Experience of Transformation the Remote Earth Sensing Taxonomy into Ontology

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***Abstract*—This article represents an example of ontology development in the field of Remote Earth Sensing (RES). Initial taxonomy was transformed into ontology. The power of the ontology, its flexibility and logic of data structuring makes the application much more effective in comparison with the taxonomy.**

***Keywords*—axonomy, ontology, remote Earth sensing**

I. Introduction

There is a lot of literature about building taxonomies. No needs to repeat importance of the taxonomic models and approaches to build it. A very comprehensive and deep literature review about the topic is represented by A. Pellini and H. Jones [1]. Meanwhile, sometimes in parallel and sometimes as an alternative to taxonomies another data structure which is ontology may be used. It is happening that initially collected data organized in taxonomy should be reorganized into ontology. R. Iqbal and others [2] give detail literature overview about ontology development.

In the article the preference is given to ontology though initial data in the field of Remote Earth Sensing were represented with taxonomy.

II. RES taxonomy

The RES taxonomy was developed for information search and navigation purposes. An expert of the RES domain collected the data and built a hierarchy of the RES terminology. The hierarchy was represented as taxonomy where parent-child relations were defined and definitions to each term were given. As a tool for visual presentation the Stanford Protégé was used.

The combined fragment of the taxonomy shows how terns and their definitions represented in the tool (Picture 1).

For navigation such a structure works well. However, for search the structure provides very limited possibilities. If a user could try finding some equipment, for example, by the term 'stabilization' no result would be given because there is no any information about the function of the item in the taxonomy.

Each definition for any item in taxonomy is a source of information to extract particular concepts and populate it into ontology in appropriate position. So, additional concepts should be introduced to accumulate specific data.

For example, the concept 'function' reflects a property of the item and will be a classification category for all possible functions of items mentioned in the category 'Earth remote sensing spacecraft'. Similar, the concept 'parameter' will be a category comprising parameters of the items. The Picture 2 shows the list of concepts including different properties of the RES spacecraft components.

So, the new structure provides the list of properties which can be linked with the items having such properties. The definitions for each concept will be used or added and kept without any changes. For example, five properties for the concept 'Earth remote sensing spacecraft' were added: Function, Information, Operation stage, Parameter. The names of the properties were chosen by the expert in the RES field. Picture 3 the shows detailed fragment of taxonomy.

III. RES ontology

Eventually, to convert RES taxonomy into RES ontology relations between properties and items should be created. Picture 4 shows the relation 'implement_function' between the item 'Damping system' and the function 'Dump', which means: damping system implement_function damp. This is a regular triple: subject — predicate -– object. The same item can have more than one relation, so the item 'Damping system' has the relation 'change_parameter' with another property under 'Parameter' -– 'Angular velocity' (Picture 5), which means: damping system change_parameter angular velocity', and it is a regular triple: subject -– predicate -– object too.

The relations between items and their properties were consistently created according to definitions of the concepts in initial taxonomy. The detailed information structure in ontology allows to provide more extended search in comparison with taxonomy having the same information as ontology but without detailed structuring.

