

Knowledge Based Information Retrieval for University Domain: Process and Reasoning

Nasrin Akter

Computer Science and Engineering
Daffodil International University
Dhaka, Bangladesh

Shah Akbar Ahmad

Computer Science and Engineering
Daffodil International University
Dhaka, Bangladesh

Abstract— One of the illustrious challenges in information retrieval and natural language processing is procedureing electronic knowledge in the form of recitation and answering users' queries about that information intelligently. Before retrieval of information, first, it needs to be formalized in database or knowledgebase. Successful knowledgeable information salvation, therefore; is emerged on the ontology for this formalization and impersonation. Our concentration is on developing ontology for representing knowledge in the domains of the University and departments in particular. Ours ontology, we have pretended to prove that, this domain of knowledge is not adequately represented by existing ontological models. We have afforded to overcome the incompatibility concept of fundamental notion of ontology design with the universe regarding object representation, where every "real" object is identified as a decoration of a category.

We have discussed the techniques for evaluating ontologies; also demonstrated how the proposed representations can be used to improve the completeness and quality of answers to user queries. We endure also showed a prototype of our developed Information Salvation System. The model is also implemented using OWL 2.0 and Protégé 4.3.

Keywords— *Ontology, Departmental Knowledge Portal, Web Ontology Language, OWL DL, RDF, RDS, XML, Protégé*

I. INTRODUCTION

The availability of information in Database and Knowledge base of different institutions such as University increases day-by-day. As the stored amount of information become bulky, in order to make all this data really useful the demand for tools to process and disseminate this information becomes more necessary. One of the great challenges in information retrieval and natural language processing is processing electronic information in the form of text and answering users' queries about that information intelligently [1].

We have principally focused on those two affairs in this thesis: intelligent information retrieval. Before salvation of information, first, it imperious to be arranged in a database or knowledge base. Successful rational actuality salvation, therefore; is based on the ontology for this formalization and impersonations. Our concentration is on developing ontology for representing knowledge in the domains of University, Departments in particular. In our ontology, we have to assert that, this domain of consciousness is not adequately represented by existing ontological models.

Similar to most of the researchers leading exception in ontology model are to:

1. Civilize the content of ontologies (ontology design)
2. Parallel, excerpt, metaphase and devise different ontologies.
3. Making ontologies sharable by developing ordinary tools and beadedoms

Offering the magnitude of upstairs affairs, our experiment motives and exploits are concentrated on the succession four duties:

1. Civilize an ontological model (content) to represent University in general and apply this model to Departmental Knowledge Portal.
2. Envisage and appealing the technics for evaluating ontologies to the knowledge model we raised.
3. Gather and parallelism several existing ontologies.
4. To answer user interrogatory, create a prototype of a rational actuality system that uses the exhibited ontology.

This paper is embodied as ensues: Section 2.0 covers Web Ontology Language (OWL) and Other Related Language and Specification, Ontology Editors is covered in Section 3.0, Section 4.0 covers literature review, Design and improvement of our proposed ontology is covered in Section 5.0, Major contribution in this field is covered in Section 6.0, Our final chapter 7.0 covers the conclusion.

II. (OWL) AND RELATED

The situation, when the information in archives is not exclusively intended for presentation to human but also necessity to be processed by an application then OWL is needed. OWL is used in the delegation of the signification of terms in lexicon and their interrelationships. This in bout called ontology. OWL provides more facilities than XML, RDF, and RDF-S for revealing meaning and semasiology, and thus the ability of OWL to illustrate machine interpretable contentment on the Web is beyond any several languages. A revised version of the DAML+OIL web ontology language is OWL, which incorporates the lessons judicious from the sketch and solicitation of DAML+OIL [2].

OWL enriches lexicon for recounting classes and properties, cardinality (e.g. "accurately one"), relations between groups (e.g. disjointness), equality, enrich typing of fervidity and characteristics of features (e.g. Transitive, symmetry), and predicted classes. There are three increasingly imaginative sublanguages provided by OWL, with an aim to serve the needs of specific denomination of implementers and users. Languages are [3]:

OWL Lite provides an easy and quick passage way for different taxonomies. Its formal complexity is less than the OWL DL. OWL DL is for those who need the maximal expressiveness that is computational completion and decidability. OWL Full is for those who necessity the endowed liberty of RDF with no computational engages and maximum expressiveness. We have usaged OWL full in implementing our model.

