Towards A Decision Support System An Ontology Validation

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I am a doctoral student from the national school of computer sciences in the RIADI lab under the direction of Mrs. hende ben ghezala and the co-supervision of Mr. Lasad mejri.
I work in the field of knowledge engineering more specifically knowledge management and IT project management. My thesis subject is entitled "contribution to the implementation of a knowledge capitalization approach for an IT project management.

THESIS OBJECTIVE

Knowledge capitalization approach, based on the notion of computer project memory for intelligent project management.

1. Work context
2. Introduction
3. Ontology and decision support
   - Related Works
   - Discussion
   - Application
4. Ontology validation
   - Related Works
   - Description of the validation approach
5. Conclusion and perspectives

Work context

01

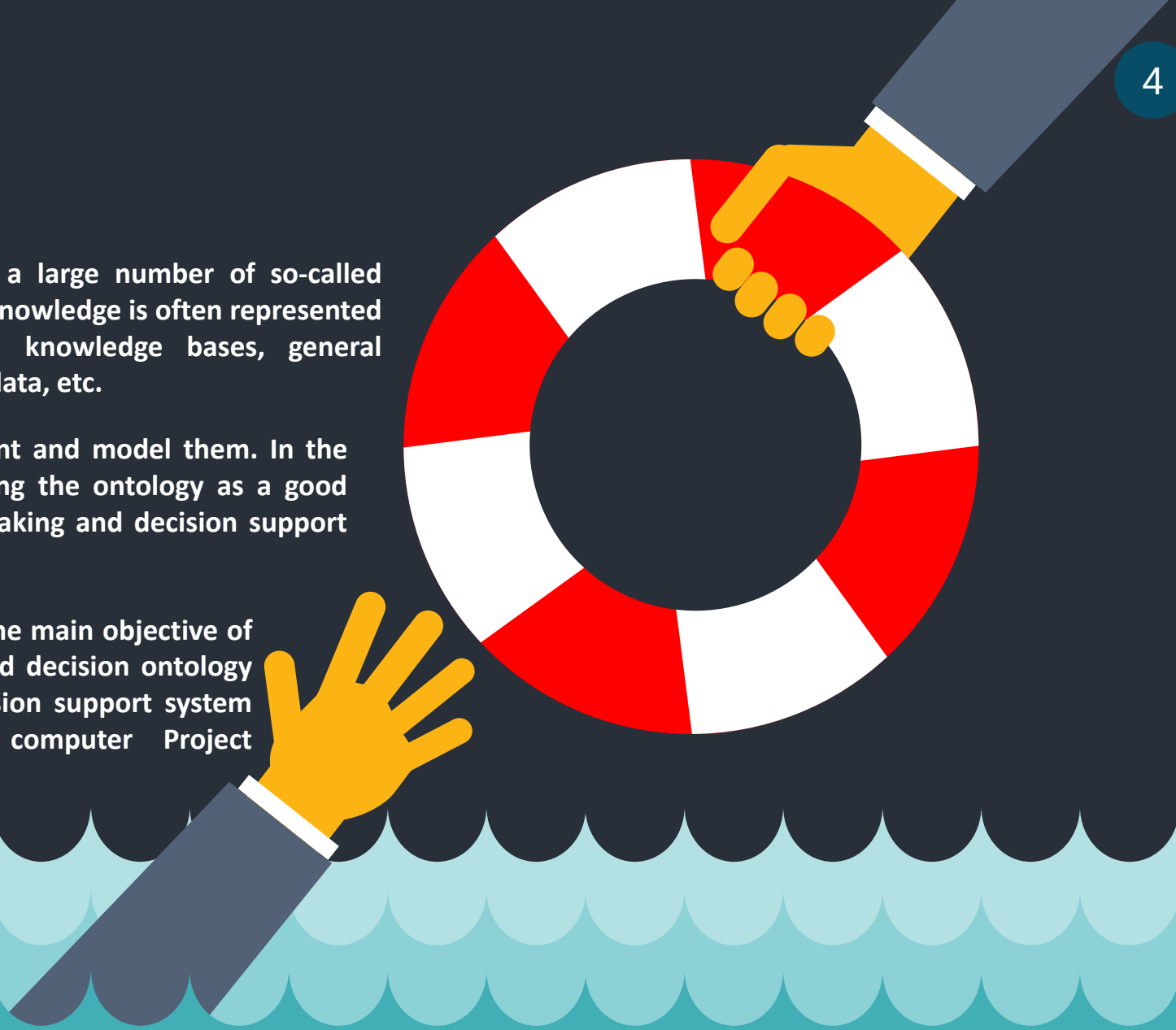
Decision-making takes into account a large number of so-called knowledge of decision-support. This knowledge is often represented as a set of database definitions, knowledge bases, general information, domain data, statistical data, etc.

02

It is preferable to formalize, represent and model them. In the literature, several works suggest using the ontology as a good solution to represent the decision making and decision support knowledge.

03

Inspired by this work and based on the main objective of our research work, we have proposed decision ontology to represent and formalize our decision support system knowledge which proposed for computer Project Manager.



Introduction(1)

- The main purpose of our domain ontology [1] is to provide a basis for the proposal decision support system offered to the project managers in the computer field.
  - The decision-making module which consists of helping computer project leaders to make a decision concerning the launch of their new project.
  - the decision support module which presents a guide and assistance support inspiring from historical project.

we must model and represent it in a structured way.

Introduction(2)

Ontology must be validated and evaluated thanks to either experts or standard validation tools.