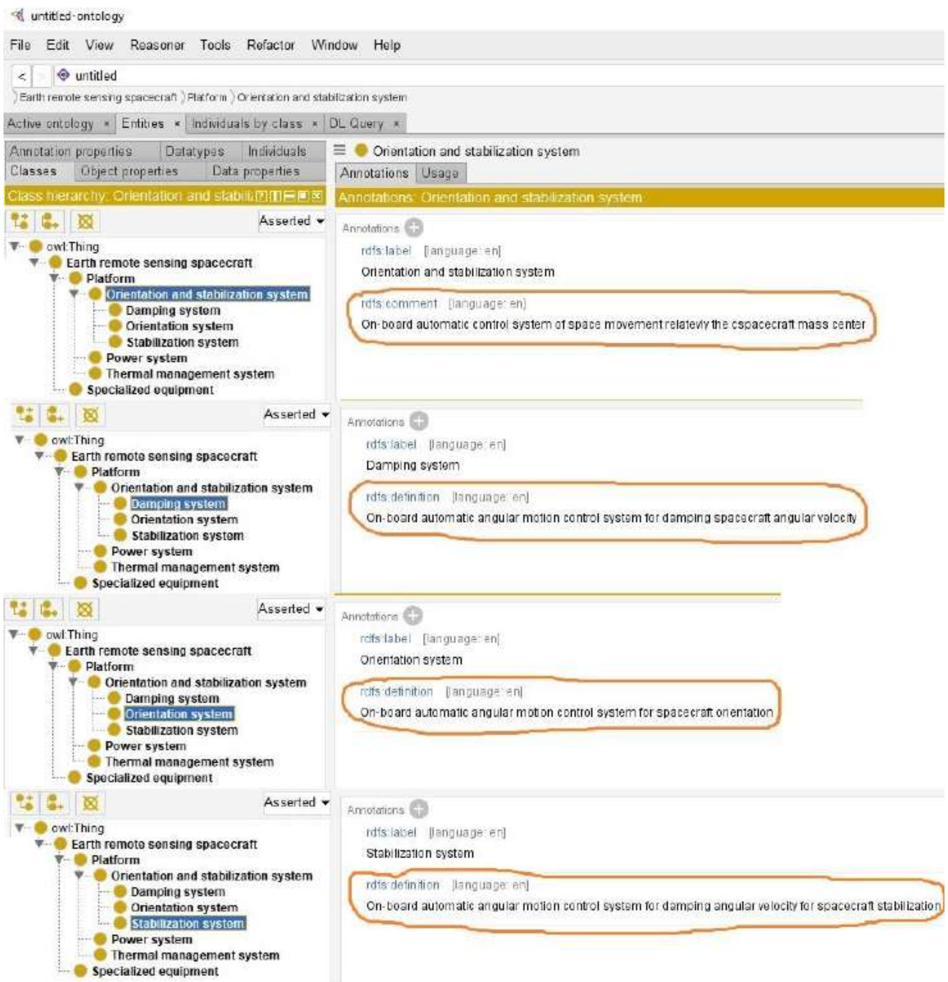

Figure 1. RES taxonomy fragment for items

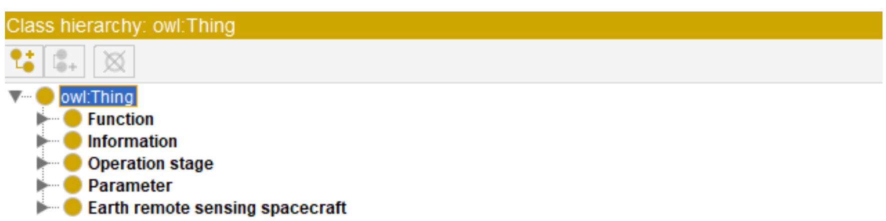

Figure 2. RES taxonomy fragment for items and properties

Now it is easy to find necessary information in ontology by query comprising as the name of some item so the name of some property. For example, for the query ‘damp’ Protégé finds all triples with the concept ‘damp’ or for the query ‘angular velocity’ it finds all triples with concept ‘angular velocity’.

IV. Conclusion

Structuring the data, it is important to make a choice between taxonomy and ontology. The choice depends on the purpose of the project. If the search feature is crucial then better to give a preference to ontology, if the navigation is enough the preference may be given to taxonomy. Ontology is more flexible but demands more work, time and physical space.

One more choice is in the tool for data visualization and representation. It was a choice between Stanford Protégé editor [3] and OSTIS technology [4]. The preference was given to Protégé because of a very convenient visualization support and usability. OSTIS provides more comprehensive and developed approach to define relations between items in the ontology and provides unified programming language SC-code to manipulate with the