RDF is an official W3C Solicitation for Semantic Web data models and RDF Schema is the knowledge delegation language used in this framework intended to structure RDF resources. RDF interrogatory language SPARQL (is a plug-in in protégé) being used to reach these resources, which might be saved in the triplestore [4, 5]. As we have used more expressive language Web Ontology Language (OWL) in implementing our model, which in turn includes many RDFS components [6].

Ontology Editors

There are even many more Ontology Editors available [7]. In implementing our work we have used Protégé 4.3. Protégé is an uncovered-source and free framework and ontology editor for building intelligent systems. To construct knowledge-based accomplishment in grounds such as organizational modeling (our model on University), biomedicine, and e-commerce, strong community of users (like, academic, state, and corporate) use protégé [8]. We use Protégé 4.3 to model our university ontology that connects business supporting algorithms with data integration. It helps us to coordinate the work of different departments by sharing ontology's, via servers. It also helps us to provide diagrams of specific concepts via the Ontoviz plug-in. The ontology's may be made publicly obtainable after the end of the project and provided upon request.

Both natural and complicated ontology-based applications can be built using Protégé's plug-in masonry. To fabricate a comprehensive range of knowledgeable systems, Developers can center the output of Protégé with regulation systems or other matter solvers. Protégé also supports RDF and the delayed OWL 2 Web Ontology Language (OWL) specifications from the World Comprehensive Web Fellowship (W3C). Different support provided by protégé 4.3 in building Ontology are [9]:

Inferred axioms show up in most standard views , DL Interrogatory tab for testing unrestricted class manifestation, Straight interface to FaCT++ reasoner ,Direct interface to Eremite 1.3.7 reasoner , Renaming (including multiple entities) ,Handling disjoints/different classes, Quick defined class creation , Various transforms on restrictions (including covering) , Changing of IDs to docket ,Moving truism between ontologies, Loading of abundant ontologies into a individual workspace, Switching between ontologies dynamically, Abundant alternative spectacles of the equivalent ontology..

III. LITERATURE REVIEW

Few university ontology being created by many developers with their peculiar concepts. So, distinct concepts make ontology variant from every other in concepts or relationship or even classes. For instance, if ontology is build on professors' details and controller of examination of a

university, and then much of information will be missed like student information in details. So, one might be fail to edit or combine ontology concepts and other important concepts related to students of the university, that is, student related to which subject or course, student belongs to which year, experience of the Professors and detailed about which teacher related to which subject.

Apropos to make the university ontology more complete, we pay observation to go on details of university concepts, which include many more concepts then, being, develop as before. Most prominent tools being used by many developers in creating ontology like, Protégé, onto Edit etc.

More than 150,000 users collaboration to amplify ontologies and evolve problem using protégé. From which there are few of them has created university ontology. Ling Zeng, et al. 2009 has created university ontology naveling only on the particular course for reuse of course for teaching purpose [10]. Sanjay Malik in 2010, created university ontology naveling on the university employee detail only based on name, address, date of joining etc [11]. Naveen in 2011, created university ontology naveling only on students, teachers and Courses relationship [10]. Narmeen Shawoo Bawany in 2013, created university ontology focusing only including only academic side of the university [9].

IV. DESIGN AND DEVELOPMENT OF PROPOSED ONTOLOGY

Following are the few Adeptness Questions (CQ), we have considered for our ontology. These are not only the matters we have resolve by our ontology, we also done many more. Figure1

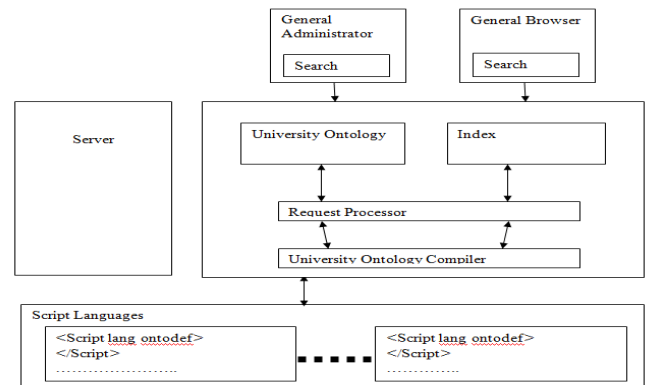


Figure1: General Architecture of University Ontology

Exhibitions the ordinary Architecture of ontology, For this architecture to work competency questions are considered.

- 1) Are the domain of convenience (in this incident, university) is properly studied?
- 2) Are various classes of the ontology is studied properly?
- 3) What is the role of Research Assistant in the ontology?
- 4) Are Students considered separate with importance to University and department?
- 5) Are courses considered separate with importance to University and department?
- 6) Are students participation constraint in the program are clearly noted?

