffice, analytical systems) without costly case-by-case integration.



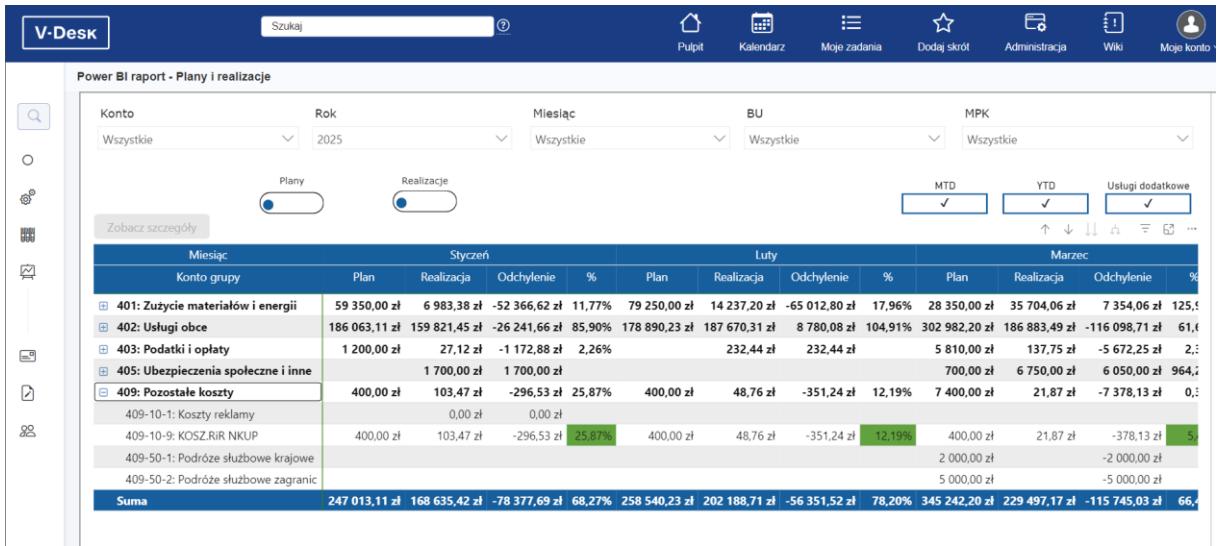
## AI and Advanced Data Analytics (BI)

We use data and AI for business decision-making, system diagnostics, and proactive security.

- AI in Operations (Computer Vision)
  - We are conducting an advanced pilot of vehicle categorization using AI cameras. The goal is to verify the potential of replacing expensive classification systems (CAPEX/OPEX) with a much cheaper solution.



- BI for Finance (Budget Management)
  - We launched a PowerBI module integrated with our EOD (Electronic Document Workflow) and accounting systems. Management now has live access to detailed budget execution analysis, linked directly to the invoice workflow.

