Improved Robotic Platform to perform Maintenance and Upgrading Roadworks: The HERON Approach

Grant Agreement Number: 955356

D8.7: Report on the project clustering activities (first version)

Work package	WP8: High-Impact Communication and Dissemination Activities
Activity	Task 8.5: Clustering and cooperation with other relevant EU-financed projects
Deliverable	D8.7: Report on the project clustering (first version)
Authors	Marusa Benkic, Jayant Sangwan, Rémy Russotto
Status	Final (F)
Version	1.0
Dissemination Level	Public (PU)
Document date	31/05/2023
Delivery due date	31/05/2023
Actual delivery date	31/05/2023
Internal Reviewers	Dimitrios Vamvatsikos (RG), Nikos Bakalos (ICCS)
	This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement no 955356.

Document Control Sheet

Version history table			
Version	**Date**	**Modification reason**	**Modifier**
0.1	05/05/2023	Initial table of contents and basic structure of the deliverable	Marusa Benkic (CORTE)
0.2	20/05/2023	Main sections of the deliverable elaborated	Marusa Benkic (CORTE)
0.3	26/05/2023	Deliverable submitted for review	Marusa Benkic, Jayant Sangwan (CORTE)
0.4	30/05/2023	Deliverable reviewed by internal reviewers	Dimitrios Vamvatsikos (Resilience Guard), Nikos Bakalos (ICCS)
1.0	31/05/2023	Final version ready for submission	Marusa Benkic, Jayant Sangwan, Remy Russotto (CORTE)

Legal Disclaimer

Table of Contents

List of HERON consortium partners

Acronym	Consortium partner
ICCS	Institute of Communications and Computer Systems
ACCI	Acciona Construcción S.A.
OLO	Olympia Odos Operation S.A.
UGE	Université Gustave Eiffel
ETHZ	Eidgenössische Technische Hochschule Zurich
ROB	Robotnik Automation
CORTE	Confederation of Organisations in Road Transport Enforcement
STWS	SATWAYS
RISA	RisaSicherheitsanalysen Gmbh
INAC	InnovActs
IKH	AINOOUCHAOU PLIROFORIKI SA -IKnowHow
RG	Resilience Guard Gmbh

Executive summary

To maximise the impact and foster synergies, HERON has identified and established a bilateral cooperation with its sister EU projects working in the field of automated road inspection and maintenance. This deliverable presents the clustering activities implemented by the HERON project during the first two years of the project implementation (M24). This document is deliverable 8.7 in Work Package 8: 'High-Impact Communication and Dissemination Activities' and is a result of the work done in Task 8.5: 'Clustering and cooperation with other relevant EU-financed projects'.

1 Introduction

HERON aims to develop an integrated automated system to perform maintenance and upgrading roadworks, such as sealing cracks, patching potholes, asphalt rejuvenation, autonomous replacement of CUD elements and painting markings. The system also aims to support the pre- and post-intervention phase, including visual inspections and dispensing and removing traffic cones in an automated and controlled manner.

The HERON system consists of:

- Autonomous ground robotic vehicle that will be supported by autonomous drones to coordinate maintenance works and the pre-/post-intervention phase;
- Various robotic equipment, including sensors and actuators (e.g., tools for cut ad fill, surface material placement and compaction, modular components installation, laser scanners for 3D mapping) placed on the main vehicle;
- Sensing interface installed both to the robotic platform and to the Road Infrastructures (RI) to allow improved monitoring (situational awareness) of the structural, functional and RI's and markings' conditions;
- Control software that interconnects the sensing interface with the actuating robotic equipment;
- Augmented Reality (AR) visualization tools that enable the robotic system to see in detail surface defects and markings under survey;
- Artificial Intelligence (AI)-based toolkits that will act as the middleware for:
  a) optimally coordinating the road maintenance/upgrading workflows and
  b) intelligent processing of distributed data coming from the vehicle and the infrastructure sensors for safe operations and not disruption of other routine operations or traffic flows;
- Integration of all data in an enhanced visualization user interface supporting decisions and
- Communication modules to allow for Vehicle-to-Infrastructure/-Everything (V2I/X) date exchange for predictive maintenance and to increase users' safety.

HERON aims to reduce fatal accidents, maintenance costs, traffic disruptions, thus increasing the network capacity and efficiency.

This document is deliverable 8.7 in Work Package 8: 'High-Impact Communication and Dissemination Activities'. It is a result of the work done in Task 8.5: 'Clustering and cooperation with other relevant EU-financed projects'. The deliverable will be updated at the end of the project (in M48) when the second and final version of this deliverable (D8.8) will be submitted.

2 Related Past EU-funded projects

Within the Horizon 2020 framework the European Union has funded several projects related to infrastructure maintenance in the past that have some linkages to HERON. These include:

- SENSKIN
- SAFETRIP
- PANOPTIS
- FORESEE
- SAFE10T
- SAFEWAY
- RESIST
- AM4INFRA
- RAGTIME
- INFRAALERT
- INTERMODEL

All these projects have now concluded, but the work done in these projects continues to have relevance for HERON and will be leveraged under the project. To this end, cooperation with some of the recently concluded projects such as PANOPTIS has also been established by HERON.

