Minutes for the Official Meeting on August 7, 2020
Paulo Gonçalves & Alberto Olivares-Alarcos transcribing

IEEE SA - 1872.2 Standard for Autonomous Robotics (AuR) Ontology Working Group

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Call and Agenda

Meeting Agenda for August 7, 2020, 1PM-2:30PM UTC

You have been invited to the IEEE SA WG P1872.2 meeting. Join the meeting:
https://join.skype.com/Buruz9jby49e

1. Call to order (Howard)
2. Introduction and rosters (Alberto)
3. Approve today's agenda (Howard)
4. Approve prior meeting's minutes (Paulo/Alberto; July 2)
5. Essential Patent Claims (Paulo/Alberto)
6. Status updates/previous action items (Howard)
7. IEEE Copyright Policy (Howard)
8. Technical discussion (Work on the draft and polish it to start closing definitions)
9. Next meeting's topic: nomination of presentation
10. New business/announcements/events/last thoughts
11. Close meeting (Howard)

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Rosters

- Y and N state for Yes and No
- ^ means the attendee is a *Voting Member*
- Members highlighted in **green** are eligible to become a *Voting Member*
- Members highlighted in **red** are eligible to lose *Voting Membership*
- Last column contains today's meeting attendees

Attendee Name	Role	Affiliation	Current Voting	Meetings Attended / last two	7-Aug
OBSERVATIONS					
Howard Li	Chair	University of New Brunswick, Canada	Y	2	Y^
Paulo Gonçalves	Co-Chair	IDMEC, Portugal	Y	2	Y^
Veera Ragavan	Co-Chair	Monash University, Australia	Y	1	N^
Alberto Olivares Alarcos	Secretary	IRI-CSIC, Spain	Y	2	Y^
Alaa Khamis	Member	General Motors, Canada	Y	2	N^
Chris Nowak	Member	DST Group, Australia	Y	2	Y^
João M.L. Quintas	Member	Pedro Nunes Institute, Portugal	Y	2	N^
Julia Bermejo	Member	UPM, Spain	Y	2	Y^
Ricardo Sanz	Member	UPM, Spain	Y	1	N^
Stefano Borgo	Member	ISTC/ CNR, Italy	Y	2	Y^
Edison Pignaton	Member	UFRGS, Brazil	N	0	Y
Elisa Tosello	Member	UNIPD, Italy	Y	2	Y^
Daniel Beβler	Member	University of Bremen, Germany	N	0	N
Mohammed Diab	Member	UPC, Spain	Y	2	Y^
Marcos E. Bareto	Member	UFBA, Brazil	N	1	N
Joanna I. Olszewska	Member	University of West Scotland, UK	Y	1	N^
Amelie Gyrard	Member	Knoesis, Wright State University	Y	2	N^
Hiren Nakawala	Member	University of Verona, Italy	Y	2	Y^
Abdelghani Cibani	Member	UPEC, France	N	1	N

Maki Habib	Member	American University in Cairo	Y	1	Y^
Dormant/Inactive					
Sandro R. Fiorini	Co-Chair	IBM, Brazil	N	0	
Eren Erdal Aksoy	Member	Halmstad University / Volvo	N	0	
Carlos Hernández	Member	TU Delft, Netherlads	N	0	
Joel L. Carbonera	Co-Chair	UFRGS, Brazil	N	0	
Edson Prestes	Member	UFRGS, Brazil	N	0	
Bao U. Nguyen	Member	University of Otawa, Canada	N	1	Y
Kathryn Bennett	Guest	IEEE-SA	N	0	
Craig Schlenoff	Member	NIST	N	0	
Jaeho Lee	Member	University of Seul	N	0	
JiSang Hoon	Member	KITECH, Republic of Korea	N	0	
Ki-Yeop Sung	Member	KAR, Republic of Korea	N	0	
Taeyoung Uhm	Member	KIRO, Republic of Korea	N	0	
Sebastian	Guest	IEEE-RAS	N	0	
Christy Bahn	Program Manager	IEEE-SA	N	0	
Signe Redfield	Guest	United States Naval Research Laboratory	N	0	
Ali Akbari	Guest	UPC, Spain	N	0	
		Total Attendees			12
		Voting Members	16		16
		Voting Members Present			10
		Quorum			Y

Approval today's meeting agenda

Motion Proposal : Paulo Seconded by: Stefano Accepted Agenda: Yes

Approval prior minutes

Minutes were distributed and also made available on our google drive. Thus, members could have read them, but Paulo summarized the minutes to ensure that everyone knew about them.