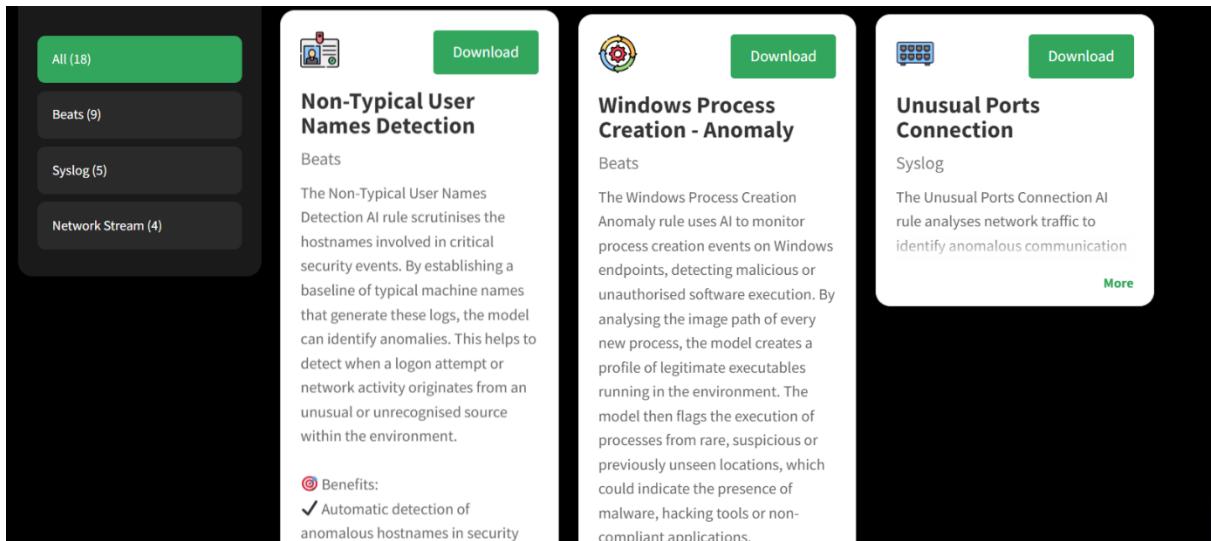


The screenshot shows a Power BI report titled "Power BI raport - Planы i realizacje". The interface includes a top navigation bar with "V-Desk", "Szukaj", "Pulpit", "Kalendarz", "Moje zadania", "Dodaj skrót", "Administracja", "Wiki", and "Moje konto". On the left, there's a sidebar with various icons. The main area displays a table with columns for Konto, Rok, Miesiąc, BU, and MPK. It compares "Plany" (Plans) and "Realizacje" (Actuals) for each category. The table is divided into three sections: Styczeń (January), Luty (February), and Marzec (March). The data includes sub-categories like "Zużycie materiałów i energii", "Uslugi obce", "Podatki i opłaty", "Ubezpieczenia społeczne i inne", "Pozostałe koszty", and specific items like "Koszty reklamy" and "Podróże służbowe zagranic". The table uses color coding for differences (green for positive, red for negative).

- BI for Operations (Diagnostics)
  - We built a suite of advanced diagnostic dashboards in Grafana. This includes:
    - Detailed Traffic Visualization: Traffic on all lanes, broken down by vehicle category, plus cumulative traffic (total, by category, and hourly).
    - Interactive Charts: Users can intuitively "zoom in" on specific time ranges.
    - Instant Reporting: High-level reports (total motorway traffic broken down by entry/exit, cumulative annual traffic) are generated almost instantly because the data is pre-aggregated in the database.
    - Operational Stability Monitoring: We implemented monitoring for toll collection software versions, down to the individual executable file level, in addition to real-time LPR effectiveness analysis.



- We are implementing a SIEM/SOAR system integrated with AI, which proactively analyses logs from across the entire company to find advanced threats (in line with MITRE ATT&CK), rather than just reacting to incidents. It also has additional AI models dedicated to specific analysis.



**All (18)**

**Non-Typical User Names Detection**

The Non-Typical User Names Detection AI rule scrutinises the hostnames involved in critical security events. By establishing a baseline of typical machine names that generate these logs, the model can identify anomalies. This helps to detect when a logon attempt or network activity originates from an unusual or unrecognised source within the environment.

Beats

**Windows Process Creation - Anomaly**

The Windows Process Creation Anomaly rule uses AI to monitor process creation events on Windows endpoints, detecting malicious or unauthorised software execution. By analysing the image path of every new process, the model creates a profile of legitimate executables running in the environment. The model then flags the execution of processes from rare, suspicious or previously unseen locations, which could indicate the presence of malware, hacking tools or non-compliant applications.

Syslog

**Unusual Ports Connection**

The Unusual Ports Connection AI rule analyses network traffic to identify anomalous communication

**More**

- **AI Research & Development (R&D)**
  - We are actively testing local AI models for document analysis (RAG and Graph RAG) and querying databases using natural language,
  - We also completed a successful Proof of Concept (POC) using a local LLM to analyse customer interaction transcripts from our Voice and Chatbot. This will allow us to assess case resolution effectiveness and identify areas to improve the BOT's performance. The POC was successful, and we plan to proceed with a production deployment in 2026.
  - The long-term plan also includes applying Computer Vision models to analyze photos within the Events Database, the service module, and the Asset Model. The idea is to use it to check if the repair is done (automatically compare before and after photos).

## Agile Engineering Solutions

We prove that innovation also means intelligently and creatively solving everyday operational problems at minimal cost.

