A Step towards Better Understanding and Development of University Ontology in Education Domain

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Abstract

The sheer amount of data on the web, together with its distributed, redundant and inaccurate nature, makes using the information within rather cumbersome. This problem is often referred to as information overload". Though, this problem is largely being addressed by many advance technologies but they operate on text based searching ignoring the meaning of the data. These technologies lack ability to perform meaningful analysis and filtering of data, there by presenting results that only human can process and not machine. The objective of semantic web initiative was to provide meaningful web that can be processed by machines and humans equally. The web, which can judge the intent of human user and provide results that fulfill the information requirement accordingly. RDF/RDFS and OWL has been developed in order to facilitate this approach. Conceptual schemas known as ontologies are created for providing meaningful structure of data. Researchers with the help of domain experts have developed ontologies for many domains. However, there is a potential to create heterogeneous ontologies on a same domain as no common criteria exists for building ontologies. This paper presents a case study for the derivation and implementation of ontology in higher education domain. Author discusses the key concepts of the domain along with its data and object properties. Model is implemented in OWL 2.0 using protégé 4.0. This paper covers the major aspects of University domain including super class and subclass hierarchy, creating a subclass instances for class illustration, properties and their relations etc.

Keywords: Semantic web, ontology, OWL, education domain, ontology development, Protégé.

Introduction

Current web is for human consumption based on html which means to display or to present data which lacks meaning. Machines are there to help user navigation through masses of information available on the web but the major problem is to extract the appropriate information from bulk of data. Current web is still not expedient and efficient enough to extract information just according to user need.

The next generation intelligent web called the semantic web offers users the ability to work on shared meaningful knowledge representations on the web[1].

With the detail and deep study on Semantic Web technology, researchers in education domain forecasted a potential future of the semantic web technology which could use in education field.

Researchers predicted that the ultimate realization of the Semantic Web and its application in education will completely change the current education mode. It will lead to a revolution of education mode. The prerequisite of Educational Semantic Web is that there is a large number of Ontology available in the Internet which can be used to describe the content of education. While the prerequisite of Ontology description of education content is that related ontology should be constructed[2].

At present much ontology exists which have covered some area of education domain but there is not such a comprehensive ontology exist in education domain which covers the basic taxonomy of the university. This should be the role of Education institutes to create University Ontology and cover more major areas in the particular domain ontology.

In this paper, the author proposed a University Ontology which facilitates the management, students faculty members and other stake holders in the University. The paper structured is follow: section 2 provides the description of the proposed ontology and section 3 provides the conclusion.

Tools for Ontology Development

To aid the ontologist in constructing and margining multiple ontologies tools are essential. In this paper author used Protégé 4.1 Ontology development tool. Protégé is the most popular and widely used tool for Ontology creation and development. It also checks ontology for inconsistencies of classes and subclasses. Protégé tool also provide reasoning.