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Motion Proposal: Paulo Seconded by: Alberto Accepted Minutes: Yes

Call for Essential Patent Claims (Alberto)

The call was raised; no participant raised any concerns or any comments for consideration.

Status updates/previous action items (Howard)

- **[PAUSED]** Future publications
  - Book chapter suggested by Amelie - Architecture
  - Article about Knowledge driven design of robotic applications - Veera
- **[ONGOING]** Vocabulary development
  - Discussion about *Behavior* examples - If you have any example about using that concept in robotic scenarios, then you can contact Alberto for further instructions
  - Alignment with Task Representation group - Terminology harmonization:
    - **[UPDATE]** During July, we discussed on: action, which is related to our definition of function. Alaa prepared a proposal for the function's specializations and presented it to the group. We commented on the proposal and we agreed on defining the specializations in our standard.
  - Needed to validate using case studies - Validation to see whether we need more entities or not
- Focus on case studies to validate the vocabulary
  - **[ONGOING]** **Mohammed's**
  - Amelie
  - Chris
  - FAiNDER (a company) which will use our standard in a Humanitarian Robotics scenario (landmine detection)
- **[ONGOING]** Christy Bahm asked us to start working on the draft for the standard
  - Howard has started filling up the draft's template that you can find on our drive. We will split sections, feel free to read it and choose a section to work on. Please, note that the most updated version is the .docx file, not the google doc.
  - Paulo is in charge of maintaining the stable version, should you have any comment or suggestion, please, prepare the text you want to add and present it during any group meeting. The changes will be updated during that meeting and they will be accepted during the next official meeting.

    - **[UPDATE]** During July, we discussed the content of sections 1, 2, 3, 4 and 7. Except from section 3, which needs more work, we agreed on the current content. We also talked about section 9, which is about the case studies, but this section will be addressed during September/October. In section 3, we discussed 'AutonomousRobot' and 'AutonomousRobotGroup', which are in an already stable shape.
- **[PAUSED]** Attracting industrial partners
    - FAinDer (already contacted and accepted, the CEO will join to our group)
    - KUKA (potential)
    - General Motors (they are already happy using SAE standard)
    - Veera got in touch with people from both OPCA and VDMA interested in collaborating with us. He will keep us updated about it

Copyright Policy (Howard)

Done.

Howard went through some slides about the copyright policy of IEEE. This policy is relatively large so we are not going to include all the material here, but two key points must be kept in mind:

- Anything (verbal or written) we discuss we need to make sure it has not copyright, if it has, we cannot discuss it during the meeting without official permission from the copyright holder.
- Whenever you bring some material to the group and it is discussed along with our meetings, you are granting the copyright of it to the IEEE. Either if you are the holder or your affiliation center is the holder. In the later case, you would need permission from your company or university. Note that when something which has copyright it is discussed during our meetings (sometimes permission would be needed), automatically, the copyright license will be granted to the IEEE. Note that anything developed during our group work, will have a copyright license owned by IEEE once the standard gets published.

Technical discussion

Topic: Work on the draft and polish it to start closing definitions

As a general reminder, note that this year we need a complete draft of the standard, then, we will have one more year to polish/validate it.

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During today's meeting, we discussed several aspects regarding section 3 of the standard, which is the section that will contain our proposed definitions. Specifically, the idea was to discuss those terms which are fundamental to our ontology. Interaction, Situation, Environment, Behavior and Engineering behavior, Function and Function execution, Autonomous Robot and Autonomous Robot Group. Paulo put together all the current definitions and some alternatives proposed during the last months, this can be found at the end of this section.