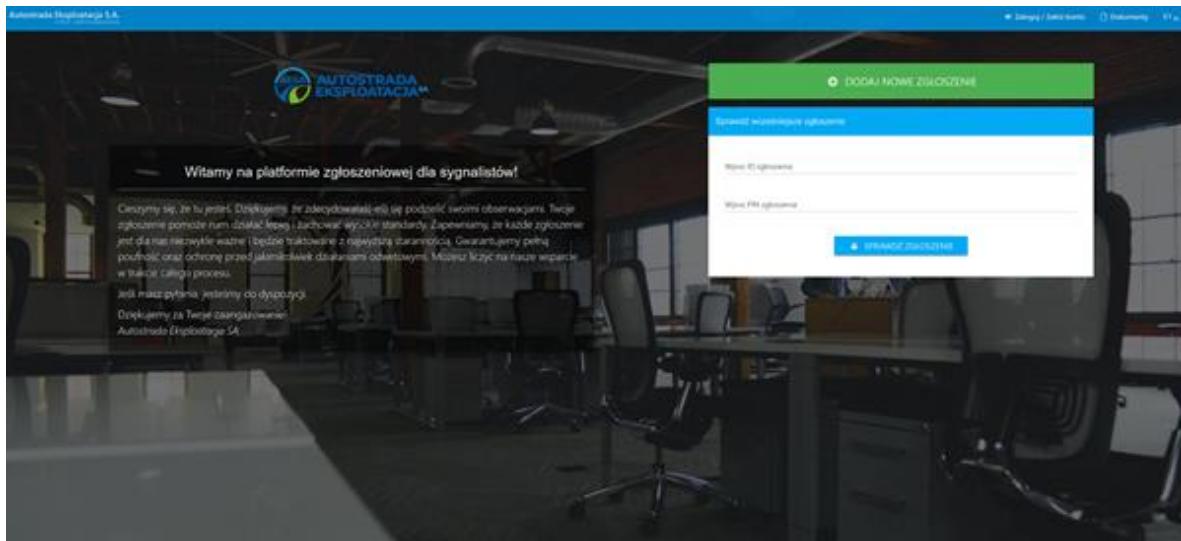
- **Rapid Prototyping (3D Printing)**
  - We use our own 3D printer to design and immediately produce non-standard components: mounts for payment terminals, spare parts for ticket dispensers, or cable organizers.
- **Smart Infrastructure (Smart IoT)**
  - We implemented network-controlled power modules that allow for the remote reboot of frozen devices (e.g., payment terminals in lanes). This eliminates 90% of service dispatches to the lane, reducing downtime and physical human intervention.

## External whistleblower reporting platform

External whistleblower reporting platform – [www.aesa.zalezymi.pl](http://www.aesa.zalezymi.pl) – allows users to submit reports either anonymously or under their name. Launched in March 2025, the platform is very easy to use. The drop-down menu enables whistleblowers not only to select the

appropriate reporting form and topic, but also to decide whether they wish to report an issue anonymously or not.

Through the website, anyone wishing to report a violation can also schedule a meeting with the Compliance Officer. Additionally, employees can use the platform to submit improvement ideas and innovations.



### Modern employee communication systems:

- o info.aesa.work and moja.aesa.work applications – available 7/24 on computers, tablets, and phones. Employees have access not only to the latest company news, but also to HR documents, employee benefits, health and safety videos, etc.

### The Employee Portal

A modern digital tool that allows employees to manage their own HR data, access schedules and payroll data, and submit vacation requests. It is simply part of the existing Softlab computer program, to which all employees of AESA are assigned.