It is in this context that this paper will focus primarily on the problem of validating the content of domain ontology

An incremental approach for validating the proposed ontology which is composed of six steps.

The main originality of our validation approach consists essentially of three criteria: the incremental validation, the multi-intervention, and the respecting of the —V cycle.

Ontology and decision support

RELATED WORKS

- **A Decision-Making Ontology for Information System Engineering[2]**

The author proposed an ontology for the modeling of decision-making knowledge (DM). The proposed DMO(decision-making-Ontology) is of dual use namely: to clarify the DM concepts to formalize the DM situations and to specify the DM requirements and to specify the components of the DM method.

- **A Productive Credit Decision-Making System Based on the Ontology Model [3]**

The author has constructed ontology for the development of DSS (Decision Support System) provoked by reviews of the effects of the pandemic on the global banking system.

The decision ontology in banking risk management is a component of the general “Banking” ontology.

Ontology and decision support

RELATED WORKS

- **A Decision Support Ontology for collaborative decision making in engineering design[4]**

Decision Support Ontology (DSO) is developed to facilitate decision making within the framework of collaborative design.
The DSO includes information related to the decision such as the design issue, alternatives, rating, criteria, and preferences. It also includes the rationale and assumptions for the decision, as well as any constraints created by the decision and the outcome of the decision.
The DSO is based on the Web Ontology Language (OWL), which facilitates the sharing and integration of decision-making information between multiple collaborators via the Web and description logic.

Discussion

1

The ontology used for the proposal of a decision aid or a decision support are a generic ontology of large domain namely the domain of design techniques, the domain of knowledge engineering, the domain of insurance banking ... etc.

2

Most of these ontologies are not well validated and if this is the case the validation is not complete and suffers from being a support for the formalization and the modeling of knowledge.

3

It is in this context that we decided to propose decision ontology for the proposal of a decision support on three main levels.

4

In addition and in order to remedy the problem of ontology validation, we will propose in the following section of this paper a validation approach.

5

This approach will try to guarantee an adequate formalization for the knowledge manipulated by the aid system to be proposed.

Application of the proposed ontology in the decision support system

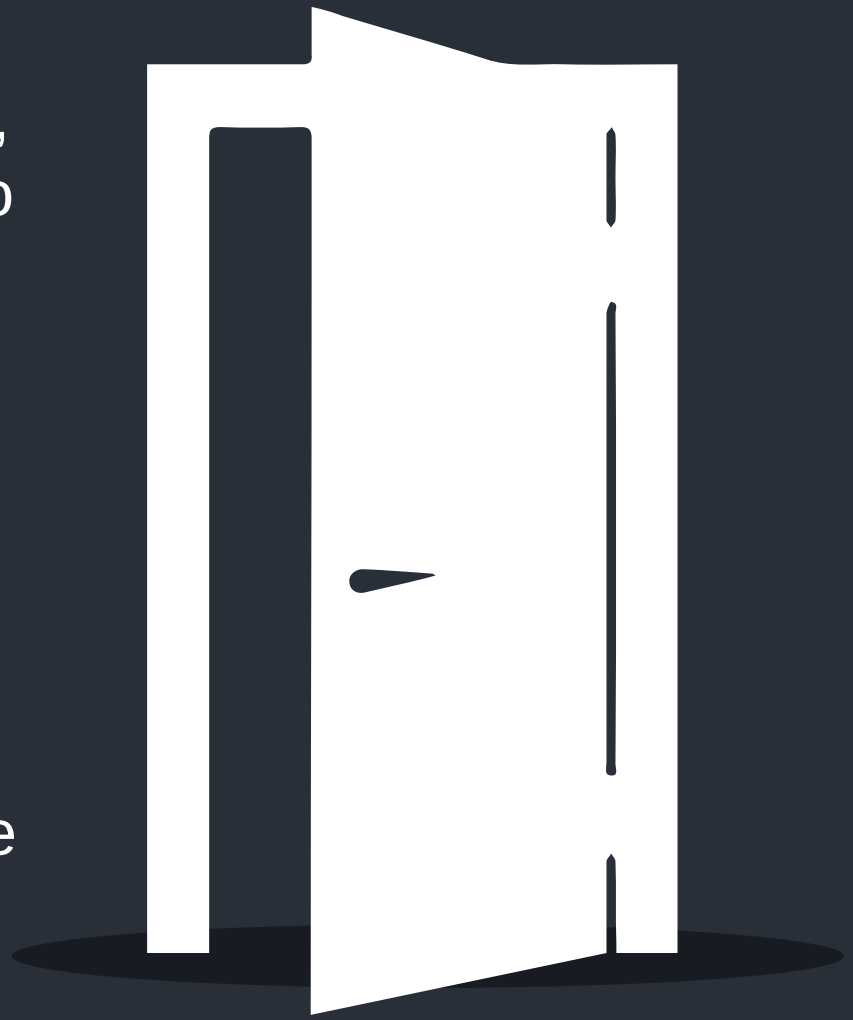
- **We have proposed our decision support system offered mainly to computer project leaders.**

The main goal of this support system is to guide the manager of a computer project from the launch of this new project until the resolution and the learning of the final results.

