

University Ontology in Semantic web using Protégé 5.0 for Query Retrieval

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ABSTRACT

Semantic web is viewed as next generation of web that enables intelligent software agents to process and aggregate data autonomously. Ontology is an integral part of semantic web. With the help of ontology, we can represent the information in graphical form. Ontology plays an important role in the construction of semantic web. Though lots of ontology available in almost every domain and in university domain also, still more chances are there to more work to be done in every field. In this paper we developed the ontology in university domain by using protégé 5.0 by taking the example of Kurukshetra University, Kurukshetra (Haryana), India. The given paper describes the implementation of ontology, different properties i.e. object and data properties and different query methods available in protégé to extract the results based on user query and finally search the results in details with the help of search window (available in protégé 5.0).

Keywords: Ontology, Semantic Web, Protégé 5.0

INTRODUCTION

Internet plays a vital role in everyone's life now days. People use internet to retrieve the information or content according to their interest with the help of search engines. The classical web is based on HTML which cannot be exploited by information retrieval techniques. Processing of information on web is mostly restricted to manual keyword searches which results in irrelevant information retrieval [3]. When user enters the query, the search engine retrieves the result based on user's query. Current web is actually not able to retrieve the relevant information as it is based on manual search ie what words we are using in the query. Current web cannot understand the meaning behind the information. This limitation can be overcome by semantic web. Semantic web is actually a collection of data and is based on semantic search. It has the ability to understand the meaning behind the phrases.

Semantic Web is a web of data and also referred as Web 3.0 which is not a separate Web but an extension of current web [1]. Semantic Web was proposed by Sir Tim Berners Lee. The Semantic Web is a collaborative movement led by international standards body the World Wide Web Consortium (W3C). The standard promotes common data formats on the World Wide Web. The aim of Semantic Web is to convert the current web into a "web of data". Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in co-operation[1].

The purpose of this paper is to construct ontology on University domain. The ontology which is constructed can be augmented and implement in search engine which will facilitate the users to search and find the relevant information related to university and also represent the information in form of graphs. We used Protégé tool which is free and open source ontology editor so that anyone can use and construct ontology by this method.

RELATED WORK

Construction of ontologies in university domain is not a new work. Many ontology have been developed in the university domain but still lot of chances are there to more work to be done in this domain. As in [2] Ling Zeng, et al. explained the importance of ontology in implementing semantic webby representing course-based design for the purpose of teaching but does not contain other administrative details of a university. They proposed a model of course ontology in context of education which can help the adult learner to find the course according to their needs. Sanjay Kumar Malik et. al. [1]

developed ontology on university using protégé 3.4 by taking the example of Inderprastha University which included university employee details like name, address, date of joining, designation, etc. in his ontology, but student relation with the year, teacher and subject has not been included. Naveen Malviya, et al. [2] has included detailed course mapping and developed ontology on Choice Based Credit System (CBCS). Vishal Jain et al [4] developed ontology in university domain using protégé 3.1 in which authors have defined the semantic web and ontology with its advantages but they have not described much about ontology and only XML code Snippet which is difficult to understand by in this field.

So we can design ontology with more relations about teacher, administrative staff i.e. Statutory bodies, officials, university bodies, Courses offered by university, teaching staff etc(as we have shown in our ontology). This ontology will help in designing a system for the students and staff belonging to different departments to help in extracting information about different staff, students, officials, related information in an easier way.

PROPOSED WORK

In the proposed work of ontology development, we have taken the example of Kurukshetra University, Kurukshetra (Haryana), India, as example for ontology development using Protege 5.0.

STEPS FOR CONSTRUCTING UNIVERSITY ONTOLOGY

1. Gather the university details

For constructing University ontology, Firstly collect all the details on university.

Here we gather all the details of university concerned (for which we want to create ontology) such as the courses offered by the university i.e. bachelor, masters diploma and certificate courses, different types of staff working in the university i.e. teaching staff, non teaching staff and administrative or managing staff of the university. Departments, institute, faculties and colleges etc. existing in the university concerned.