## Warning message transmitter

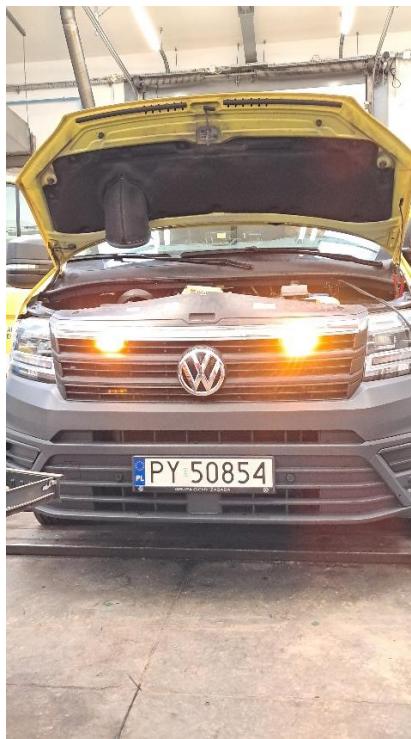
New communication tool for drivers

The use of directional antennas and low-power transmitters allows messages to be broadcast at the work site (without “cluttering” the airwaves) at a distance of approx. 300–500 m in the direction of oncoming vehicles. These modules are installed in vehicles securing road works (e.g., U26a and U27 trailers).



## Retrofitting Patrol and Intervention vehicles with additional orange LED warning lights

They will be located at the front of the vehicle, in the radiator grille, similar to emergency vehicles. These lights will be clearly visible in the rearview mirrors of passenger cars and will enable drivers to react more quickly to vehicles approaching them on their way to an incident. This will make the highway operator's cars more visible to vehicles in front of them. Currently, after testing, the project to retrofit cars with warning lights has been referred for implementation to the OMC's.



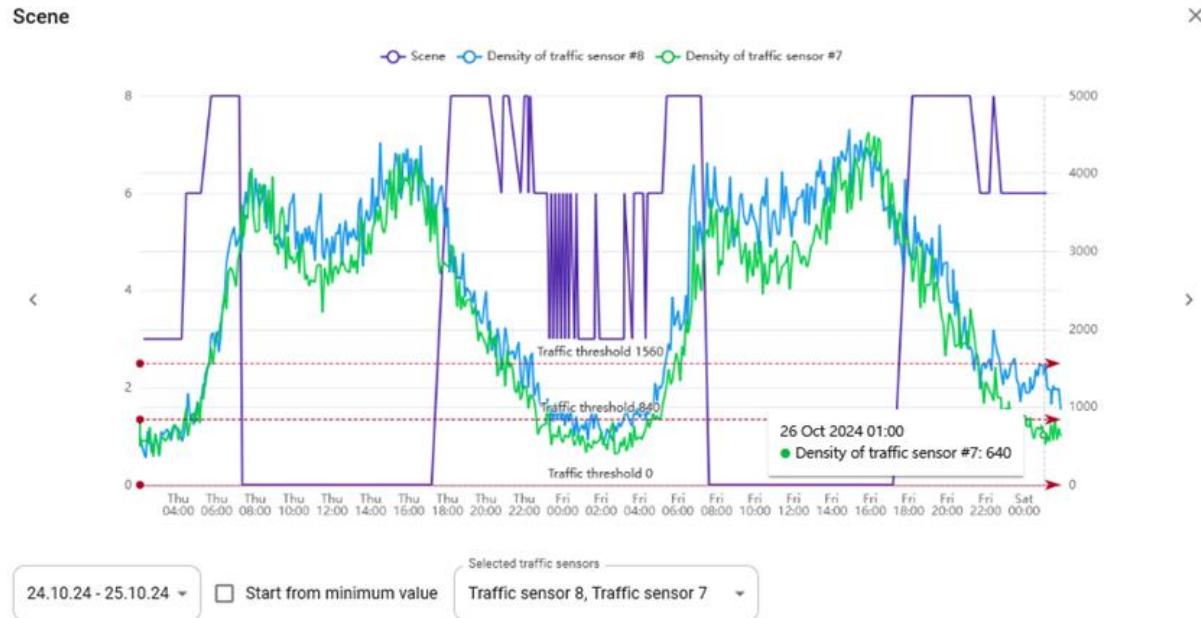
### Implementation of real-time road lighting level control depending on traffic (dynamic adjustment of lighting levels).

Implementation of **real-time** road lighting level control based on current traffic, achieving an **additional 42% reduction** in road lighting energy consumption (October 2024). It is probably the first such system in Europe.