- **Our proposed ontology is described in three main concepts: project context, project features and project rational design.**

1 The first level of help "help oriented services".

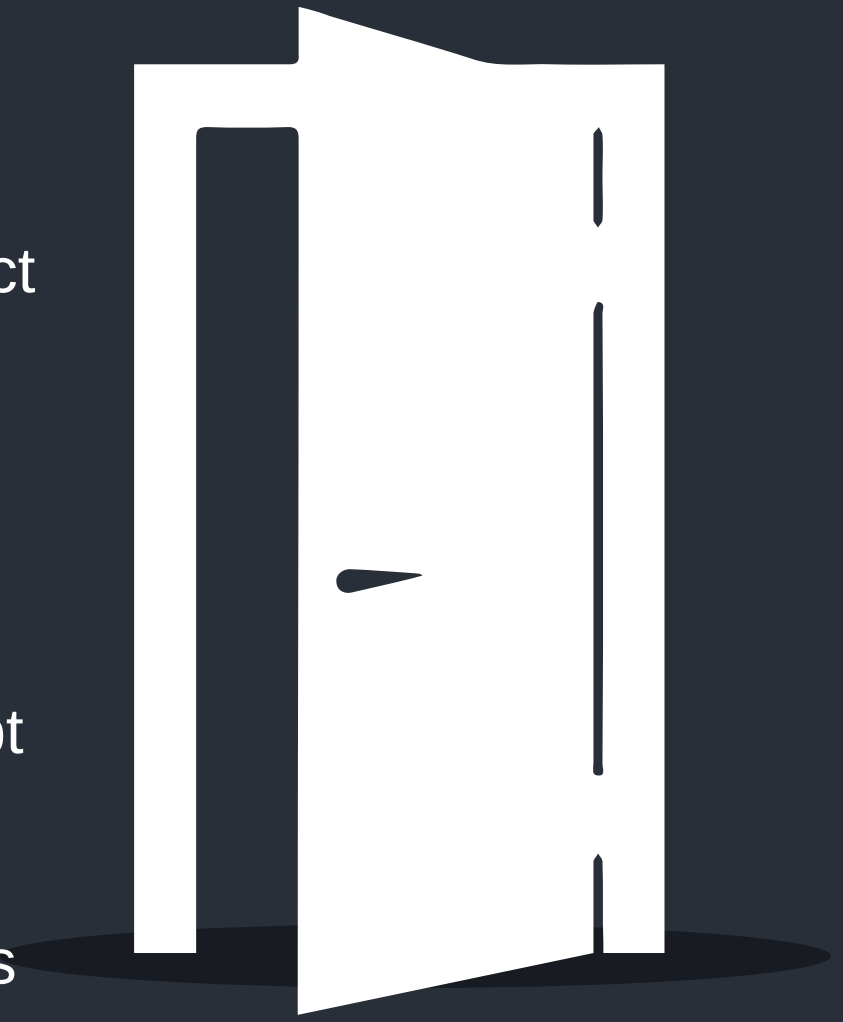
It allows the enrichment, consultation, statistics, framing and contextualization of new projects to be processed. Here we need the conceptualization and definition of concepts and terms describing computer projects.



The support decision knowledge recommended in this type of help is given by the instantiation of the concepts and relations defining these two classes "project features" and "project context" as well as their subclasses.

2 The second level of help "help oriented decision making"

Presents the main goal of our decision support system.
During this level, project leaders (chief or project manager) will make a decision about the launch of their new project.
This decision is made by checking whether the problem of their new project if was already addressed or not.
Here, the need to define a "problematic" concept for each project is very important.
The instantiation of the project feature class contains the concept "project problematic" forms the answer to the decision-making question.

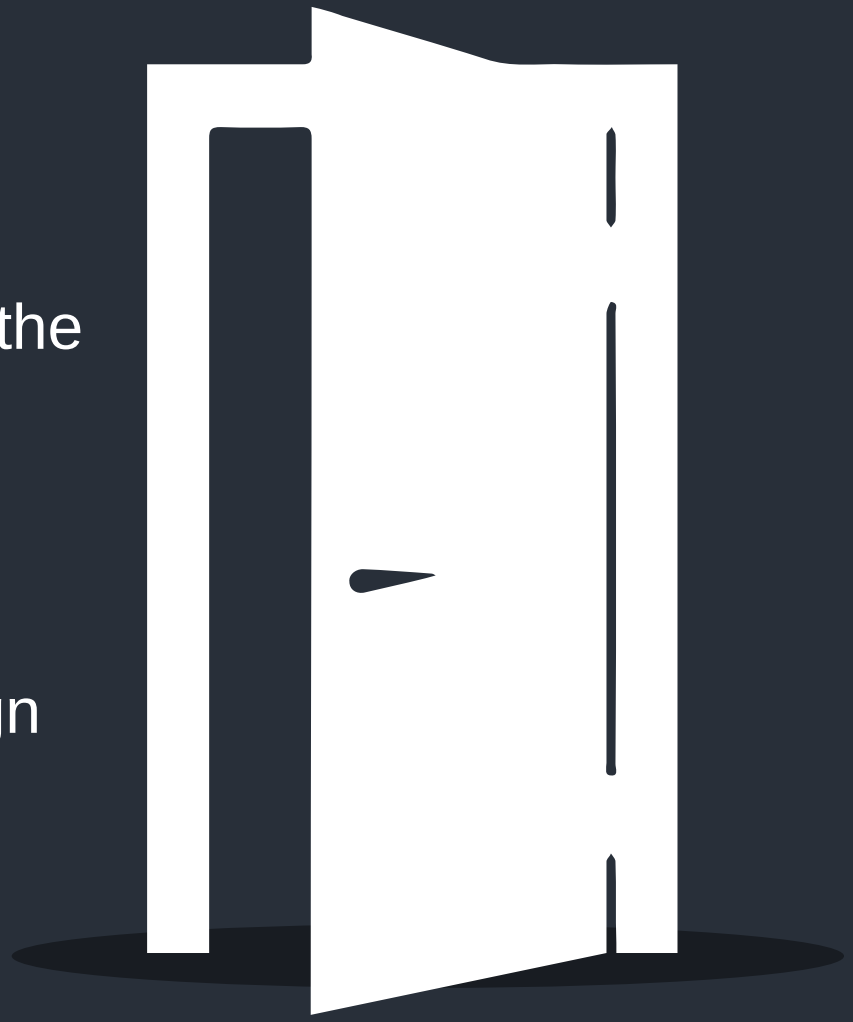


3 The third level of help "help oriented decision support"

For this type of help the project leader will be inspired by the projects already resolved to complete their new projects.

