

Autonomous Robotics Ontology

WG P1872.2 Ontologies for Autonomous Robotics

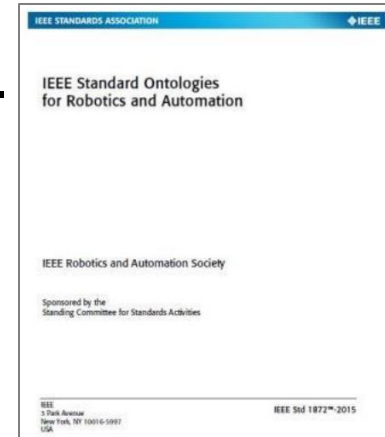
<http://www.ieee-ras.org/industry-government/standards/autonomous-robotics-group>

OUTLINE

- AuR Ontology
- Motivation
- Stakeholders
- Group Activities
- Publications
- Current Progress
- Proposed Ontological Framework
- Future Plan

- **Autonomous Robotics (AuR) Ontology**

This standard is a logical extension to **IEEE 1872-2015 Standard Ontologies for Robotics and Automation**, focusing on **autonomous robotics**.



1. General **ontological concepts and domain-specific axioms** for AuR; and
2. General **use cases and/or case studies** for AuR.

- Knowledge needed to build autonomous systems comprised of robots that can operate in all classes of **unstructured environments** - including, but not limited to, aerial, ground, surface, underwater, and space robots.
- Allows for **unambiguous identification** of the basic **hardware and software components** necessary to provide a robot, or a group of robots, with **autonomy** (i.e. endow robots with the ability to perform desired tasks in unstructured environments **without continuous explicit human guidance**).



Application Domains

Cloud Robotics

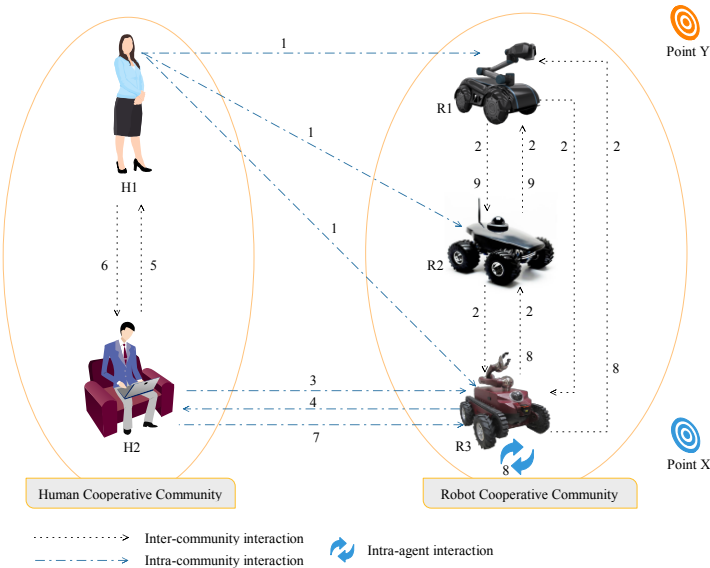
Autonomous Cars

Service Robots

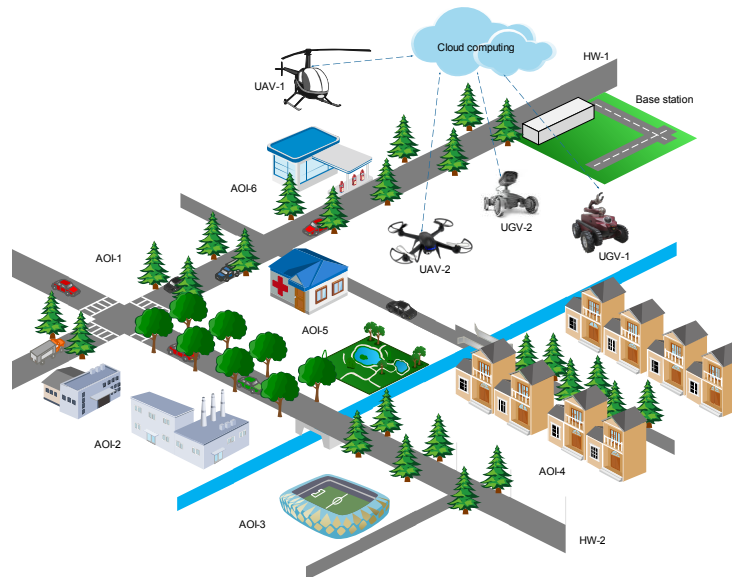
Industry 4.0

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- Robot designers and builders
- Robotics researchers
- Robot industry experts
- Robot users
- Policy makers



HRI Scenario in "Ontology for Autonomous Robots," IEEE International Symposium on Robot and Human Interactive Communication, Lisbon, Portugal, 2017



La w Enforcement Scenario in "Requirements for building an ontology for autonomous robots," Industrial Robot: An International Journal, v ol. 43, no. 5, pp. 469-480, 2016.

- Group members are from a cross-section of **industry, academia, and government** that represents over twenty countries and six continents.
- **Weekly tele-conference meetings** started in 2011.
- Workshop and working group kick-off meeting at **IEEE International Symposium on Robot and Human Interactive Communication**, Lisbon, Sept 2017.
- **Working group committee:** Joel Carbonera, Sandro Fiorini, Paulo Goncalves, Alberto Olivares, Veera Ragavan, Howard Li.

- “A suite of ontologies for robotics and automation,” IEEE Robotics and Automation Magazine, 2017.
- “Ontology for Autonomous Robots,” IEEE International Symposium on Robot and Human Interactive Communication, Lisbon, Portugal, 2017.
- “Requirements for building an ontology for autonomous robots,” Industrial Robot: An International Journal, vol. 43, no. 5, pp. 469–480, 2016.
- “Extensions to the core ontology for robotics and automation,” Robotics and Computer-Integrated Manufacturing, vol. 33, pp. 3–11, 2015, special Issue on Knowledge Driven Robotics and Manufacturing.
- “Towards an ontology for autonomous robots”, in IEEE/RSJ Int. Conf. on Intelligent Robots and Systems, 2012, pp. 1359–1364.

- **Architecture development:** function, behavior, structure models.
- **Vocabulary development:** entity, relationship, property, attribute.
- Due to difficulties in representing concepts in SUMO, it was decided to have SUMO as an option. The Group will try to **develop equivalent ontological concepts to represent autonomous robots at the upper level.**

Finish the four steps in **3 years by 2020**, then revise/update the architecture and vocabulary **by 2021** to finalize the standard

- 1. Development of standard vocabularies** for architectural concepts in IEEE1471 and IEC42010.
- 2. Development of a functional ontology** for R&A.
- 3. Checking/validation of relationship** using functions as a basis for relationship checking.
- 4. Using developed vocabularies and ontology** for conceptual design of robotic applications.

Thank you for your attention!

More information: <http://www.ieee-ras.org/industry-government/standards/autonomous-robotics-group>