3 Related Ongoing EU-funded projects

HERON has established a close cooperation with two related sister projects funded under the Horizon 2020 research and innovation funding programme, more specifically under the 'H2020-EU.3.4. - SOCIETAL CHALLENGES - Smart, Green and Integrated Transport' programme: OMICRON and InfraROB.

OMICRON is a technology-focused project funded by the European Union's Horizon 2020 programme (05/2021 – 10/2024) which aims to foster the industrialisation and automation of road construction, inspection, and maintenance technologies. The project is working to integrate a broad portfolio of solutions from inspection to execution, to improve safety levels; increase the availability, reliability and capacity of the road network; reduce traffic disruptions and lower construction and maintenance costs.

The project combines the most modern automatized tools in a way that can be adapted and applied to specific local requirements. These technologies together will be developed to create an Intelligent Road Asset Management Platform. The platform has four main focus areas:

- Digital inspection technologies
- Predictive maintenance
- Smart intervention and maintenance
- Smart construction

https://omicronproject.eu/

InfraROB is a European Union's Horizon 2020 funded project (09/2021 – 02/2025) which aims to reduce workers' exposure to live traffic and construction machines, increase the availability of the transport network, reduce the cost of repetitive tasks, and increase the safety of road users

by promoting significant advances in automating, robotising and modularizing the construction, upgrade and maintenance of the road infrastructure.
The project focuses on the roadbed and, particularly, on roads paved with asphalt and will provide advancements across 5 strictly interrelated technological areas, namely:

- Autonomous robotized machinery for pavement construction, upgrade or large maintenance interventions.
- Autonomous robotized machinery for the routine or periodic maintenance of the pavement.
- Modularization of road construction/upgrade through industrial prefabrication.
- Collaborative operation of safety cone robots and remotely piloted aircraft system (RPAS) for work zone segmentation and signalling.
- Upgrading of Management Systems to ensure safer operations and maintenance.

https://infrarobproject.com/

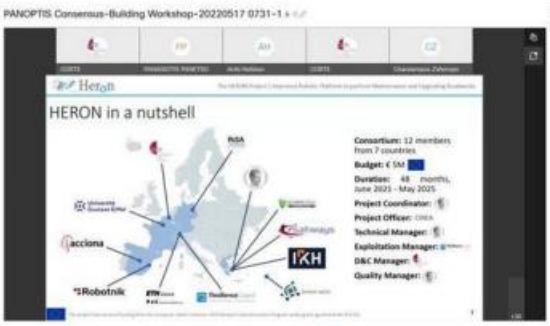
4 Clustering activities

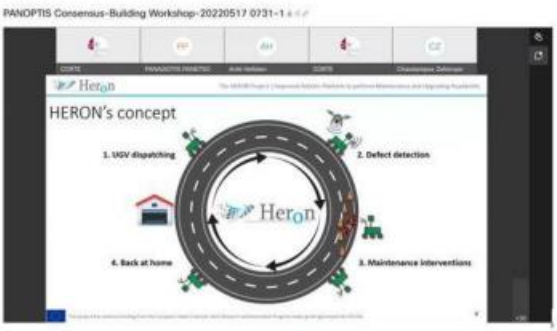
1.1. First meeting of HERON with OMICRON and InfraROB

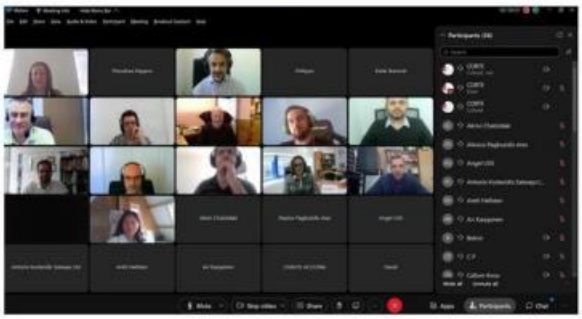
CORTE as dissemination leader of the HERON project initiated the first contact with OMICRON and InfraROB in March 2022. The first meeting of the three projects took place online on 17 March 2022. After a presentation providing an overview and scope of each project, the project representatives discussed the possibilities for future joint activities and creation of synergies. All project representatives appreciated the relevance of joint meetings to inform and update each other about project activities and encourage knowledge sharing. The project representatives were in favour of identifying opportunities for collaboration, not only at the level of communication & dissemination but also for technical work of each project. They had also identified several concrete collaboration opportunities which were later implemented and are described below.

1.2. Joint dedicated session at PANOPTIS workshop

HERON, together with the OMICRON project, was invited to participate in the PANOPTIS project's final consensus-building workshop which took place on 17 May 2022. This was initiated by CORTE as a dissemination leader in HERON, as well as a partner in the PANOPTIS project. PANOPTIS was an EU project funded under the Horizon 2020 programme that has developed a range of tools to improve road maintenance and increase the resilience of road transport infrastructure against extreme conditions (such as weather, earthquake, and other natural hazards). The online workshop saw the presentation of PANOPTIS results and provided an occasion for HERON and OMICRON to appreciate how these results could be leveraged by the two projects during a dedicated session.