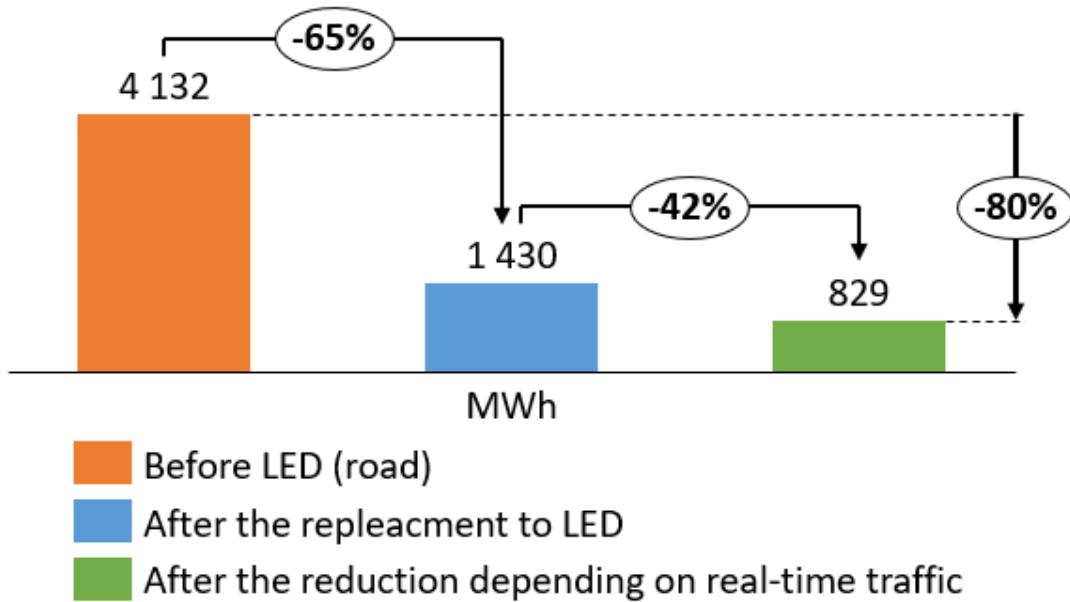
Traffic flow data is collected from traffic counting stations every 6 minutes. The system processes the received data on the number of passenger cars and trucks, converting them into equivalent units [pu] and traffic intensity expressed in [pu/h]. These values are then compared with the maximum capacity of the given road section.

According to the PN-EN 13201:216 standard (Appendix A), if the calculated result is lower than 65% of the maximum capacity, the lighting level is reduced by one class (in our case from M3 to M4, by 25%). If the result is lower than 35% of the capacity, the lighting level is reduced by two classes (in our case from M3 to M5, by 50%).

The results and corresponding actions (lighting class changes) are recorded and displayed in the system in the form of charts. An example chart is shown in the figure below, where the scene number corresponds to the lighting class (lighting level), and the traffic thresholds represent 35% and 65% of the maximum capacity for the given road section.



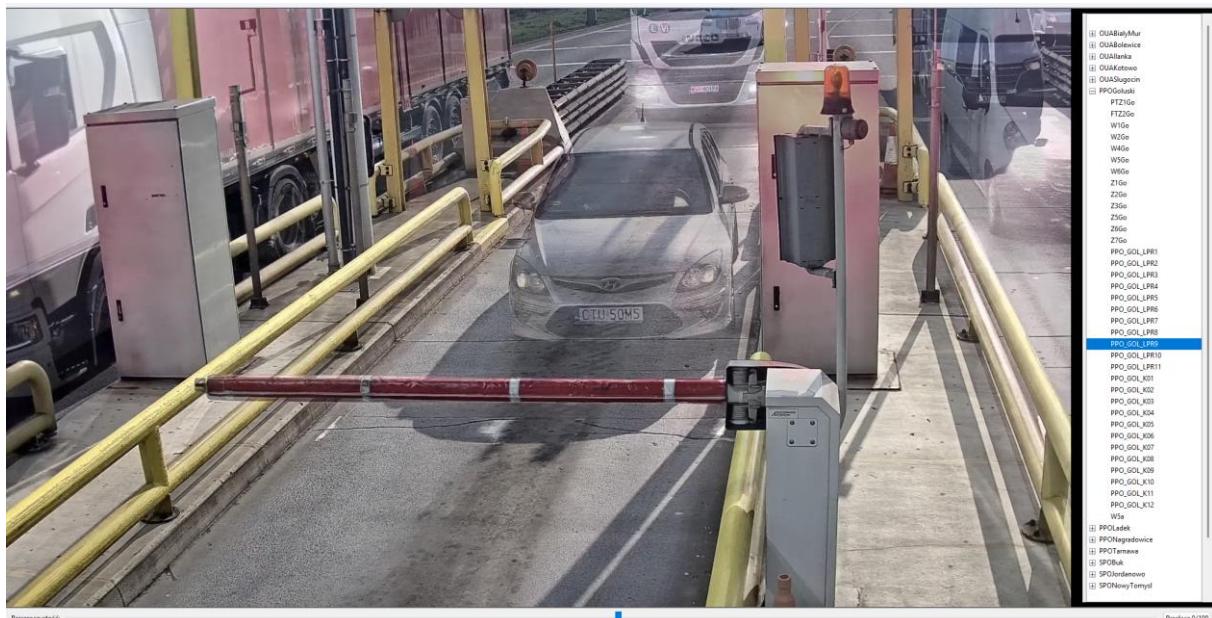
### Real annual energy savings from road lighting