In this case, they will not only be inspired by the suggestions and solutions proposed for old projects, but also they will benefit from the problems and failures encountered during the resolution of these different projects.

The instantiation of the project Rational Design (problem, suggestion and solution) forms a basis for decision support knowledge.



Even if the use of the proposed decision ontology plays a key role in determining the knowledge necessary for building a decision-making knowledge base, it is still insufficient.

This insufficiency is explained by the fact that this knowledge is not always true and need to be evaluated and to be validated by experts and specialists.

ONTOLOGY VALIDATION

01 The ontology validation is considered as a stakeholder of the life cycle of ontology that they can keep their interest related to the applications for which they were built.

02 the validation of ontology knowledge has an influence on the evolution and the maintenance of systems using this ontology [6],[7].

03 the quality of the knowledge modeled by ontology directly affects the quality of these systems.

we have decided to validate the content of our proposed ontology and we propose a validation approach for our proposed ontology which is characterized by a set of criteria.

Main Ontology Validation Approaches

01 A validation approach proposed by Rim & al [8]

The proposed validation process consists in defining weights by the domain expert for each criterion by giving it a weight relative to its importance in relation to the domain and the use of the ontology.

Thus, the process will minimize the intervention of the expert in the validation of changes.

Main Ontology Validation Approaches

02 An approach for validating the content of an ontology proposed by Ben Abacha et al [9]

Authors have proposed a semi-automatic approach called SAVANT based on the generation of questions to validate their ontology. These questions are submitted to experts in the field who provide an agreement decision (Yes / No) and then an interpretation of these comments made to validate or modify the ontology.

The originality of this approach rests on the fact that the interventions are manual and they are carried out only by health professionals.

Main Ontology Validation Approaches

03 An interactive method for the validation of ontology proposed by Richard [10]

OVIM "Ontology's Validation by Interactive Method" has been proposed. This method will be based on five stages.

- They started with the structural validation that has four stages of validation namely; consistency, validation by OOps, validation by request and validation of the choice of the preferential label.

- In the fifth step they realized the semantic validation by collaborating with actors of the modeled domain.

Main Ontology Validation Approaches

04 An ontology validation Approach by the experts via a questionnaire by Laila et al.

The proposed approach consists essentially of five steps:

- In the first step a questionnaire is produced from the components of the ontology.
- Secondly, results of the survey of the experts will be done.
- The third step is to analyze and synthesize the results obtained.
- The update of the questionnaire based on expert feedback as well as the update of the ontology according to the knowledge of the results is realized during the last two stages.

Main Ontology Validation Approaches

05 A validation approach based on evaluation by Tartir et all

This approach essentially consists of verifying the consistency and measuring the impact of the change on the quality of the ontology.

It also allows consistency checking and evaluation of the structure and content of the proposed ontology based on well-defined evaluation criteria and metrics.

Discussion and synthesis(1)

A bad quality of validated ontology is related to two reasons: The absence of ontology-expert interaction and the absence of interface.

Wrong time planning of the expert and the reduction of his level of concentration during the answers to the questions.

The choice of questions is not generic. It also depends on the context of the problem.

An approach for validating the content of an ontology proposed by Ben Abacha et al

Expert, in this approach are simply domain actor and are not necessarily specialists in the field of ontology engineering.

The validation method of [10] like any other method allows the structural and semantic validation.

The problem here is that during the semantic validation domain actors verify only the existence of the general semantic domain

the fact that the domain experts are not allowed to add, modify or update the used concepts.

Discussion and synthesis(2)