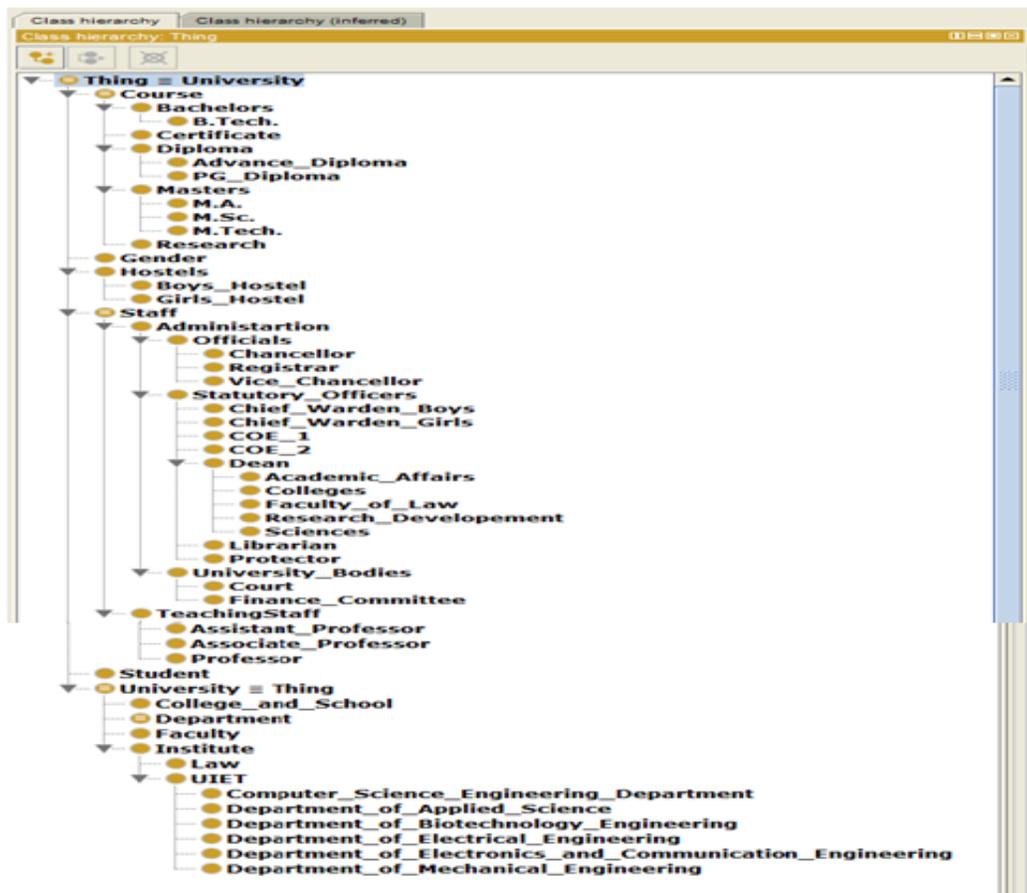


Fig 1: Class and subclasses of University Ontology

Create the classes, subclasses, superclasses and individuals

After deciding classes and individuals, create the classes so open the protege 5.0 and create classes, subclasses and superclasses in it. Fig. 1 shows the classes created in Protege for university ontology. Fig. 2 shows the example of individuals(of course).