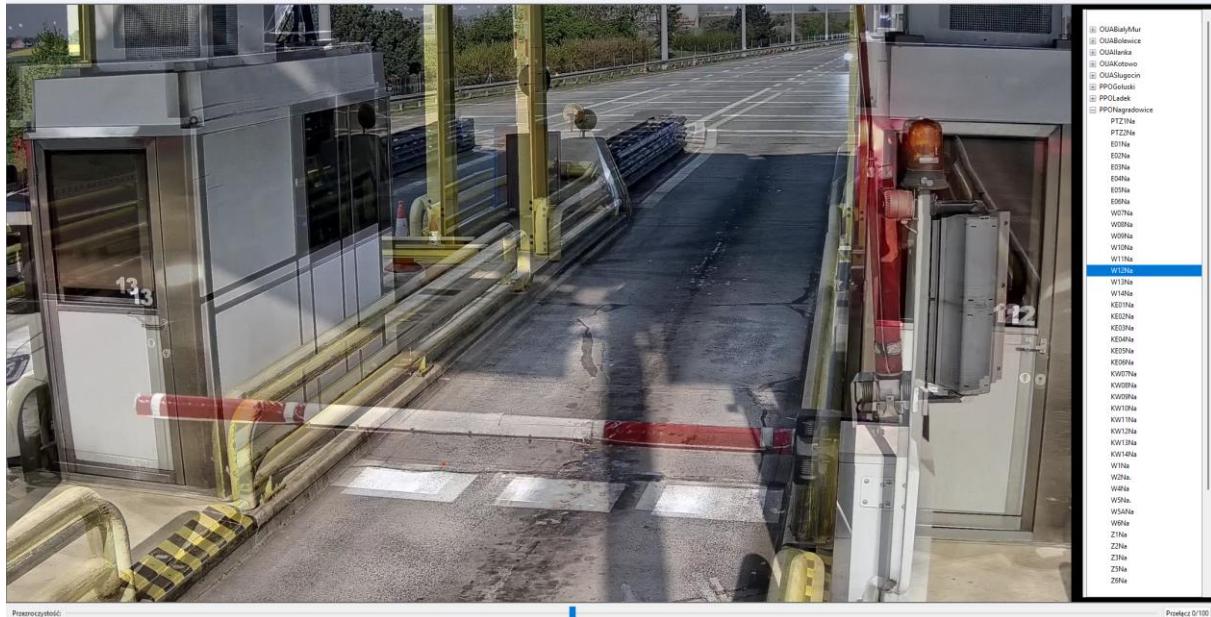
## Cameras maintenance software "KamTest"

CCTV cameras and road incident detection system cameras operate in harsh weather conditions, which often causes changes in their viewing angles. Due to strong winds or vibrations of mounting elements — such as poles and camera brackets — the cameras may shift, altering the observed image. For road incident detection system cameras, proper camera alignment is crucial for the correct functioning of the system. Restoring the correct camera view without an appropriate tool is not easy — and certainly not optimal. Therefore, a program has been developed to compare the current camera image with a reference image to check whether the camera has shifted since installation. The reference image serves as a template with which the current camera image should always be identical. If noticeable differences are detected, it is necessary to adjust the camera's viewing angles on the bracket. This software facilitates the correction of camera viewing angles by allowing the reference image and the current image to be overlaid with adjustable transparency. Thanks to this feature, technical personnel can more easily and quickly restore the correct camera alignment.