- 7) Are courses pre-requisite are adequately mentioned?
- 8) Are teacher relation with registrar office apart from students and departments are studied?
- 9) Are different branches of university is noticed clearly?
- 10) What form of relation does departure among students and teachers aloof from teaching?

What form of relation does exist between students and departments?

- 1) What form of relation does exist between students and courses?
- 2) What form of relation does exist between teacher and departments?
- 3) What form of relation does exist between teacher and courses?
- 4) What form of relation does exist between different departments?
- 5) What form of relation does exist between students and divisions?
- 6) What form of relation does exist between teacher and divisions?
- 7) How students are categorized?
- 8) How teachers are categorized?
- 9) How student advising is done?
- 10) How publication information of both teacher and students are conceptualized?
- 11) How publication information of teachers, students and administrator are conceptualized?
- 12) How the participation Information in the event by different students is conceptualized?
- 13) How the task of Controller of examination are modeled?
- 14) How different student clubs are conceptualize with stature to students?

As per requirements established through competency Questions, we have designed the University ontology as describe below and shown in Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure7

- Our Reference University “IIUC” is highly studied and maps the different Entity and their relationship of this University in our ontology clear importance.

As we have resolved our dominion of interest i.e. University. We have found the following are the main Entities in our ontology that need to be modeled: People, Departments, Divisions, Program, Courses, Clubs, Events, and Publications