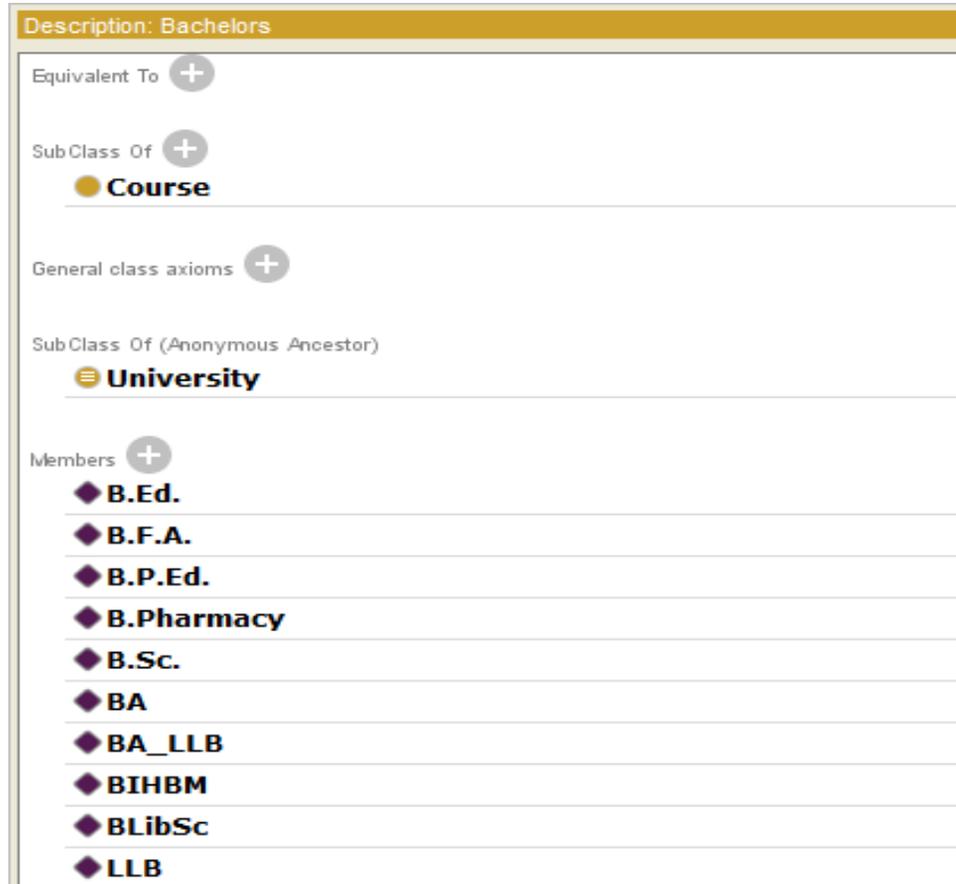


Fig 2: Members list of course (sub-class Bachelor) class

Identify the properties and restrictions

After identifying concepts we have to represent the relationship between them. Properties represent relationships. Three types of properties are defined in OWL. Annotation properties are used to add information to classes, individuals and object/data type properties[1].



Fig 3: Anotation propertyfor University ontology.

and apply the restrictions on classes and individuals. object properties relate one instance of a domain class to instance of range class. Object Properties of University ontology is given in Figure 4.

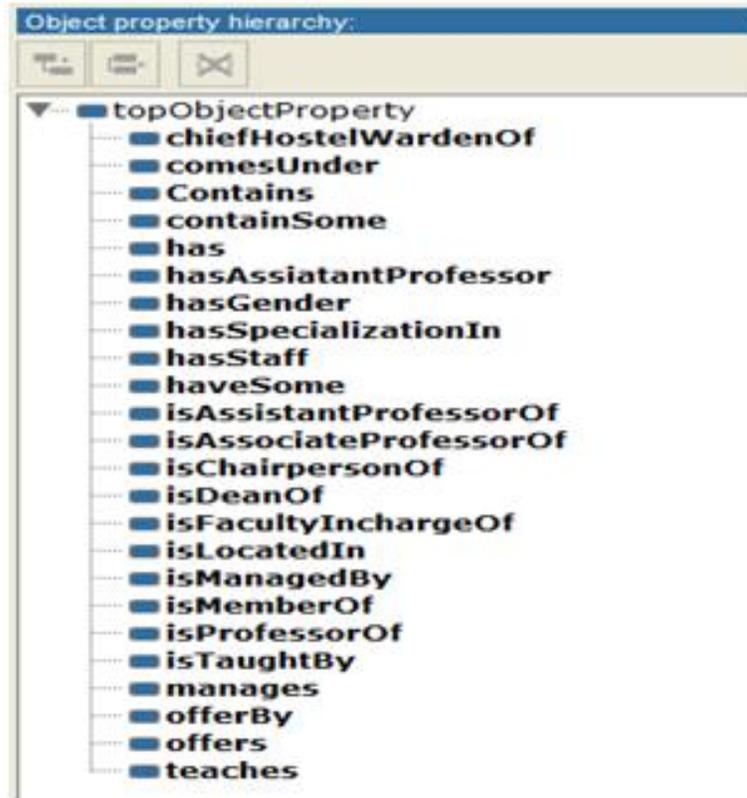


Fig 4: Object property

Data type properties show the relationship between individual to data literal (as shown in fig.5). Data type properties for University ontology are shown in Figure 5.



Fig 5: Data property

QUERY RETRIEVAL USING ONTOLOGY

This part of paper gives the result based on query and represents the information in the form of graph and also represents the complete details of any topic related to university ontology.

OWL Viz Representation

The OWL Viz tab is used to represent the information in graphical form and for such visualization of graphs in OWL-Viz is only possible by using the plug-in Graphviz. We used the graphviz version i.e. GraphViz 2.39 for this purpose.

