

IEEE RAS Sustainability Grant Report

1. Project Title

“Eco-Label Toolkit: A Community-Based Platform to Promote Sustainable Robotics”
(submitted in June 2025)

2. Project Overview & Objectives

The rapid expansion of robotics across industrial, urban, and societal applications has raised increasing concerns about their environmental sustainability. Despite growing awareness, the robotics community lacks practical, accessible tools to assess and improve the environmental performance of robotic systems in a structured and comparable way.

This project addressed this gap by developing the Eco-Label Toolkit, a lightweight, web-based platform designed to operationalise sustainability principles in robotics. The toolkit builds on five key environmental metrics; resource conservation, life cycle extension, carbon footprint, energy efficiency, and circularity & recyclability, previously developed by the team.

The primary objectives of the project were:

- To create an interactive self-assessment tool for evaluating robotics projects against sustainability metrics.
- To provide educational content and guidance to support researchers and developers in implementing sustainable practices.
- To establish an online community-driven platform where users can share case studies and best practices.
- To engage the robotics community through co-design, dissemination, and feedback collection.

The project primarily benefits:

- Robotics researchers and engineers seeking practical sustainability tools
 - The broader research and innovation ecosystem through improved environmental performance
 - Long-term environmental sustainability through more responsible robotics design and deployment
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3. Outcomes & Impact

The project successfully delivered a functional and publicly accessible platform:

- Website launched: <https://roboticsecolabel.com/>
- An interactive checklist tool was developed based on the five Eco-Label metrics
- Educational content pages explaining each sustainability metric
- Community contribution feature enabling users to share sustainability practices

Quantitative Outcomes:

- 1 fully operational web platform developed and deployed

- 5 sustainability metrics operationalised
- 1 video produced in collaboration with IEEE RAS (currently in final approval stage)
- 1 manuscript submitted to IEEE Robotics and Automation Magazine titled “Towards an Eco-Label for Sustainable Robotics” by Fatma Demir, Tamas Haidegger, Sophia Falk, Parham Haji Ali Mohamadi, Pablo Lopez Garcia, Jiacong Sun, Marian Verhelst, Seppe Terryn, Joost Brancart, Lola Canamero, Aleš Ude, Mirko Kovač, Barbara Mazzolai, Bram Vanderborght.
- Initial pilot users engaged from both academic and applied robotics communities

Qualitative Impact

The Eco-Label Toolkit has received initial positive feedback as a practical, actionable framework for integrating sustainability into robotics design and evaluation. It supports the translation of high-level sustainability goals into concrete technical and design decisions.

The project has also contributed to broader community engagement and visibility. The Eco-Label Toolkit and its underlying framework will soon be disseminated and discussed in key scientific venues, including the sustainability panel during ICRA 2026 together with Barbara Mazzolai, and also at the ICRA IEEE International Conference on Robotics and Automation workshop “Circular Robotics: Designing Sustainable Autonomy for a Finite World”, the EARMA Conference 2026 (May 2026), and the Belgian Polymer Group Meeting (27–28 April 2026).

These engagements enable direct interaction with interdisciplinary communities, facilitating feedback, fostering adoption, and positioning the toolkit as a reference approach for sustainable robotics assessment.

Overall, the project contributes to long-term environmental sustainability by promoting life cycle thinking, resource efficiency, and circular design principles in robotics, while supporting more informed and responsible innovation practices.

4. Project Team & Acknowledgments

- Prof. Bram Vanderborght (Brubotics, Vrije Universiteit Brussel & imec)
Project Coordinator, led overall project direction, community outreach, and dissemination
- Dr. Fatma Demir (Vrije Universiteit Brussel)
Research & Project Manager – Led content development, platform design, coordination, and dissemination
- Dr. Carl Mörch (FARI - ULB/VUB)
Co-Researcher & Advisor – Provided SSH expertise, content validation, and outreach support
- Web Developers; Mohammad Omar Sharieff from VUB and Yunus Goven from FARI)
Responsible for website development, implementation, and technical maintenance

We acknowledge the support of:

- Vrije Universiteit Brussel (VUB) for institutional support
- FARI – AI for the Common Good Institute for technical and research support
- IEEE RAS Sustainability Committee for funding and enabling this initiative

5. Supporting Photography & Video

Please include **3–5 high-resolution photographs** and **one video** (link or file; video should be short - between 30 seconds and 2 minutes max - video should explain the objectives and outcomes, and include all credits and funding acknowledgment). For every file, please provide a brief description of the action shown. Confirm that all individuals pictured have provided consent for their likeness to be used in report materials.