The screenshot shown presents the current camera image overlaid on the reference image with 50% transparency. By observing fixed elements in the image, such as the traffic light or ticket machine, it can be seen that the camera is aligned according to the reference image. Using the slider, the operator can adjust the level of image transparency from 0% to 100%.



In the screenshot below, it is visible that the current camera image does not align with the reference image. Fixed elements in the image, such as the toll kiosk or traffic lights, appear "doubled." Camera adjustment is therefore required.



In the case of thermal cameras used in road incident detection systems, the same tool is also applied.



13

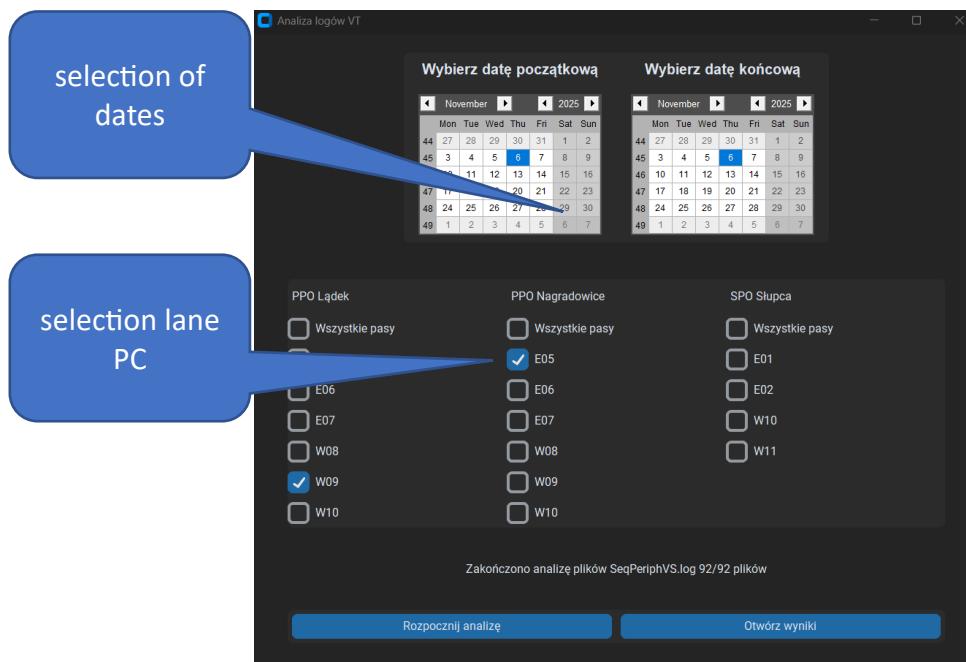
## Log Analysis Program „AnalizaVT”

During the operation of the toll collection system, errors or anomalies in system performance occasionally occur. An essential aspect of maintaining proper operation of toll collection devices is fast and simple error diagnostics. The system records peripheral device events in text files — these are the so-called system logs. However, the problem is that these files contain dozens of lines per second. For example, 30 minutes of system operation may generate around 7,500 lines of log text. These numbers can be much higher depending on system activity. Manually finding useful information about a specific system error is both time-consuming and labor-intensive. Additionally, the content of the logs is not easy to interpret, as they include abbreviations, unfamiliar terms, and codes. Therefore, a log analysis program has been developed for the VideoToll system, which automatically searches log files, filters the relevant entries, and translates their content into language understandable to the system operator.