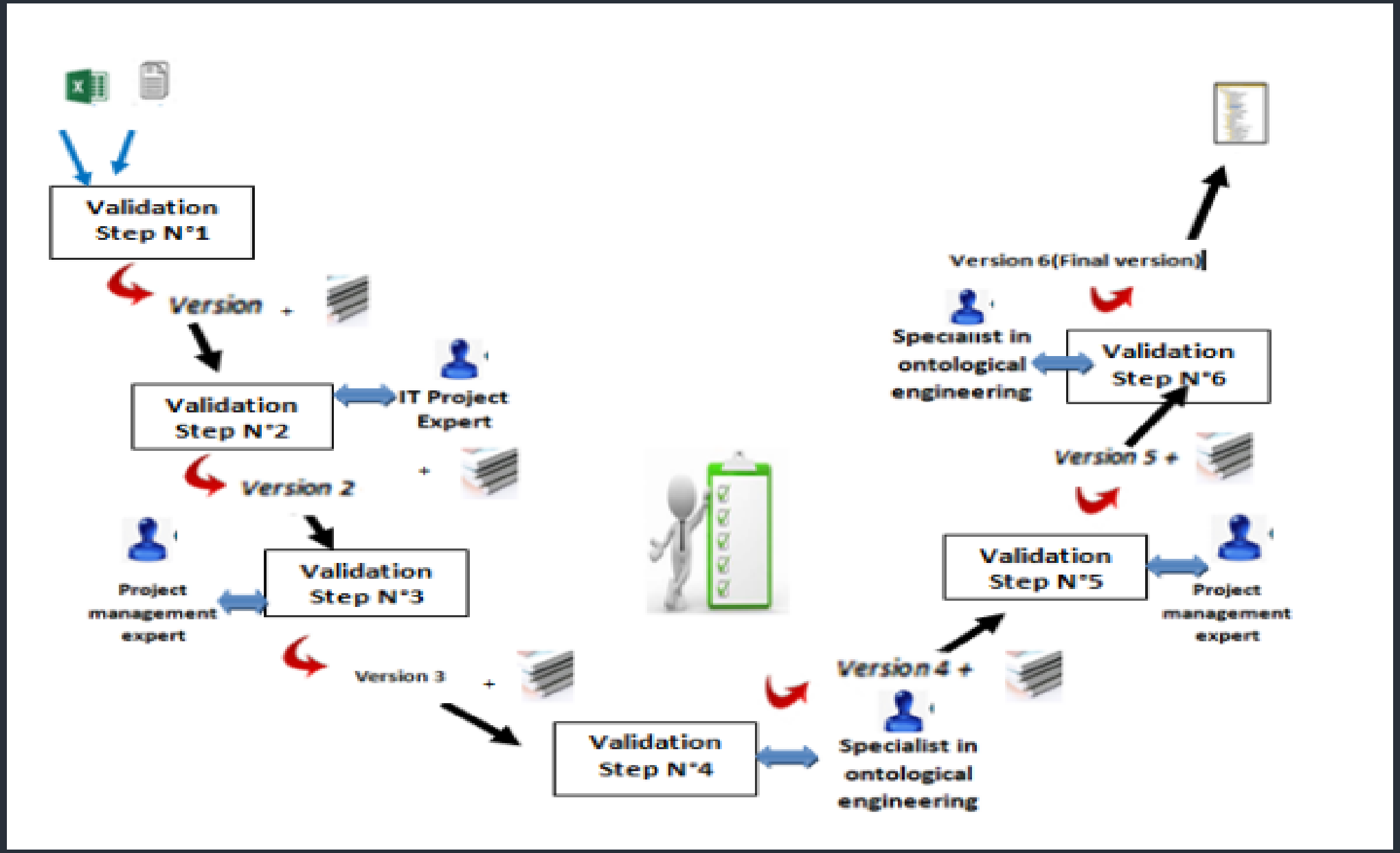
An ontology validation Approach by the experts via a questionnaire by Laila et al.

- It is an approach not updated in the term of the novelties of the version of the OWL language.
- Uses only English for the generation of questionnaires in natural language.
- The questionnaires are generated using non-specialists in the construction of ontology study which reduces the quality of validated ontology.

The study of these different approaches allows us to notice that :

- A total absence of documentation.
- Absence of multi-expert validation [just one expert involved].
  - ✓ Generally the major approaches make use simply of an evaluation of their ontology.
  - ✓ Effectively this evaluation could not be considered as a validation permitting to exploit really their ontology.

INCREMENTAL & MULTI-INTERVENTION VALIDATION APPROACH



INCREMENTAL & MULTI-INTERVENTION VALIDATION APPROACH

The Incremental validation of the ontology :
the passage from one validation step to another results in an update [modification, deletion or addition] of the initial ontology.

The Multi-intervention criteria: This approach is characterized by the intervention of several and different experts. Three experts are involved in the validation process.

The third criterion: Our validation approach is respecting the V cycleⅡ .We inspired by the live cycle of⎪ software engineering. Effectively our approach like the V cycle requires a feedback between all the validation phases.

Incremental & Multi-intervention validation approach

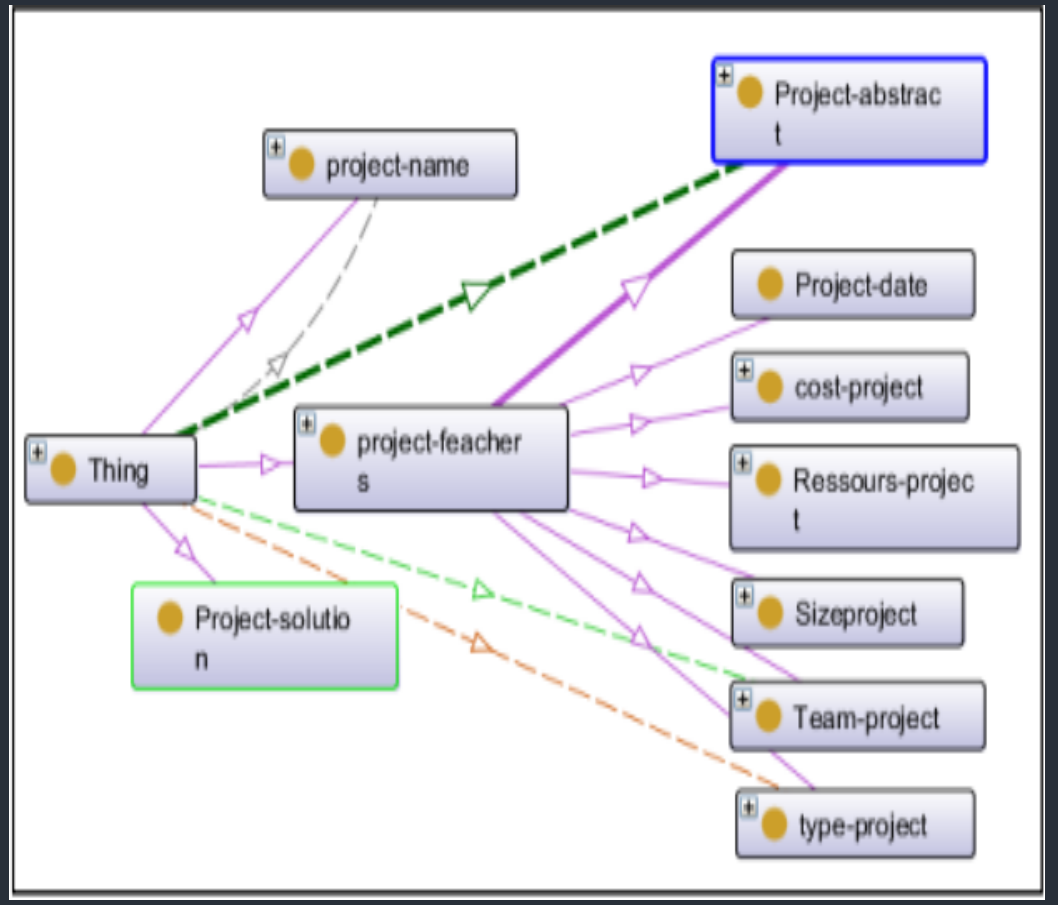
A technical validation level which is carried out according to the tools and menus integrated into the "Protégé"(ontology construction environment). During this level we checked at each phase the consistency and the coherence of the proposed ontology.