1.3. Joint session at the Transport Research Arena (TRA) 2022

HERON, together with OMICRON and InfraROB, participated in a joint session at the Transport Research Arena (TRA), the largest European Research and Technology Conference on transport and mobility. The 2022 edition of TRA took place on 14-17 November 2022 in Lisbon and attracted transport policymakers, practitioners, and researchers from Europe and beyond to present and discuss policy issues, best practices, and research findings across the broad spectrum of transport. The conference also offered the opportunity to network, participate in technical visits, and explore the exhibition.

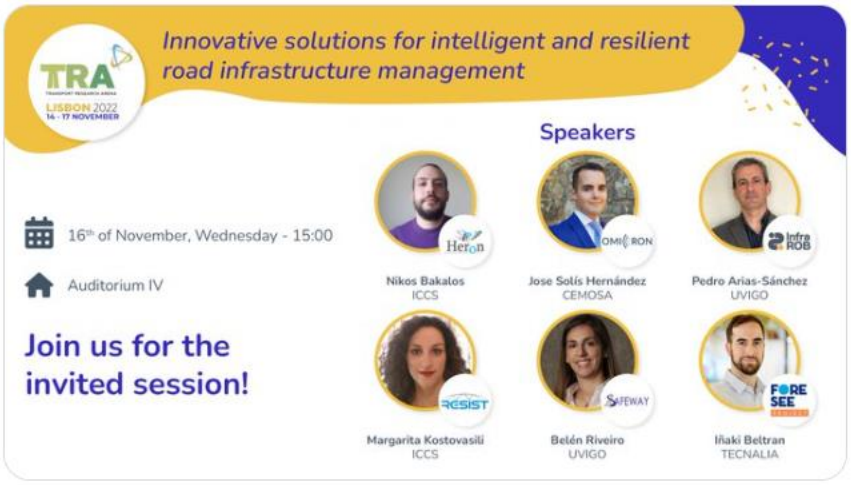
The three projects took part in a session on intelligent and automated solutions for road asset management, together with three preceding Horizon 20202 projects (RESIST, SAFEWAY, and FORESEE). The panel discussion focused on the journey to safer, better and more efficient road inspection, maintenance and intervention. It discussed emerging technologies such as Artificial Intelligence based decision support, Infrastructure Digital Twins and Autonomous Robotic intervention solutions. HERON, as well as OMICRON and InfraROB, presented insights into their perspectives of working towards a common goal of providing an integrated solution for more efficient road inspection, maintenance, and intervention.

Mr Nikos Bakalos from ICCS participated on behalf of HERON and provided insights into how HERON has been working towards addressing key challenges related to integrated solutions for infrastructure resilience.

Several online meetings between the representatives of the projects took place to coordinate and prepare a joint application which highlighted how the work performed by these projects addresses the whole life-cycle of road infrastructures as well as their digitalisation and automation. The following portfolio of topics addressed by the three projects was highlighted:

- Modular and efficient planning, design, and construction. The technologies in these projects aim at fostering the use of pre-manufactured components to increase the modularity, circularity, and operational efficiency of infrastructures.
- Intelligent inspection. The projects develop technologies to automate road inspection, including the use of UAVs and terrestrial vehicles.
- Automated maintenance. Developing automated and robotised equipment to perform periodic, emergency, and extraordinary intervention actions.
- Digitalised operation. All of the above technologies are coordinated by road Digital Twins and decision-support tools, as well as other base technologies such as Augmented Reality and new communication systems such as Vehicle-to-Everything (V2X).

To promote the session, the three projects combined their efforts on social media by creating dedicated visuals and posts that were shared on social media profiles (LinkedIn and Twitter) of the three projects.



1.4. Joint session at the RTR Conference 2023

HERON participated in the 2023 edition of the Conference on Results from Road Transport Research taking place in Brussels on 14-16 February 2023. The RTR Conference has been an entry point into the state-of-the-art of European funded research projects in road transport. Participants learned about Horizon2020 projects' results and expected impacts, and what the next research steps are in essential areas for road transport: Green Vehicles, Urban Mobility, Logistics, Intelligent Transport Systems, Safety, Automated Road Transport. The conference aimed to deliver a holistic view of how the European research scene is moving forward in these fields. HERON, together with InfraROB & OMICRON, participated in a session on full automated infrastructure upgrade and maintenance.

Dr. Nikos Bakalos from ICCS participated on behalf of HERON and presented the technical work implemented by the project so far.

5 Conclusions

This deliverable presents the clustering activities implemented by the HERON project during the first two years of the project implementation (M24). It describes how the HERON project has reached out and collaborated with sister EU projects the field of automated road inspection and maintenance, namely OMICRON and InfraROB, but also with the preceding projects working in this field, namely PANOPTIS, SAFEWAY, FORESEE and RESIST. HERON will continue making efforts to create synergies with its sister projects in the second half of the project implementation, as well as to possibly identify opportunities for a potential collaboration with other related EU projects.