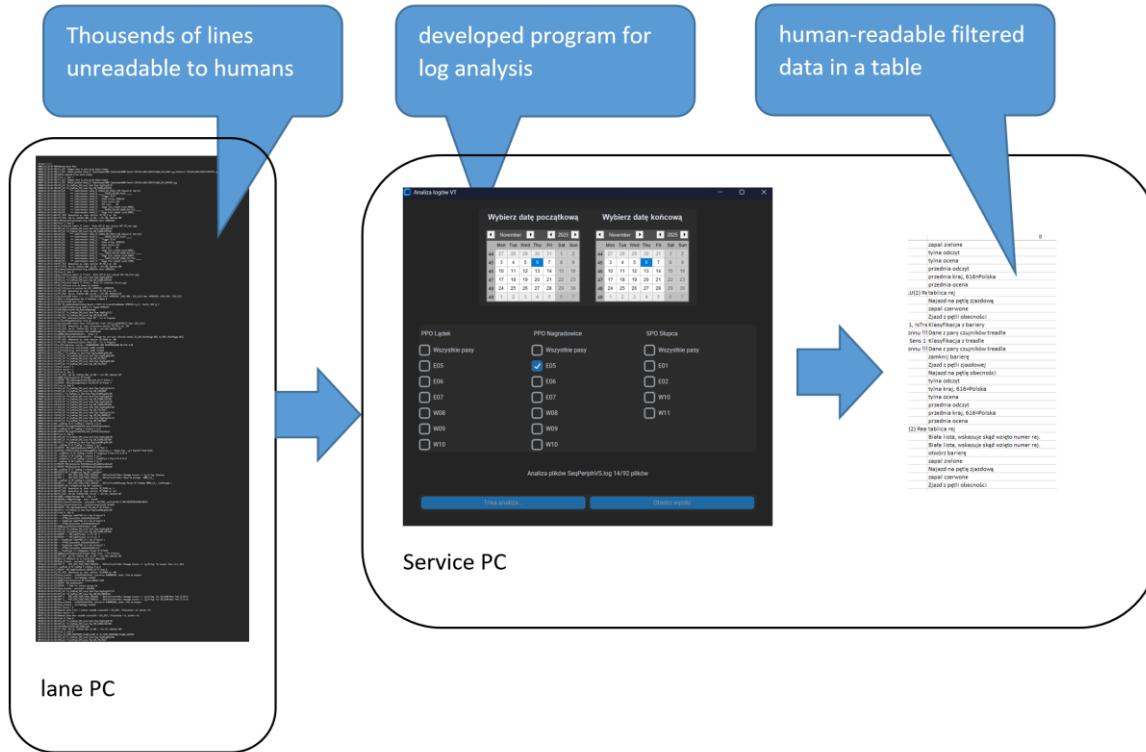
The software automatically connects to the specified VideoToll lane computer and searches the directory containing log files for the selected time range. This eliminates the need to manually open directories on the lane computer. The filtered and translated data are saved to a .xlsx file, which allows further analysis using Excel tools.

Thanks to this tool, technical staff can quickly locate information about the operation of the system's peripheral devices and analyze the source of errors. For example, finding all events related to the license plate recognition camera on a selected lane for a seven-day period takes only a few minutes.

Main screen of the software



# Simply workflow.



## Photo Application “FotoNotatnik”

A simple application that allows users to create photographic notes with the ability to add text descriptions and draw annotations. To make identifying taken photos quick and easy, a mobile application for Android devices was developed. Using the app, users can take a photo that automatically includes the date, GPS location, highway kilometer marker, and a custom text description.

The application works offline and can also function without GPS; in that case, location data will not be recorded. Photos are saved locally in two versions — one with annotations and one as a clean, unmarked image. This tool enables effective identification of photos taken, for example, during system inspections along long highway sections, especially when a large number of photos are produced. Photos taken with this method can be attached as part of an inspection report without the need for adding additional written descriptions.

Main view



### Examples photos



### Roller Pressure Meter

The correct roller pressure in the ticket reader and dispenser affects both the reliability and the mechanical wear of the device's components. If the pressure is too low, the ticket may not feed properly; if it is too high, it accelerates the wear of mechanical parts. Therefore,

proper adjustment of roller pressure is essential — but to achieve it, a roller pressure gauge is required. While a traditional force gauge can be used, it is a more difficult and time-consuming method compared to the presented solution using a digital strain gauge meter. The strain gauge sensor is inserted under the rollers to take measurements, and the results are displayed on an LCD screen, indicating whether the measured pressure value is appropriate for the device. The digital meter is simple and easy to use, and the measurement results are clearly presented on the display.