Figure 6 shows the OWLViz representation of university, here university has nine subclasses i.e. course, department, gender, hostels, students, staff etc. In which all the classes have subclasses

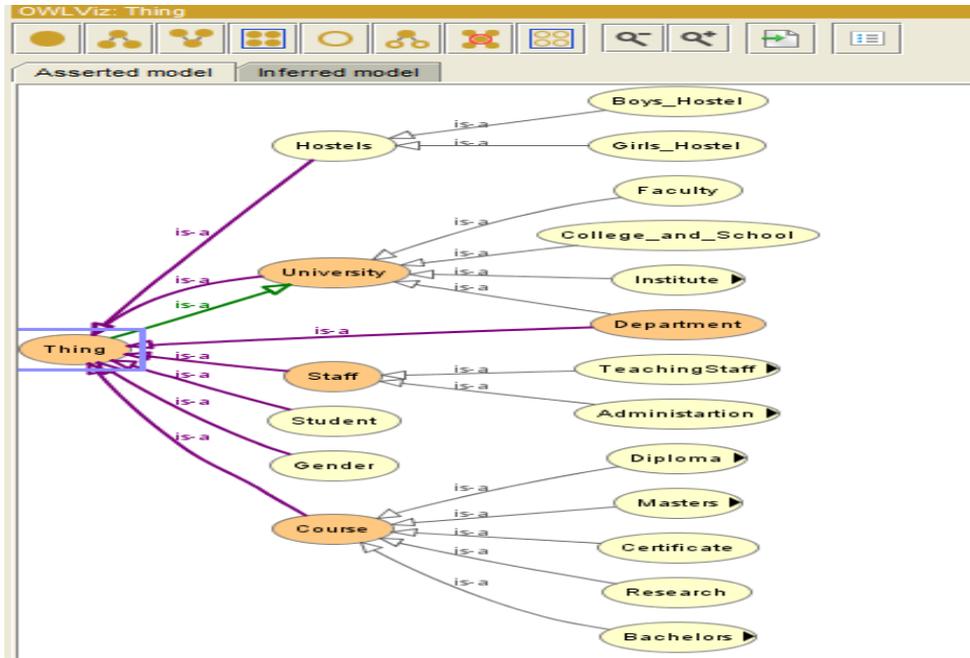


Figure 6: OWLViz representation of university

Fig 7 shows another the OWLViz representation a subclass statutory officers (Statutory officers is a sub class of class Administration and which is also a subclass of a subclass Staff)

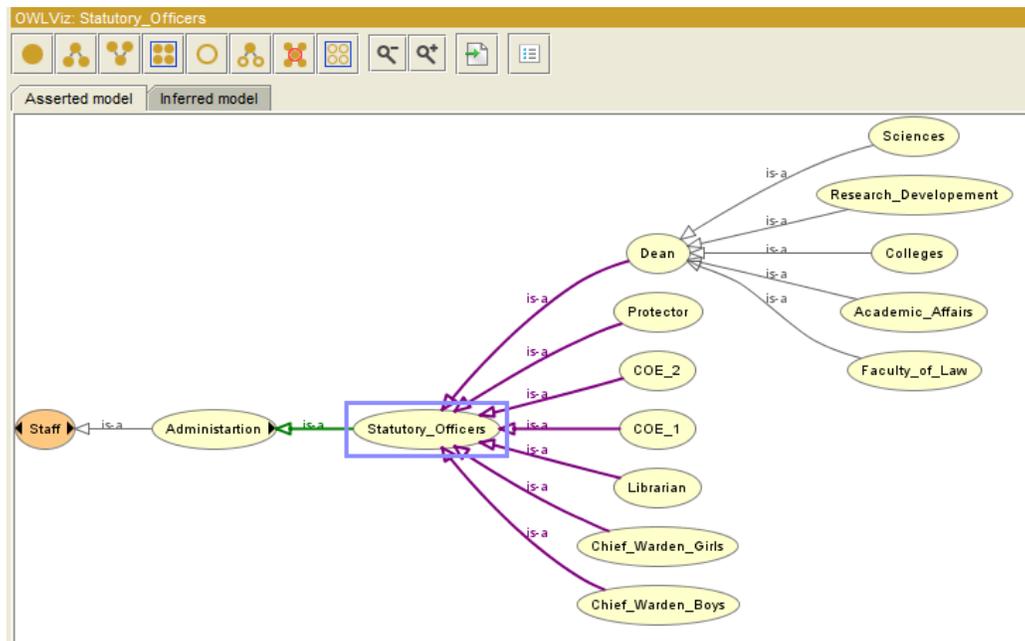


Fig 7: OWLViz representation of subclass statutory officers

Onto Graf Visualization

This visualization of graph is used to represent the relation between classes i.e. sub classes, super classes, equivalence classes, individuals etc. We can expand any class and individual. We can also represent the graph in grid form, spring form, vertical directed, horizontal directed, tree form etc. Fig 8(a) represent the onto graph visualization of the keyword Sanjeev i.e. the classes that contains the word Sanjeev, we got the three results here named Mr. Sanjeev Ahuja, Dr. Sanjeev Sharma and Dr. Sanjeev Dhawan.