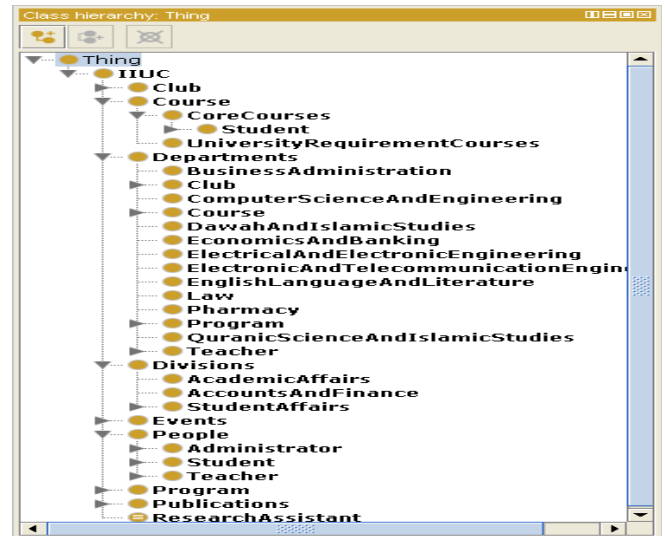


Figure 2 : Super-classes and Sub-classes of our ontology

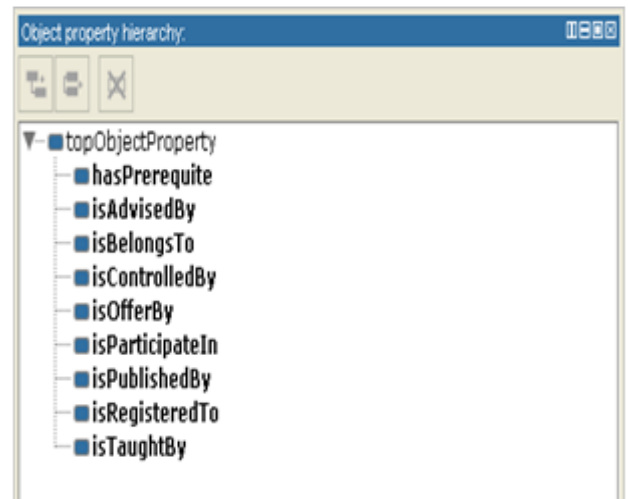


Figure3:Object Properties of our ontology

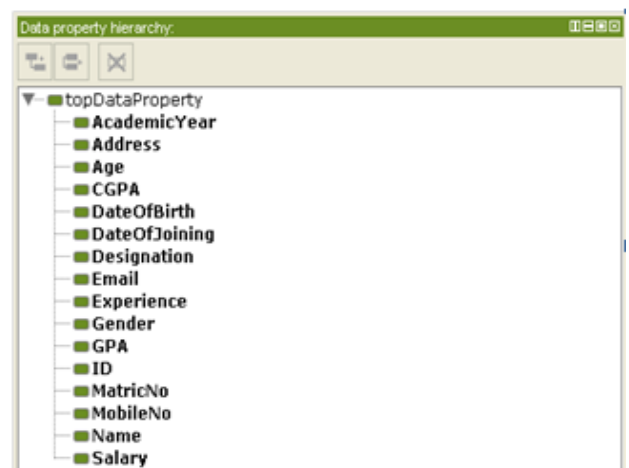


Figure 4 : Data Properties of our ontology

- Research Assistant is playing a dual role. He/she is a student as well as teacher.
- Student and courses are given separate existence with stature to University and department.
- A student execute belong to mere particular Department, this point is being accomplished.
- Courses have separate existence with stature to Departments
- A student could participate mere same of the available Programs of the University.
- Each course execute or execute not have some pre-requisite, this clause is being implemented
- A Teacher is a individual entity in our ontology, though they are controlled by registrar of the university. Therefore, their induction is well implemented.
- A hierarchy from Vice-Chancellor of the University to lower level Employee and Students are well organize noticed.
- Relations with Students, Teachers and Different division are well prescribed and accomplish in ours ontology.
- There is a condition on course for teacher that, a teacher could conduct how much of courses. For instance, condition is conferred in our ontology that, a teacher could conduct minimum 3 courses and maximum 5 courses.
- There is a condition on course for Students that, how many courses a student could register. For instance, condition is conferred in our ontology that, a student could register maximum 5 courses.
- Each department is considered as separate in our ontology.
- Teachers are considered separate in various departments.
- The advising students of each teacher are separately defined
- The finance information with stature to students registration are well prescribed and implemented
- Each student are dedicated to be member of the corresponding club of their department, is defined
- The participation Information in the event by different students is noticed in our ontology.
- Students are categorize in undergraduate and Graduate, with sub-group to current and prospect students
- The load of Controller of examination is mention with great importance with different sub-category.