A professional validation carried out by a specialist in the field of computer project and an expert in the field of engineering and ontological construction and a knowledge management expert.

Validation Steps

Step 01

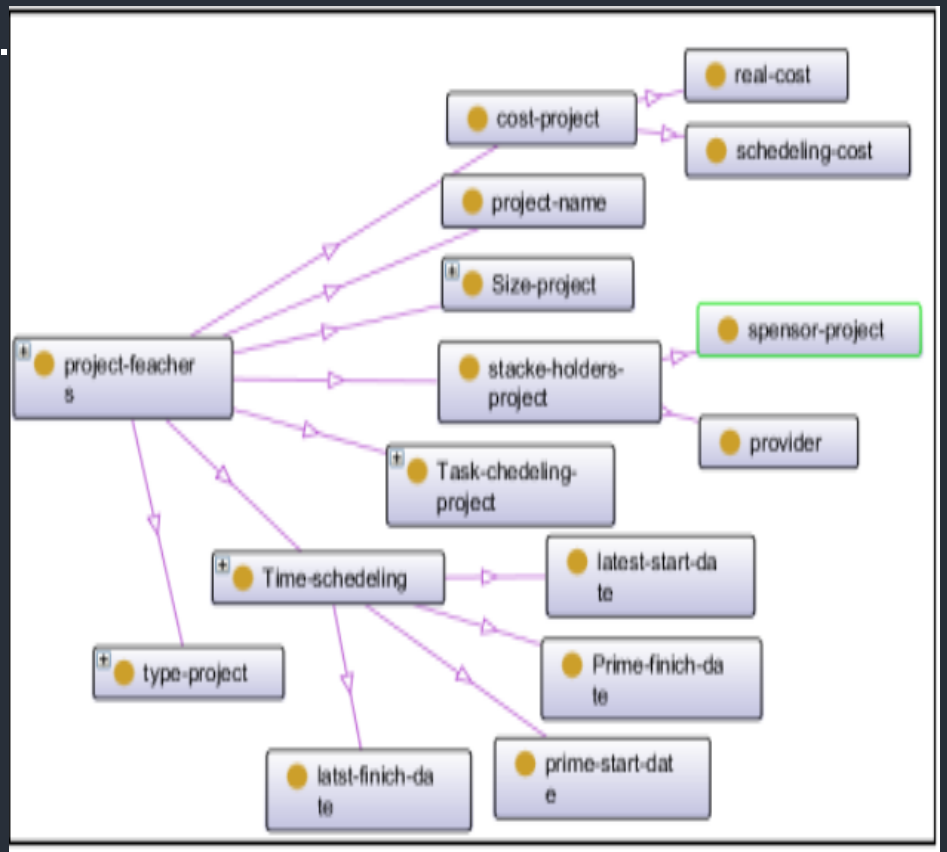
During the first validation step, a descriptive document presented in tabular form containing all the concepts and terms as well as their descriptions constituting our first version of the ontology was be prepared.



