

## Conception Of Integrated IT System For Telemetry-Enhanced UAV Surveillance In Railway-Proximate Plant Inspections

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This article introduces the concept of an Integrated Information System designed for Telemetric Drone Monitoring in Railway Facility Inspections. The article provides an overview of the key role played by rail facility inspections in ensuring safety and operational efficiency, juxtaposed with the challenges of traditional inspection methodologies. The focus is on the transformative potential of incorporating drones into telemetry-based monitoring to address these challenges.

The main objective of this article is to present partial results of a project on the inspection of vegetation growth around railway infrastructure. The inspections are carried out using a UAV built as part of the project. The data acquired will be recorded within a dedicated information system. The main elements discussed in the presentation will be the construction of a dedicated UAV equipped with a mounted sensor to visually and/or three-dimensionally record data by the moving UAV along the tracks, over power lines, documenting the current state of vegetation, water, terrain (soil type) surrounding the railway infrastructure and the concept of a system to record the acquired data.

The first part of the article presents the design of the dedicated UAV and the parameters describing it. The first data collected, and its preliminary analysis are presented.

The second part of the article focuses on the concept of an information system for the efficient collection of data related to the dedicated UAV. Such an IT system is a key element that supports the analysis of the collected data, manages the information and optimizes the site inspection and monitoring processes.

The central part of this system will be a platform containing data analysis software, modules responsible for storing information and a user interface to facilitate the use of the system. With this structure, users will be able to effectively manage and analyze the information collected by the UAV.

The system will record detailed information about each UAV flight. Recorded parameters such as flight path, altitude, speed, pitch angle or flight duration will be an important source of data for analyzing the effectiveness of UAV operations and optimizing flight paths.

Another important element will be the storage of multimedia data, such as photos and inspection videos. The system should categorize and store multimedia in a structured manner, allowing easy access to specific information relating to a particular area or inspection task.

The software should also provide tools for analyzing the data collected, enabling reports to be generated on the status of the area, problems detected, and the progress of inspections carried out. These reports are a valuable source of information for decision-makers and professionals monitoring UAV-controlled areas.

Data security issues, especially those of a sensitive nature, should be a priority. Therefore, the system should implement appropriate data protection measures, taking into account privacy principles and compliance with applicable regulations.

It is also worth considering the integration of the system with other systems, such as GIS or field data management systems. Such integration can significantly increase the functionality and usability of the overall system and allow for more comprehensive data analysis.

The introduction of such an advanced information system is an important step towards improving the operability and efficiency of monitoring and inspection activities in areas where UAVs are used.

The article outlines the conception of an integrated information technology system tailored for telemetry-enhanced UAV surveillance in the inspection of plants proximate to railway infrastructure. This innovative system aims to seamlessly merge telemetry capabilities with UAV operations, allowing for efficient data collection and analysis during plant inspections. The proposed framework underscores the potential for improved railway-proximate plant monitoring through the synergistic integration of advanced telemetry and UAV technologies.

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### **References**

- Stypulkowski, K., Golda, P., Lewczuk, K., Tomaszewska, J. 2021. Monitoring System for Railway Infrastructure Elements Based on Thermal Imaging Analysis. *Sensors* 21 (May), 3819. <https://doi.org/10.3390/s21113819>.
- Wawrzyński, W., Zieja, M., Sigieli, N. 2022. Optimization of Autonomous Underwater Vehicle Mission Planning Process. *Bulletin of the Polish Academy of Sciences, Technical Sciences* 70 (January), 2021. <https://doi.org/10.24425/bpasts.2022.140371>.