- During previous meetings, we discussed the term 'Behavior'. Initially, Stefano tried to define behavior using a single term. However, it seems that the members of our group found it necessary to have more behavior-related concepts even though they are not reducible to a single ontological category. Hence, Stefano proposed a new approach, in which the class Behavior is a generic term without ontological commitment. Any concept that people call behavior, besides being classified in the ontology, is also subsumed by this generic Behavior class. Then, we could have three main behavior's specializations: manifested, engineering and emergent. Other people proposed to also consider reactive and deliberative behaviors, but we did not reach an agreement on this.
- Stefano pointed out that if we only consider the three main specializations of behavior, potential users of our ontology who could want to use the notions of 'reactive' and 'deliberative' would need to define them on their own. This could lead to some issues: people will not use our ontology, or they will not use it in a proper way. For other people, such as Paulo, reactive/deliberative could be sub-classes of the engineering specialization.
- Julita commented on 'behavior': "In General Systems Theory, Klir defined Behaviour, Structure and so at a general level, distinguishing between permanent behaviour, temporary behaviour and so, based on the properties of the system and the relations among its elements and the environment".
- Julita comments on 'interaction': "it is already defined in the other standard (1872.1), although this is more detailed for us" ; "I like the definition, but it mentions objects which are not defined in the rest of the document". Stefano said that the term 'Object' should be used from any top-level ontology that the user of AURO ontology will work with. Paulo agreed and stated that some examples should be added in the standard to help/guide the user of our ontology.
- Stefano asked the group about the group's perception on 'behavior'. Answers were addressed by Maki, Paulo, Alberto.
- Paulo stated the importance and the link between robot architectures on the behavior of the robot. Maki raised the works/book from Rodney Brooks on "behaviour-based robotics and the subsumption architecture".

- We agreed that Stefano will prepare a final statement for the core definitions except from Behavior. He will prepare a definition plus a paragraph with comments for each term. Then, Stefano will distribute them, we will polish them and close/approve them.
- About the rest of definitions, Howard suggested deleting those which are not essential, and if they are, we can keep them and clean them up.
- We also talked about terms like object, event, etc., which are too general for this standard (Stefano). So we can skip them, leave them as terms without characterization and users could decide what is an object for them. For instance, people could use other ontologies like sensor ontologies to describe measurements (point clouds of a LIDAR scan).
- It was discussed by Paulo and Stefano the importance of the capability concept. For example it is needed in robotic applications such as the following: capture the 'environment' to gather its knowledge (in a machine readable format). This can only be achieved by proper capabilities of the robot or other devices in the 'situation'. Obtain a LIDAR scan of the environment, to be performed by a robot with a given capability.
- Our definition of capability is not in our list because the one we have so far is not stable. But Stefano thinks it would be relevant for us. If someone has a proposal we can discuss it, because Stefano has some work on it but he is not 100% happy with it.

####################################
INTERACTION:
####################################
An INTERACTION is an event, with two or more participating objects, in which the behavior of one (or more) objects is at least in part affected by the behavior of the other(s), and possibly vice versa.

Example: as the person walked towards the door the robot moved out of her way to avoid a collision

Notes
1: I actually consider this a primitive notion that one can use to qualify behavior. Thus, the above should not be considered a definition. An alternative would be to consider behavior a primitive notion and use it to define interaction.
2: "at least in part" means that an entity does not need to affect the other(s) at each instant of the interactivity period. The intuition is that these components actually affect each other at least at some time during that period and that one has to consider the whole period to understand the interactivity at the system (or subsystem) level.
3: we might need/want to define specific subnotions like

- No-gap interaction
- Direct (physical) interaction e.g. via sensing
- Indirect interaction e.g. via communication

##
SITUATION
##
A SITUATION is a space-time region including the objects in it, their properties, positions and relationships.

Example: the situation of the laboratory hasn't changed since yesterday as nobody has entered it today yet.

##
ENVIRONMENT
##
ENVIRONMENT of an object (including agents, robots, devices) over some time
The environment for an object and a period of time, is a delimited spatio-temporal part of a situation that includes the object itself and all the entities (their properties and relationships) that can potentially interact with the object during that period of time.

Example: the environment of an industrial robotic arm is the area it can cover and the objects with which it can physically come into contact.

EXTERNAL ENVIRONMENT of an robot/agent/device is the environment excluding the robot/agent/device itself.

INTERNAL ENVIRONMENT of an robot/agent/device is the environment limited to the spatio-temporal part of reality topologically internal to the robot/agent/device itself.

##
BEHAVIOR
(engineering behavior | manifested behavior | emergent behavior)
##
A BEHAVIOR of an object (including robots, agents and devices) is the way the object interacts with its environment as well as the way its environment interacts with the object.

Example: the car rattle when hitting the curve.