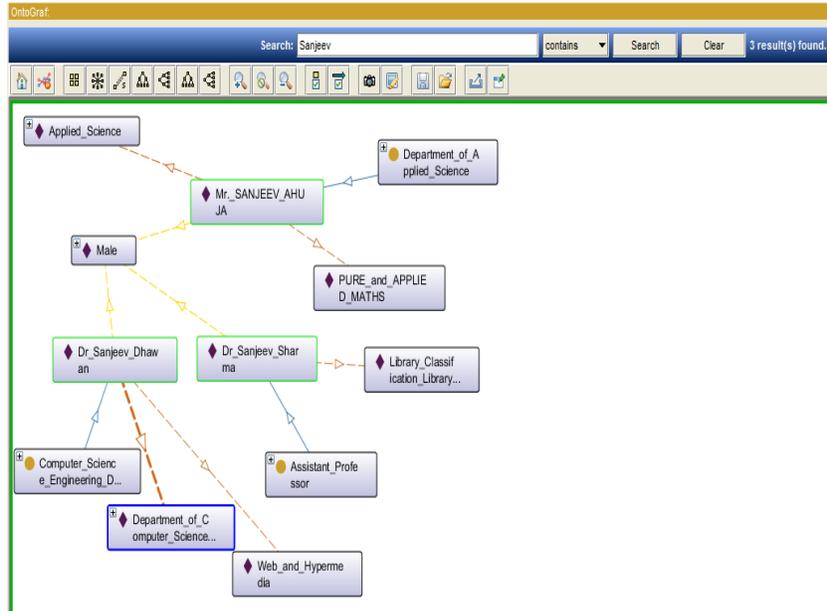


Fig 8(a): Result when contains a word for searching

If we refine the search by selecting the exact match and enter the value Dr. Sanjeev Dhawan we get the following result

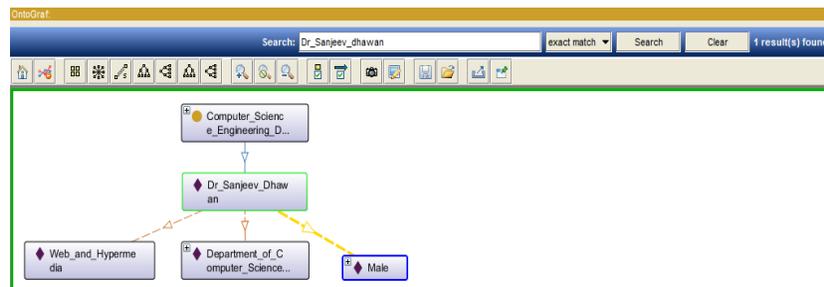


Fig 8(b): Result when done with exact match

RESULTS BASED ON QUERY

DL Query

In order to execute the query with the help of DL query, firstly we start the reasoner and enter our query in DL query window (as shown in fig 9(a) & 9(b)) and execute the query. Suppose we want to search the person in the department of Computer Science and Engineering having specialization in web and hypermedia holding the post Assistant professor. We get the following result. We have to take care that we type name correctly with the particular case either upper case or lower otherwise query will not run.

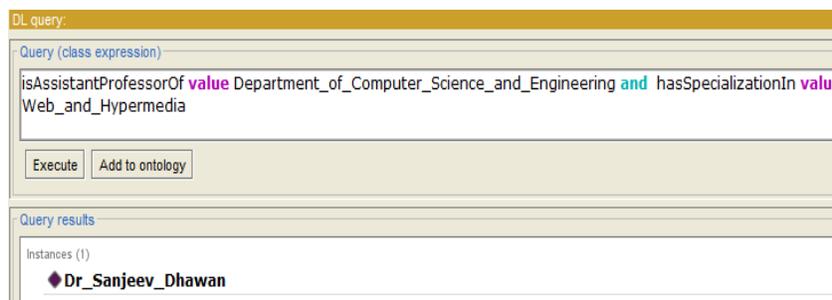


Fig. 9(a): DL Query result

Similarly if we want to search the names of members of university court then we will have to enter the following query:

