

Modeling situations in an intelligent connected furniture environment

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June 21, 2017

Plan

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Context

We are in the intelligent and connected objects environment. These objects in our case are the furniture units, which can:

- measuring and monitoring their environment;
- communicate;
- be instrumented by sensors.

Challenges

To find the representation of the situations in a furniture units community.
This representation must be able:

- allow to recognize potential situations and realized situations
- allow a dynamic modification from data sensors;
- to identify situation instances;

State of the art

According to the works of literature, the recognition of the situations in the connected objects environment. We have these both approaches:

- Firstly, we assume that the basis situations are known, without worry about how it has been obtained;;(Henricksen et al. 2002; Wang et al. 2004; Ye et al. 2012)

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This approach doesn't allow to do the dynamic modification from data sensors!

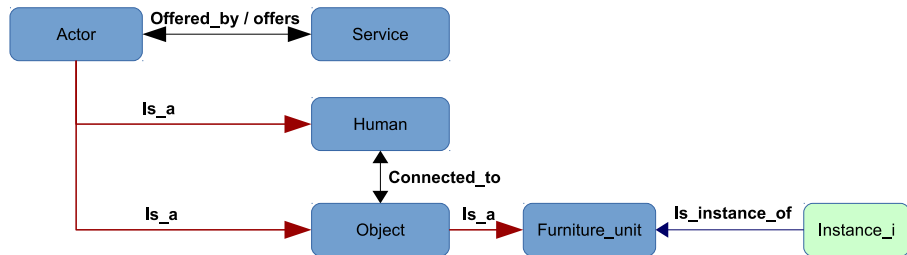
Representation of a furniture units community

We propose a representation based on ontology, which takes into account:

- of the structure our furniture units;
- the sensors into our furniture units;
- and support on mereo-topology.

Representation of a furnitures units community

A generic representation our environment of the furniture units, where the actors are humans or objects , who can provide services.



Representation of the situation in a furniture units community

A situation S is defined like a set concept ontologies where associated rule for each ontology of the concept.

$S = G(N, V, R)$: is defined as a set subgraph where :

- N is the set of the concepts, who characterize S ;
- V is the set of the relation between the concept in N ;
- R is the set rules who verify S .

Representation of the situation in a furniture units community

An example of graphic representation of the situation "**Seat on a chair**", where :

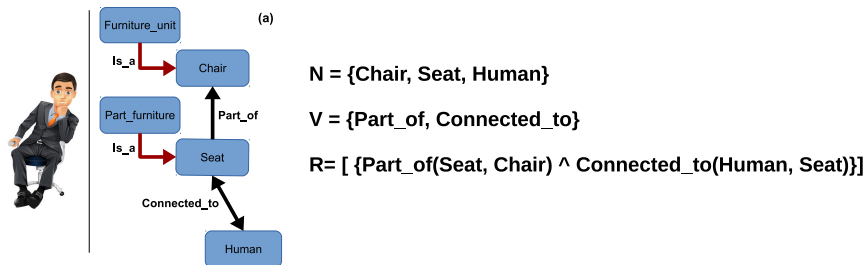
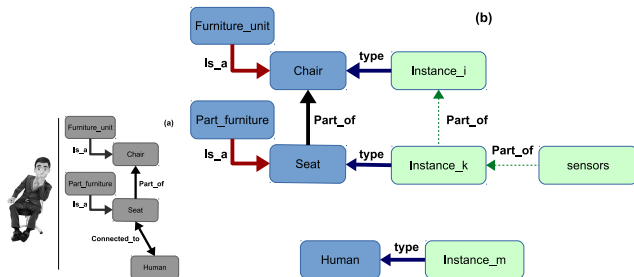


Figure: Sitting situation: (a) graph of the reference situation

Representation situations in a furniture units community

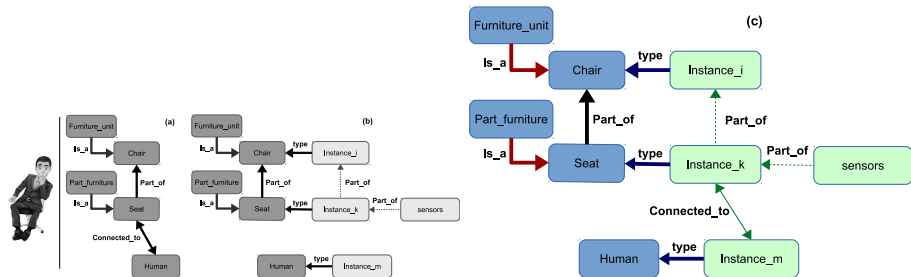
We get the following figure, after instantiating.



It describes the structure of the furniture unit, but does not give information about instances of the concept human and the concept chair.

Representation situations in a furniture units community

After the processing data sensors, we obtain a new information about instance human and instance chair , given by this following figure:



Representation situations in a furniture units community

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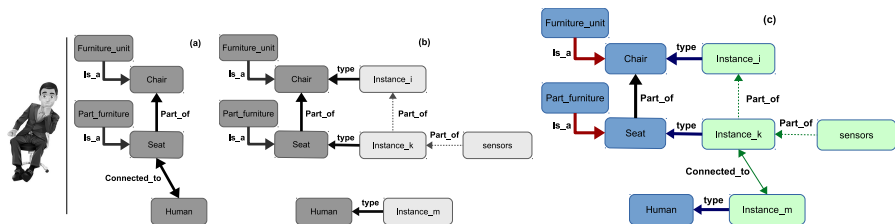


Figure: (c) observation of the `connected_to` relation between individuals

You will notice immediately an alignment between subgraphs of instances and situation. So, we can conclude that the situation `Sit` on the chair is realized.