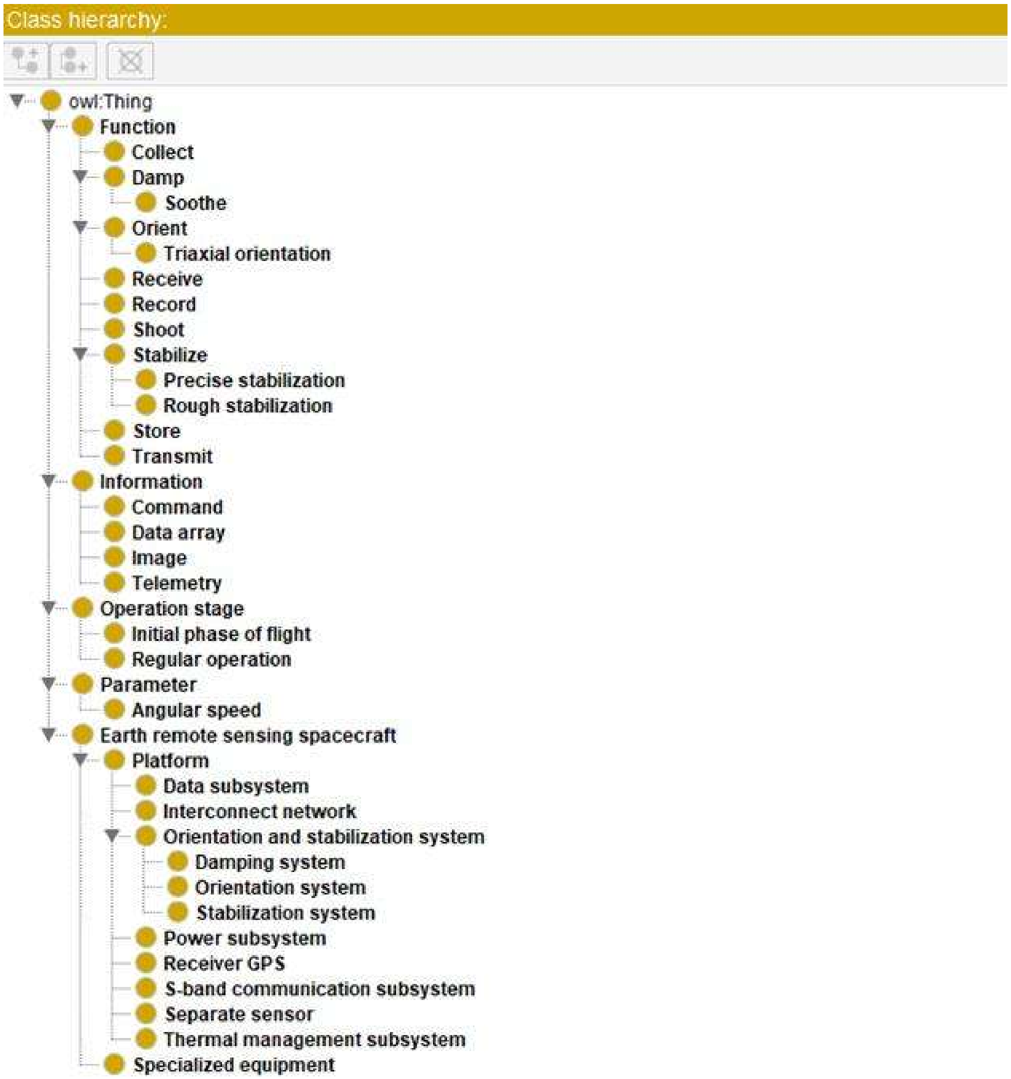

Figure 3. Detailed fragment of RES taxonomy for items and properties

stored data, which is a strong feature of the technology. The OSTIS tool does not provide the effective visual editor to control data yet, but if the tool would be completed it would be applied and illustrated in the article.

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Опыт преобразования таксономии по дистанционному зондированию Земли в онтологию

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В статье показан практический пример преобразования таксономии, содержащей информацию по дистанционному зондированию Земли в онтологию с целью обеспечить не только функцию навигации в иерархической структуре данных, но и обеспечить эффективный поиск требуемых данных по запросу пользователя.