Validation Steps

Step 02

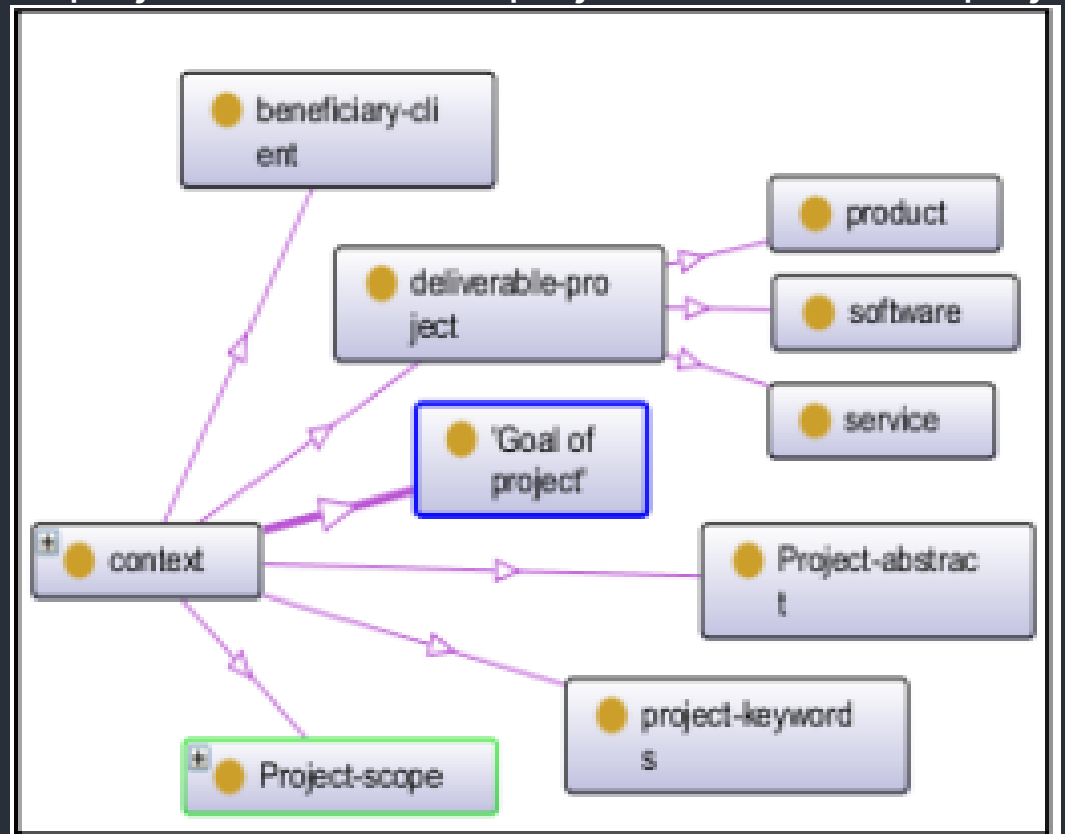
In the second step, it is up to us to update our proposal based on the remarks and the assertions given by the computer project expert. This step was considered as a meeting accompanied by discussions. The result of this phase is a second ontology's version that is ready to be evaluated by "project computer expert". This version is an amelioration of the version 1 at the level of project features.



Validation Steps

Step 03

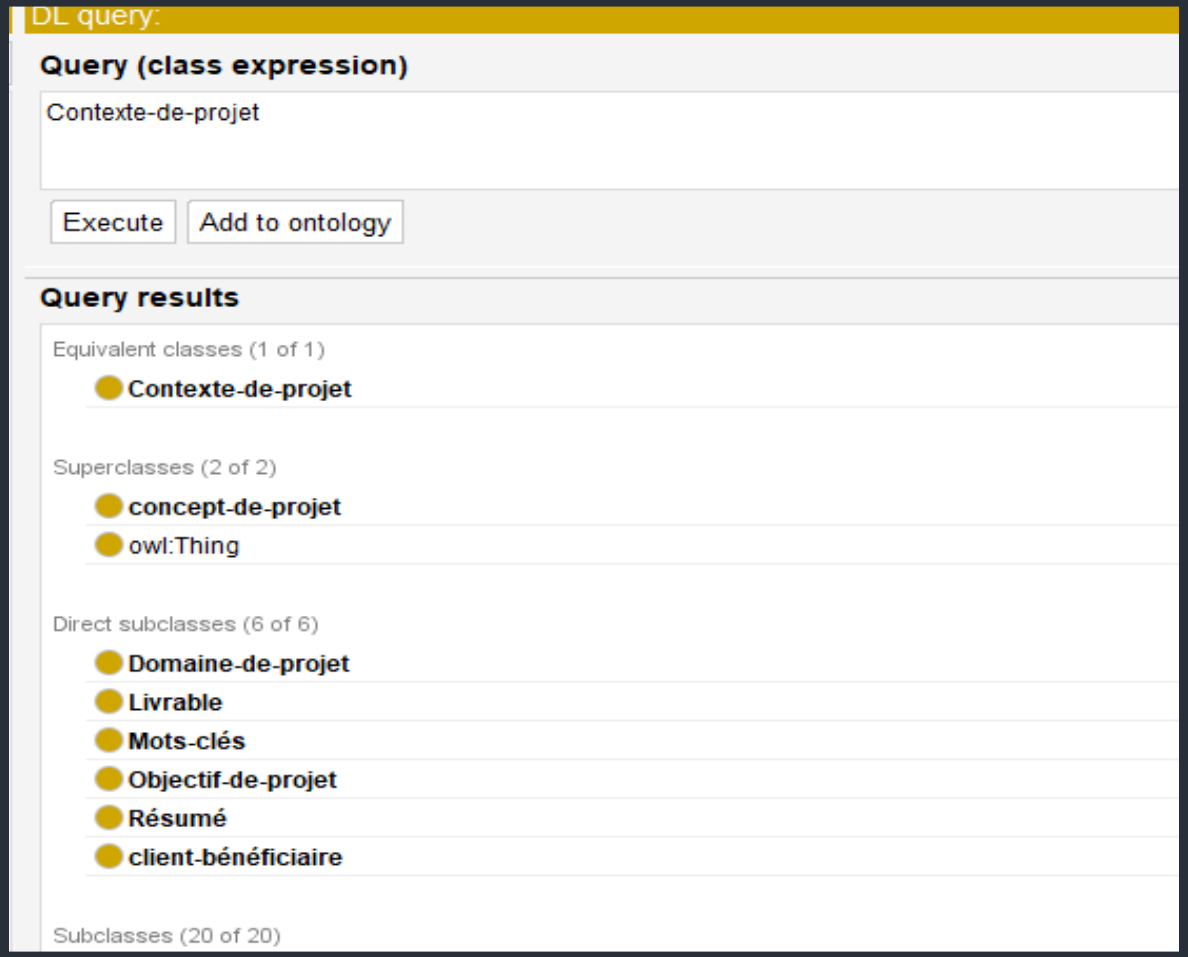
During this step, we prepare a second report: a document describing our objectives and orientations. This report is then submitted to a project management expert for evaluation. This second expert could affirm or refute, add or modify the proposal by adding a textual justification. Effectively, in a version 3, this expert proposes to restrict the ontology by adding a new super class named "project context". This class gives a detailed idea about project deliverables, project abstractll and project keywordsll, etc.