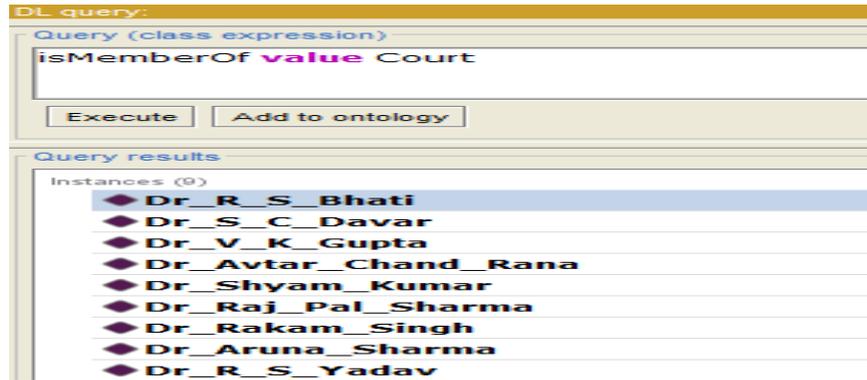


Fig 9(b): Members of University Court (DL Query result)

Results when search in search box

This is the new feature of Protégé beta 5.0 version which was not available in previous version of protégé. If we want to see the complete details of anything we simply have to search in a search box.

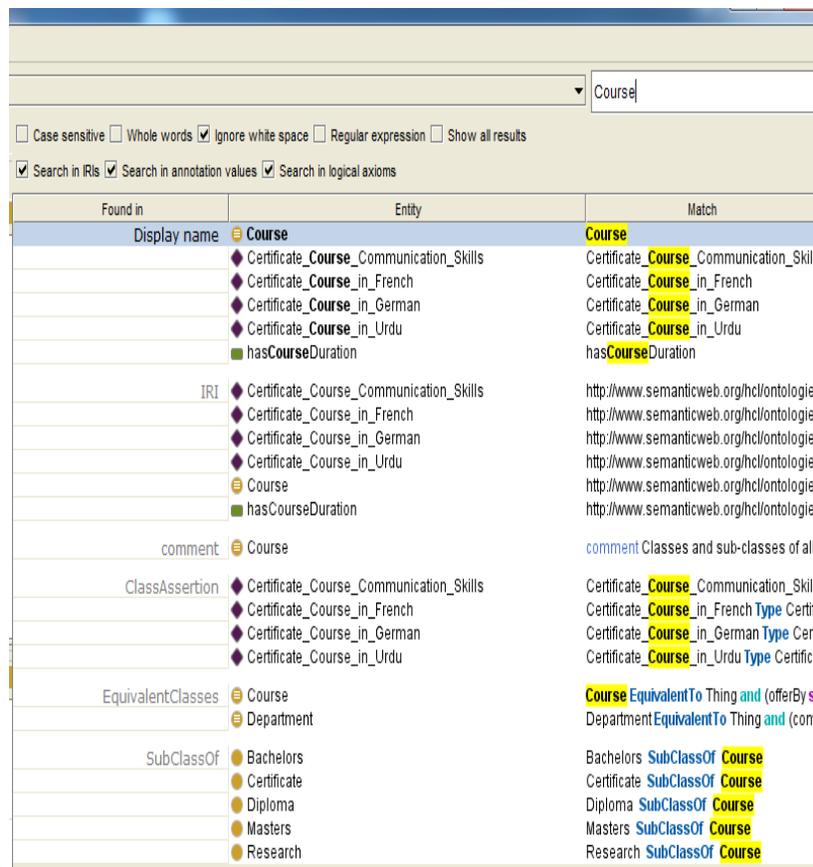


Fig 10: shows the complete details of anything we simply have to search in a search box

CONCLUSIONS

As the web services with the traditional web increasing, the problems like imprecise and irrelevant results also increasing. The semantic web technology based system is able to handle the above said problems of irrelevant results up to many extents. The ontology based on university systems are able to handle the above said problem in the university domain

which usually occurs when user find such results in classical web based search engines and by producing exact result will eliminate the use of surfing various web pages to find the required results. Search time required in case of ontological based system is also very less as compare to traditional web search engines.

While the given ontology shows the better performance of the extracted results on the basis of queries given, this work has some limitations. In order to measure the reliability of the constructed ontology, we can perform experiments by taking different parameters such as precision, recall and F-Measure. After performing the above said experiments, we can show the true evaluation of ontology and the given ontology can be augmented in domain specific semantic web based search engines.

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