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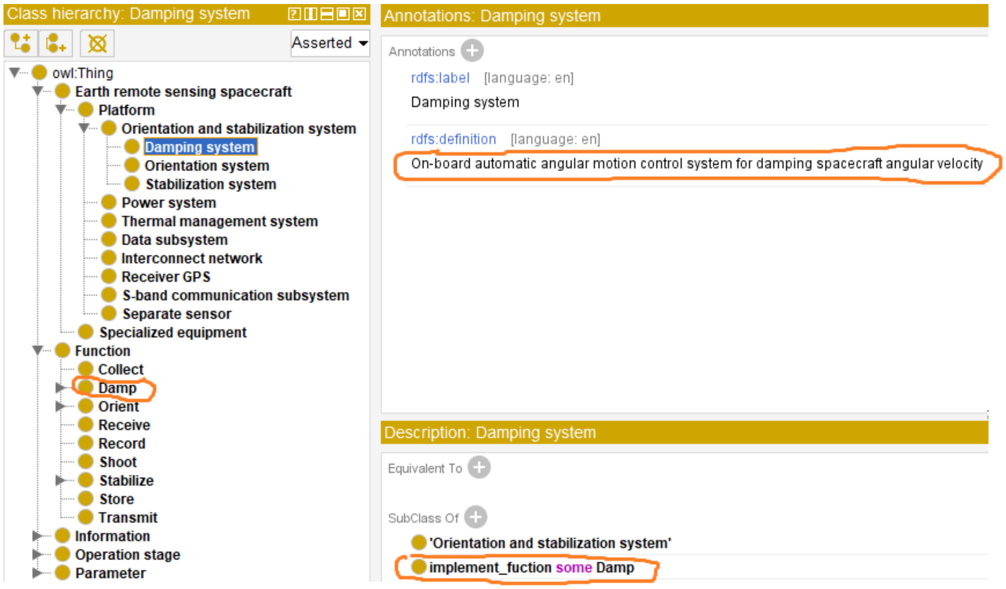

Figure 4. Example of RES ontology with the relation between item and property

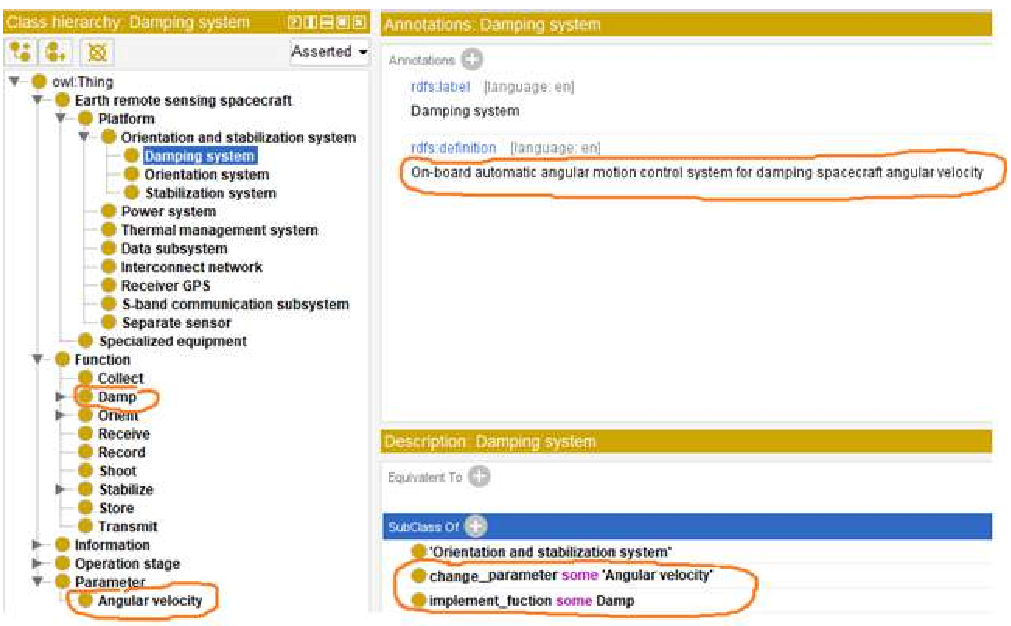

Figure 5. Extended example of RES ontology with the relations