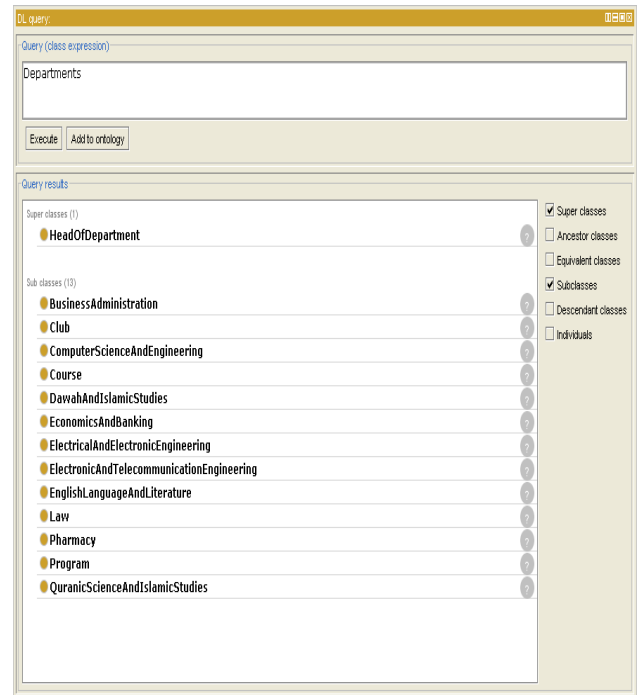


Figure 5 : Sample DL Query View Of Our Ontology

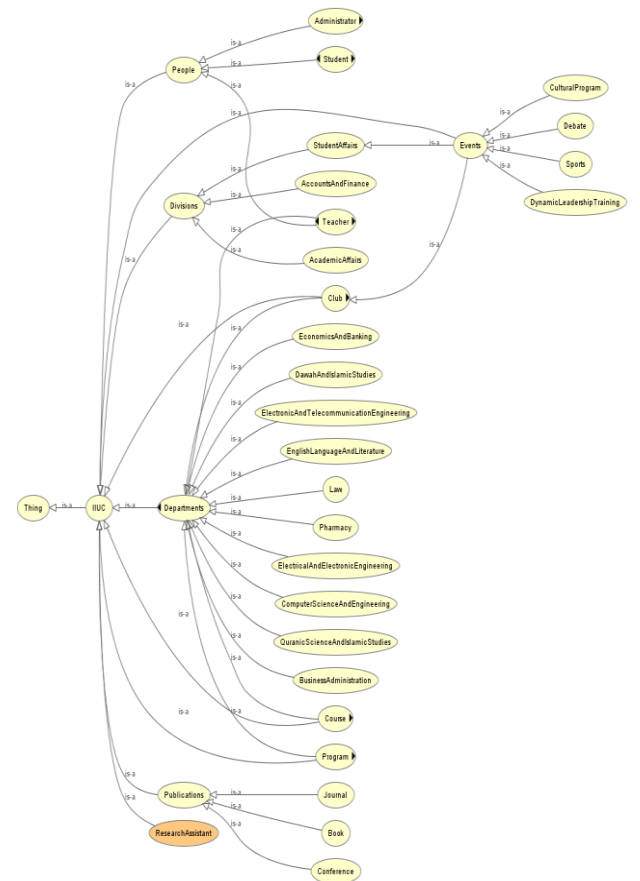


Figure 6 : Asserted View of University Ontology

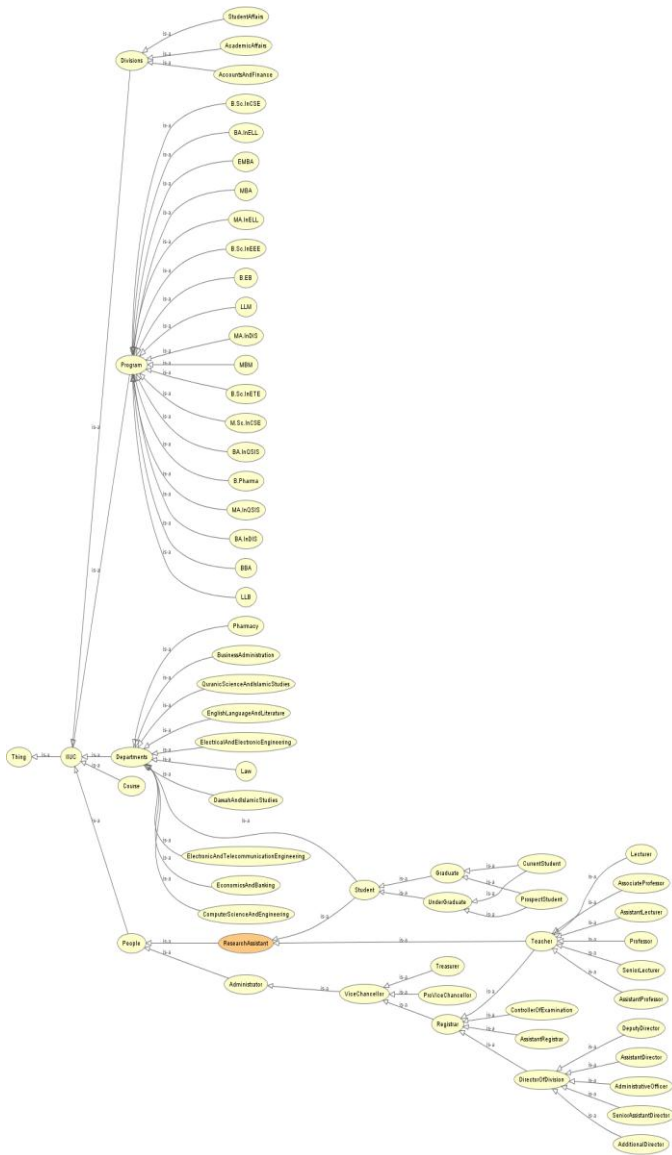


Figure 7: Inferred View of University Ontology

V. MAJOR CONTRIBUTIONS

Following are our contribution through these thesis and research action:

1. We have study the requirements in residence the ontology in our defined university domain (Especially, Departments).
2. We have analyze different projects in ontology design and choose best framework among them to construct our ontology that will surely facilitate the upcoming developer of the ontology in said domain in selecting their framework.
3. We have study in details about major categories in our dominion of interest, i.e. University including

configurations of concepts, objects, components, properties and functional relations.

4. We have build university ontology in similar a way that facilitates the conception of category conversions, histories for objects that alter their category and identity through processes.
5. We have exalted information deliverance system by using inference rules that make usage of the knowledge contained in our ontology.

VI. CONCLUSIONS

In today's world, Knowledge management is considered as on of the key aspects. Especially, modeling of organization like university can not be thought of without intelligent Knowledge management system. This system helps different departments and groups in the university to interact with each other, to participate in a common job virtually, to learn and grow for mastering higher skill. Thus our effort was to represent knowledge and knowledge-based information retrieval for the University (especially, Departmental Knowledge) intelligently, which, in turn helps the departments of the Institutions to integrate into the work process faster and more effectively and economize both financial and Human resources of the Institution.

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