Validation Steps

Step 04

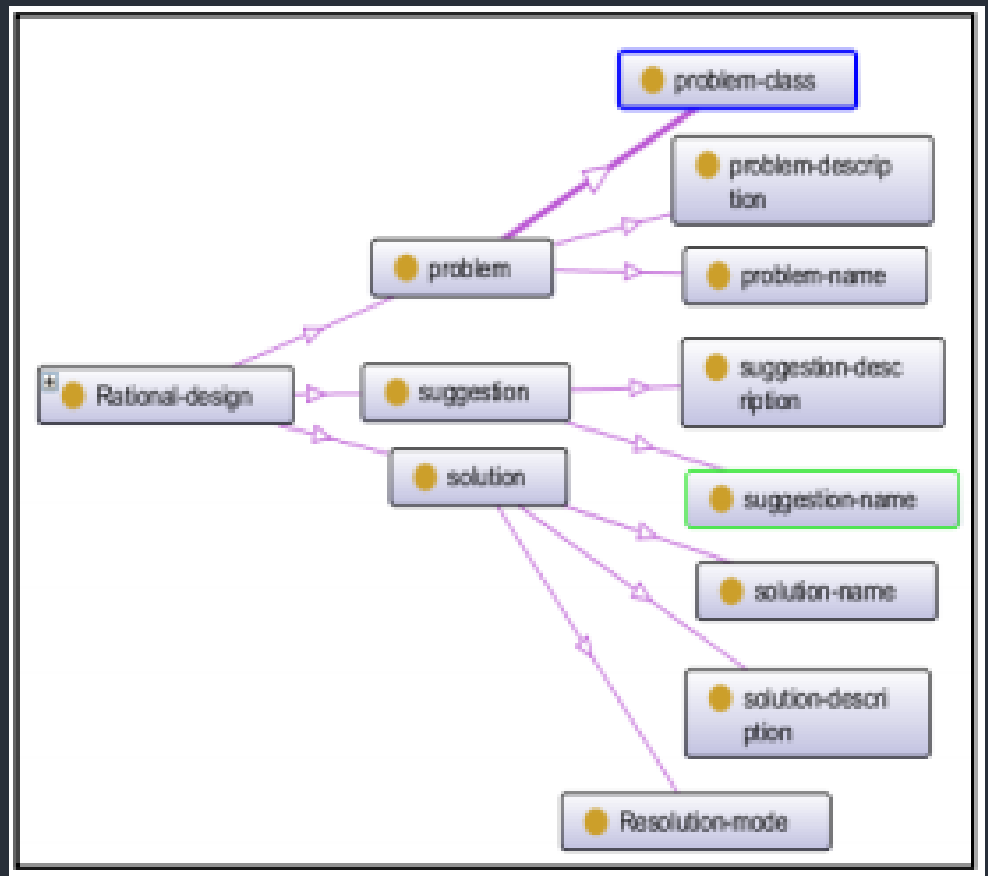
After the evaluation made by the expert in project management, we must now, in the current step, carry out a technical validation which consists in verifying the consistency and inconsistency of our ontology. This validation is first used by the "Dl-Query" tool for the consistency check.



Validation Steps

Step 05

At this step, the version 4 is sent to the project management expert according to our objective which is essentially to discuss about projects problem solving. Our goal here is to enrich ontology in the way to facilitate problems solve in a new project by exploiting historical projects. This step leads to a new version of ontology labeled version 5. At this effect the expert proposes to add a new sub-class baptized "Rational design“.



Discussion and Result

The multi-interventions of experts and specialists who cooperate for the validation of ontology. These will intervene not only when an error has occurred but in each phase where it is necessary to be present.

The generic validation goal: a technical validation a semantic validation (contained in the meaning of the concept) and an ergonomic validation.

Favoring a documentation content of each validation step favoring an aspect of reuse and sharing of validation technique for future validation phases and even for future projects.

It is an approach that is limited to computer projects since our experts are restricted to those who are specialists in this field.

The approach suffers from being a means of validating the logical aspect of ontology.

Conclusion and perspectives

1

In this paper, we have presented how we have used our domain ontology for modeling knowledge decision.

3

Then we have shown its application in our decision support system.

The proposed ontology decision is a representation of concepts and relationships of computer filed used to create a decision knowledge base.

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2

In this context, we proposed a validation approach which is an incremental and a multi-intervention approach that allows a semantic and structural validation of the proposed ontology.

4

Conclusion and perspectives

It is in this context that our future work must focus on the experimentation phase. This phase is carried out by building a knowledge base containing a real computer projects forming the basis of the facts and a set of rules forming the basis of the rules.

Classification rules which help to classify the projects and association rules which provide a help to describe in detail a new project.

To do this, we will use the classification data mining techniques and we are going to propose classification and learning algorithms.

Thank You

For Your Attention