Ontology Description

Figure 1 shows the whole layout of the University ontology proposed in this paper.
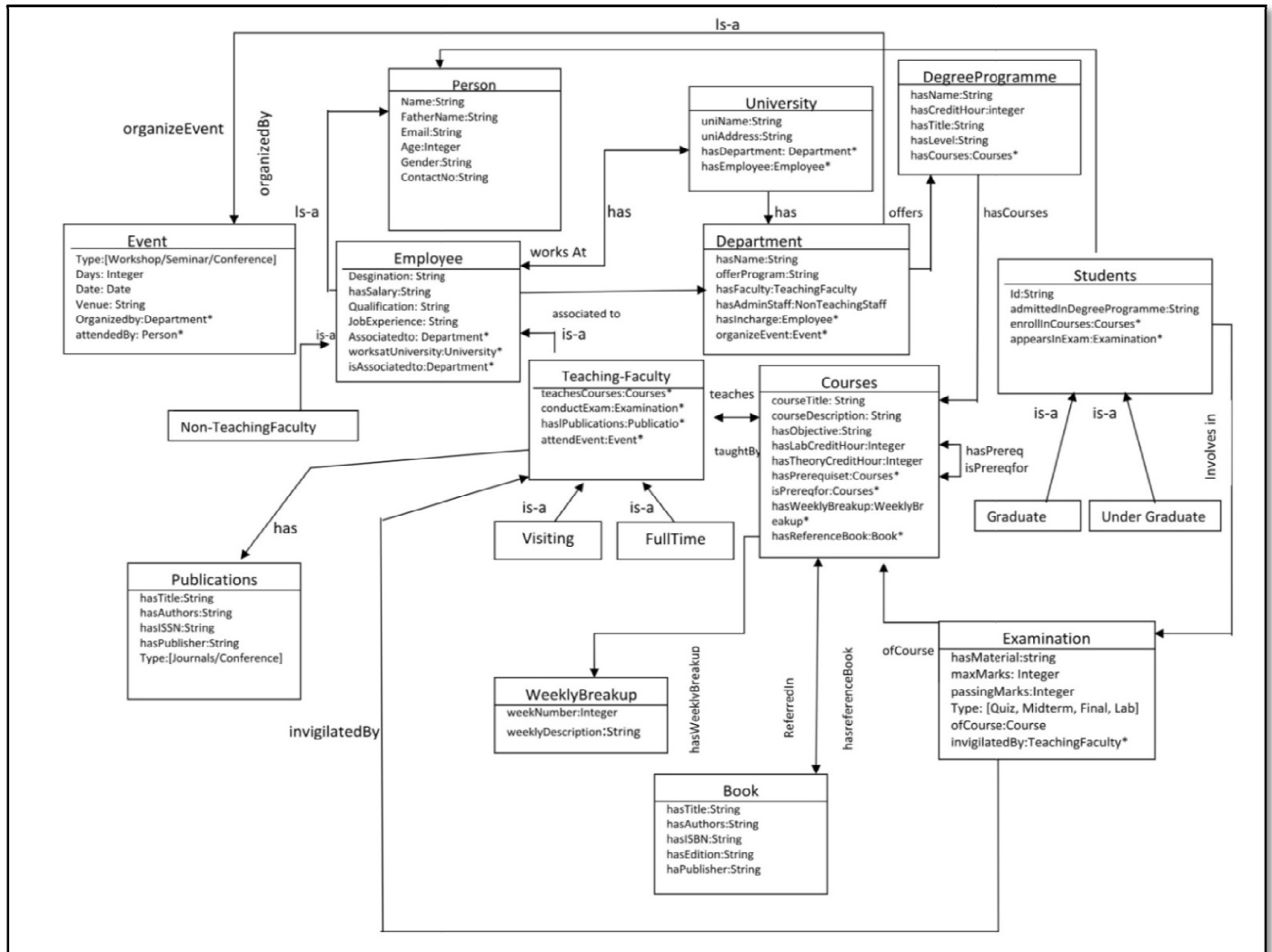
Figure-1
General Layout of University Ontology

Person: Firstly, let start with class person, which represents any individual, belongs to the university. The class contains several data properties to hold the corresponding information. Data properties include: person Name, father name, email Id, age, gender, contact information and address. Class person has an object property attend event which associates person to a class Event.

Person is a super class of employee and student. Like object oriented programming, OWL provides the inheritance concept of super and subclass. Class inherits from a super class also inherit all the properties of the class.

Employee: The class employee inherits from the class Person represents an individual who is the employee of the university. The class contains several data properties to hold the corresponding information. Data properties include all the general information of the person inherits from a class Person.

Further data properties which separate an employee class from other classes include designation of an employee. For example employee can be a technician, faculty member, dean or director of the university. Other data property includes salary, qualification, job experience. The object property of an employee class includes works at university which points to the class university. Inverse property of works at university is *has* property which links class university to class employee.

Employee associated to department via object property.

Employee class is further divided into two major sub classes include: Teaching faculty and non-teaching faculty.

Teaching Faculty Class: Teaching faculty has all inherited data and object property of class employee and person. Object property includes: teach courses. Inverse of teach courses is taught by which links class course to class teaching-faculty.

This property associates a faculty member that teaches course to the course class. Faculty member is linked to class publications via has publication property. Teaching faculty can have journal publication or any conference proceeding. Teaching faculty conduct exam and related to the examination class via conduct exam property. Teaching faculty is further extended which includes two sub classes full time and visiting faculty.

Publications: Publication class includes data properties such as has title, has ISSN, has publisher and type [journal or conference]. Publication class belongs to class Teaching Faculty shows the relation, teaching faculty has publications using object property.

Student: The class student inherits from the class person represents an individual who is the associated to the university. The class contains several data properties and object properties to hold the corresponding information. Data properties which separate a student class from other classes include the Id and batch of a student and year of admission.

Object properties include the admitted in degree programme property which links student to the class degree programme. For example university offers many degree programme such as bachelors in computer science or masters in business administration. Every student who is enrolled in university must be associated to a class department via an object property. Every student must take number of courses offered by the department via enroll in courses property which links student to the class course. Every student has to appear in exam which link student to the class examination via appears in exam property. Student is associated to student class via object property. Student class is further extended into two subclasses graduate and undergraduate.