Situations discovery in a furniture units community

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- **A situation is known as potentially realizable or recognizable in an instance of our concept ontology O^i if for any item of the set of the whole nodes situation N there exists an instance in O^i**

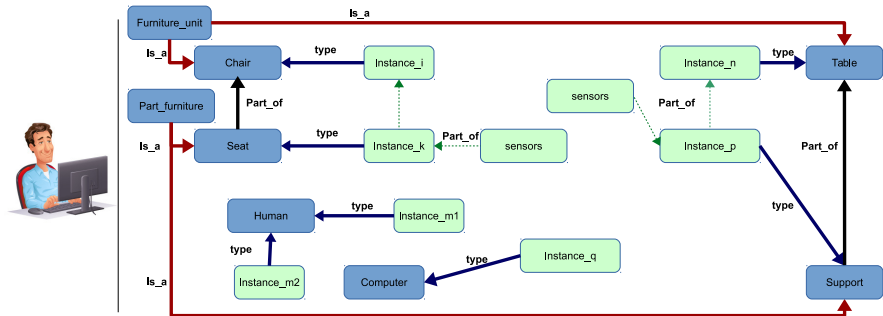
Situations discovery in a furniture units community

In a general way, from an ontology of the concept instantiated which correspond to our environment. We find to recognize the different potential situations and situation realized.

- A situation is known as potentially realizable or recognizable in an instance of our concept ontology O^i if for any item of the set of the whole nodes situation N there exists an instance in O^i
- **A situation is said to be realized if there exists at least a subgraph of the instance ontology graph that respects at least one of the rules of our reference situation.**

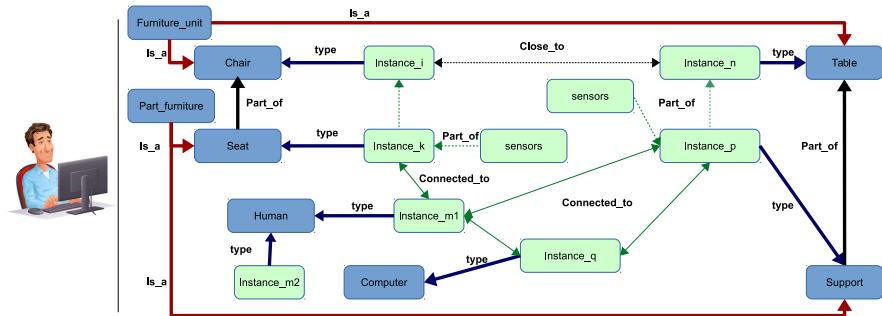
Situations discovery in a furniture units community

Considering a work environment represented by this figure:



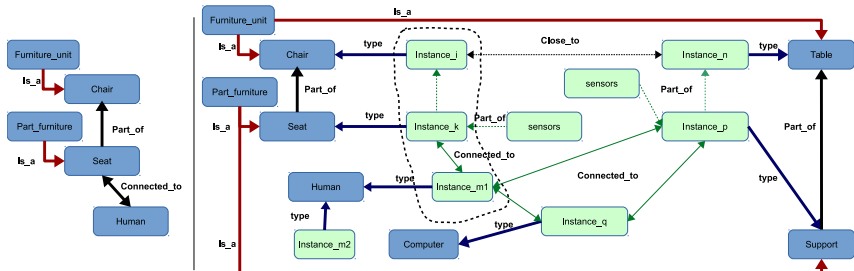
Situations discovery in a furniture units community

After the processing data sensors, we obtain:



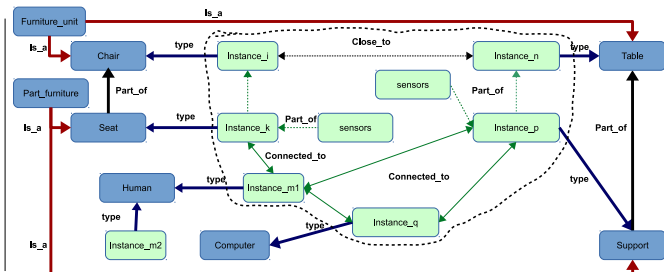
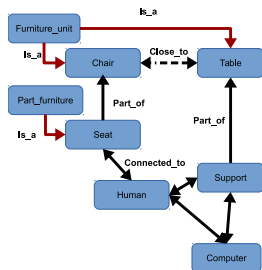
Situations discovery in a furniture units community

We recognize the following situations: A human seat on the chair



Situations discovery in a furniture units community

We recognize the following situations: A human seat on the chair, connected to table and computer



Conclusion

- We propose a generic representation of the situations of a community of intelligent connected furniture units.
- We chose a representation of the physical entities by using ontologies, which takes into account the sensors of our environment.
- We define the algorithms which make it possible to recognize potentially realizable situations and presently realized situation.
- Allows the dynamic modification from data sensors

Conclusion

The future work for improvement of the present study will concern:

- the discovery of new situations in an autonomous way
- the association of the masses to the various elements of the graph of a situation to allow uncertainty based reasoning.

Thanks for your attention.
Any question?