File Name	Caption/Description	Consent Confirmed?
https://roboticsecolabel.com/ https://roboticsecolabel.com/en/the-five-sustainability-metrics https://roboticsecolabel.com/en/form/eco-label-score-calculator	Eco-Label Toolkit platform showcasing the homepage, metrics and the eco-score calculator	Yes
https://drive.google.com/file/d/1w9WtXxRS2YFGfZpb-YUFMMzBt6EgT_98/view	The video is in its final stages to be published by IEEE RAS (by Nicola Nosengo and his team)	No



BRUBOTICS
HUMAN ROBOTICS
RESEARCH CENTER



SUSTAINABLE MATERIALS
ENGINEERING
RESEARCH GROUP



AI FOR THE
COMMON GOOD
INSTITUTE
BRUSSELS



Measuring Sustainability in Robotics; A Multi-Metric Eco-Label Framework

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Eco-Labels

- Eco-labels turn sustainability into clear and comparable scores.
- Common in consumer products, e.g. energy labels, electronics & appliances.
- Missing in robotics → introduced here

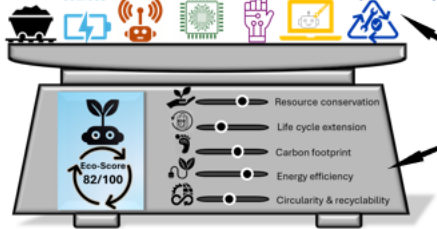
What?

- Multi-metric eco-label framework for robots.
- Self assessment + benchmarking.
- Community-based platform.

Why?

- Robotics sustainability is not standardised.
- No comparable metrics across systems.
- Lifecycle impacts remain hidden.

Materials Energy Sensors Processors Actuators Design Recyclability & easy disassembly



Framework overview

- Robots are complex systems, composed of 7 core technologies.
- Each core technology is evaluated using 5 sustainability metrics.
- Matrix-based assessment applied.
- Combined results yield an overall Eco-Score (1-100).

Impact

- Enables robot designers to integrate sustainability into design.
- Supports policy makers in informed decision-making.
- Empowers end consumers to make responsible choices.

Explore



How sustainable is *your* robot?

Scan to assess it!



<https://roboticsecolabel.com/>



Supported by the IEEE Robotics and Automation Society Sustainability Grant (2025).

The poster prepared to disseminate the project in ICRA Conference on 1-5 June 2026, Vienna.

Yes



SUSTAINABLE MATERIALS
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From Material Selection to Eco-Score: A Polymeric Materials Self-Assessment Framework for Sustainable Robotics

Fatma Demir, Sustainable Materials Engineering Research Group, Vrije Universiteit Brussel, Fatma.Demir@vub.be

Why materials matter?

- Polymers shape robot performance and environmental impact.
- Sustainability effects of material choices are often invisible.
- This framework makes them measurable & comparable.

What we assess?

The 5 metrics:

- Resource conservation
- Life cycle extension
- Carbon footprint
- Energy efficiency
- Circularity & recyclability

Framework overview:

- Sustainable robotics begins with sustainable materials.
- Material choice is evaluated across 5 metrics.
- Matrix-based assessment: Enabling strategies vs limiting factors.
- Metric results combined into an overall Eco-Score (1-100).

How it works?

Material Choice -> Metric Scores -> Eco Score (1-100)

- ✓ Recycled / bio-based
- ✓ Durable / self-healing
- ✓ Mono-material
- ✗ Multi-layer composites

Why/how it helps?

- Enables material scientists to integrate sustainable polymer choices for robots.
- Supports early-stage design decisions.
- Enables comparison across robotic systems.
- Bridges polymer science and sustainable robotics.

Examples:

- Thermoplastics ↑ recyclability
- Lightweight polymers ↓ energy use
- Self-healing materials ↑ lifetime
- Composites Δ recycling challenges
- Additives Δ circularity risks

Explore!

A Community-based Platform to Promote Sustainable Robotics

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MSCA-DN Project DurAMat 101119767 and IEEE RAS Sustainability Grant are acknowledged.

The poster prepared to disseminate the project in Belgian Polymer Group Annual meeting in 27-28 April 2026, Blankenberge.

Yes