Courses: Class courses which represents the subject being taught by teaching faculty and linked to class teaching faculty via object property. For example, semantic web is a course being taught by any faculty member whether permanent or visiting. The class contains several properties: course title, course description, has objective, has lab credit hour, has theory credit hour. Property has weekly breakup points to the class weekly breakup whereas has reference book belongs to class book and has inverse property. Has prerequisite and is prereq for is the self inverse properties of class Courses.

Weekly Breakup: Class weekly breakup is associated to courses class via object property. Every course has a defined weekly breakup. Weekly breakup properties include week number and weekly description. It contains information about number of classes being conducted by a faculty member in a week and description include the content which is being covered in a week.

Book: Book is referred in every course contains many data properties which include: has title, has author, has ISBN, has edition, has publisher, has edition. Every book is referred in a class course via has reference book object inverse property.

Examination: Every course has a exam and every single student who is enrolled in a course will appear in an exam. Examination class is linked to class courses via object property of course. Exam is invigilated by teaching faculty. Data properties include max marks, passing marks. Type of examination includes: Quizzes, midterm, final paper and lab.

Department: University is incomplete without department. A general university can have many departments like department of pharmacy, department of mathematics, and department of computer science etc. Data properties include department name i.e. has name. Another property is offer programme. Offer programme means numbers of degree prorammes being offered by a department. For instance a computer science department can offer number of degree programmes like BS in information technology, BS in software engineering, MS in telecommunication etc. Every department has Incharge and associated to class Employee. Every department has administrative staff and has faculty which links to class non-teaching staff and teaching faculty respectively. Department organizes events like seminar, workshop, training session, conferences. Organize event is a object property and belongs to the class event.

Event: Events are organized by department. Data properties of class event includes days, date, and venue. Department organize events. Attended by person and links to class Person.

Degree Programme: Department offers numbers of degree programme. Data properties of degree programme include has name, has credit hour, has title, has level and has courses. Department offer courses and associate to class courses.

University: University class includes uni name and uni address. Object properties include has department and has employee.

Conclusion

This paper developed domain ontology of a University. The existing university ontology lacks the detailed taxonomy. They do not include all the required concepts and information that are necessary to be added in a university ontology.

This paper demonstrated a university ontology with respect to the super and subclass relation. Moreover data properties and object properties are being highlighted and elaborated in detail. Using Protégé 4.1 is ontology building tool.

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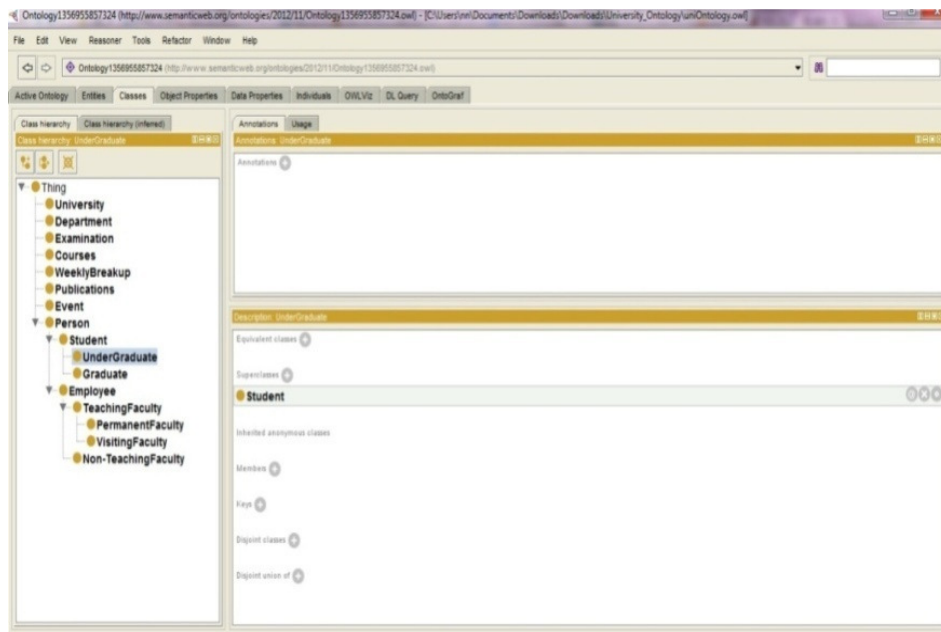
Figure-2
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