Note

1: a behavior is a relational quality of the robot (i.e., it inheres in the robot only) whose manifestation depends on the environment in which the robot is. The manifestation of the behavior is an event. When the robot affects (part of) its environment, the event is an interaction.
2: the definition aims to be object-centred but interpretation-independent.
3: one can use this definition to establish:
— similarity among manifested behaviors (trajectories in the space, for instance when we say “it started too fast but then it took a suitable speed”.
— similarity across robots wrt a given behavior (“the two robots behave similarly even though the first does not move as smooth as the second”), and
— similarity across environments wrt to the manifested behavior (“the robot behaves the same in rough ground and uphill, it slows down and becomes unpredictable”).

:: two proposals for engineering behavior:
A *ENGINEERING BEHAVIOR* of an object as described by a set of its state variables.
Engineering behavior is an operational view of a behavior based on state variables.

Example: the accelerometer attached to the body detects a vibration of value X when the car hits a curve at 30kmh.

:: two proposals for manifested behavior:
MANIFESTED BEHAVIOR (represented by an engineering behavior)
Manifested behavior represents something that happens, ontologically, it is an event in which an object interacts with an environment.

:: two proposals for emergent behavior:
EMERGENT BEHAVIOR (something that appear during robot function executions, that is different from the manifested behavior)
Emergent behaviour is an evaluation or judgement about something that happens. For instance, birds fly following simple rules and they manifest simple behaviors (e.g. fly close to other birds) but at the end, a behavior emerge from the whole set of birds (e.g. a specific formation). This type of behaviors only make sense when they are externally evaluated.

Notes:
1. Paulo’s notes from meeting (25-5-2020)
to program a robot -> give the rules (policies) to the robot -> programmed behavior (elaborate the state machine for the machine to manifest a 'desired' behavior) -> the robot will manifest a behavior -> from here, can appear an emergent (novel) behavior or the 'desired' manifest behavior, that can be represented by an engineering behavior.

2- Paulo’s notes from meeting (25-5-2020)
- behavior as a robot feature

- classify robot architectures in various modes: autonomous (deliberative behavior ; reactive behavior) ; teleoperated ; ...
- all the robots have this feature (deliberative or reactive) to classify the architecture.
- agent -> robot -> architecture (reactive ; deliberative)

3- Alberto's notes from meeting 15-5-2020.

Reactive and **deliberative behaviors** make sense from the internal view point of the robot, that is how we build robots. These ontological notions represent knowledge about the architecture of the robot. They are justified by the architecture of a robot and, ideally, they contribute to explain the manifested/emergent behaviors. Note that if we build a robot with a reactive behavior but it breaks before using it, then, there will never be any manifested behavior.

Some other ideas about these concepts..

- If a robot is on, its behaviors can be related to its architecture, but when it is off, still we have a manifested behavior that is not related to its architecture.
- Paulo pointed out that maybe we should include the notion of architecture, since it is not defined in the previous standard.

####################################
FUNCTION
####################################

A FUNCTION of an object (robot, agent, device) is a role that the behavior manifested by the robot plays in an event.

Example: The robot is sensing the area and analyzing the collected data (behavior). [Since sensing the area and analyzing the data contributes to surveilling the area, we conclude that the robot has the function of surveilling the area.]

Note: the robot has a function (plays a functional role) in an event if its behavior causally contributes to the achievement of the function goal. Thus, a function needs a goal to be identified. Examples of functional roles a robot can play are: acquisition of knowledge, exchange of information, physical modification/preservation of objects, or classificatory modification/preservation of objects, modification/preservation of physical/spatial qualities, modification/preservation of relational qualities.

####################################
FUNCTION EXECUTION
####################################

A FUNCTION EXECUTION is an event in which the behavior of an object (robot, agent, device) plays a role with respect to a goal.

Example: the robot communicated its location. [The robot has executed the localization function.]

##
ACTION
##
An ACTION is a function execution.

Example: the agent communicated its location. [The agent executed the localization function.]

##
Autonomous Robot
##
An autonomous robot is a goal-oriented intelligent system that can function, decide, and interact within structured/unstructured, static/dynamic and observable/partially observable environments without explicit external guidance

##
Autonomous Robot Group
##
Autonomous Robot Group is a group of robots that, as a whole, can function, decide, and interact within structured/unstructured, static/dynamic and observable/partially observable environments without explicit external guidance

Next meeting's topic: nomination of presentation

- [Next weeks] Maki will prepare a presentation on the intersection of architecture and behavior

New business/announcements/events/last thoughts

- Found Patent from Magazino (see here) - Howard working on it
- Next official meeting for September 4

Close meeting (Howard)

Adjourned 2:30 PM UTC