

ARIES

Augmented Reality-Enhanced Robotic Inspection of Electrical Substations

ARIES enables safer and faster inspection of high-voltage substations by combining robotic mobility, remote VR operation and thermal/visual condition assessment.

THE CHALLENGE AND WHY IT MATTERS

Manual thermographic inspection of EHVCs is travel-heavy, time-consuming and exposes experts to live high-voltage environments. Limited inspection frequency can delay fault detection and hinder condition-based maintenance. Solving this challenge improves personnel safety, reduces mobilisation effort, enables faster fault assessment and supports more reliable operation of critical electricity infrastructure.

OUR SOLUTION AND VALUE PROPOSITION

The final prototype integrated a mobile inspection robot with a VR operator interface, 360° live video, optical / thermal inspection views, component overlays and a Digital Representation Tool minimap. It was validated in IPTO's EHVC environment through training, routine inspection and emergency fault-assessment scenarios. The demonstrated workflow allowed an operator to remotely orient the robot, navigate to target equipment, inspect components, acquire thermal evidence and support maintenance decisions. The solution provides TSOs and high-voltage asset operators with safer inspection, reduced field exposure, faster first assessment of suspected faults and better support for condition-based maintenance.

ADDED VALUE FROM JARVIS

ARIES used the JARVIS Digital Representation Tool, adapted as a top-down EHVC minimap and virtual environment. Integrated into the VR interface via streamed Unity content, it showed robot position and orientation during teleoperation. This improved operator situational awareness, reduced disorientation in complex substation layouts and supports future training and demonstrations.

KEY RESULTS

- ✓ TRL7 field validation: ARIES demonstrated remote robotic inspection in a representative IPTO EHVC environment.
- ✓ Safer and faster workflows: 100% operator-exposure reduction in tested remote scenarios; routine inspection in ~25 min; emergency assessment in ~7.2 min.
- ✓ Positive user acceptance: 72% operator acceptance; 11 operators trained using ARIES teleoperation/AR capabilities.

POTENTIAL MARKET OPPORTUNITIES

Initial target customers are TSOs and operators of EHVC/high-voltage substations, starting with IPTO and comparable transmission environments in Greece and South-East Europe. Later, the solution can be adapted for DSOs, renewable-energy substations, converter stations, industrial high-voltage facilities and other safety-critical sites requiring remote inspection.



ARIES in an EHVC



Component detection.



Thermal imaging workflow



Robot, VR app (top), operator (bottom)



DRT for spatial awareness



PILOT AT A GLANCE

Lead organization: Castalia Technologies SMP

Consortium: Athena Research Centre, Independent Power Transmission operator

Sector / use case: Infrastructure / Energy

JARVIS module(s): Digital Representation Tool

Demonstration environment: Extra-High Voltage Centre, Pallini, Athens, Greece

MORE INFORMATION

Website: <https://jarvis-project.eu/document/#blog-posts>

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Videos: <https://www.youtube.com/@JARVISHorizonEuropeProject>