ONE APPROACH TO KNOWLEDGE MAPPING FOR INTERNATIONAL STUDENT PORTAL[1]

Tatiana Gavrilova, HaiNan Jin

Abstract: Knowledge portal is an approach used to provide view of domain-specific information on the World Wide Web [13]. In this paper, we present one approach by using ontology engineering as a conceptual backbone and relationships for knowledge extracting, structuring and formalizing as a comprehensive way for building knowledge portal. For illustration of a practical ontology development of knowledge portal, the described ideas are implemented in a system design for international student service.

Keywords: Knowledge portal, ontology engineering, international student service

ACM Classification Keywords: I.2.4 Knowledge Representation Formalism and Method — Semantic Network

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Introduction

Today, data and information can be retrieved from many different sources, such as databases, World Wide Web, knowledge bases, and other specific information systems. Using web-based technologies, knowledge portals are developed by providing a single point of access to various types of information [5].

In this paper, we attempt to develop a knowledge portal, which aims to integrate and organize the data/information resources dispersed across web resources [2] by using ontology technique that makes them useful, and a framework of user-centric design for accessing the requested information.

Knowledge Portal

The key to a successful knowledge dissemination strategy is to channel the knowledge to the communities of practice and at the same time provide means for information exchange and peer-to-peer collaboration [9]. One of the models for a virtual collaborative research environment that provides means for both, knowledge sharing and collaboration is the “Knowledge Portal” model. Or we can say that the aim of knowledge portals is to make knowledge accessible to users and to allow users the exchange of knowledge [1]. Knowledge portals specialize in a certain topic in order to offer deep coverage of the domain of interest and, thus, address a community of users.

Ontology Methodology

Traditionally, basic philosophical definition and its further development are pointing that term ontology stands for study of “being” [14]. In information science, today, ontology is a set of distinctions, explicitly made in order to understand and view the world (see Fig.1). There are some of varieties of definitions of this milestone term [7, 8]:

1) Ontology defines the basic terms and relations comprising the structured vocabulary of a topic area, as well as the rules for combining terms and relations to define extensions to the vocabulary.
2) Ontology is an explicit specification of a conceptualization or a hierarchically structured set of terms for describing a domain that can be used as a skeletal foundation for a knowledge base.

This definition clarifies the ontological approach to knowledge structuring while providing sufficient freedom for open-ended, creative thinking [11]. Ontology as a useful structuring tool may greatly enrich modeling process, providing users of KM-systems as an organizing axis to help them mentally mark their vision of the domain

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knowledge [4]. For example, ontological engineering can provide a clear representation of a company's structure, human resources, physical assets, and products, and their inter-relationships.

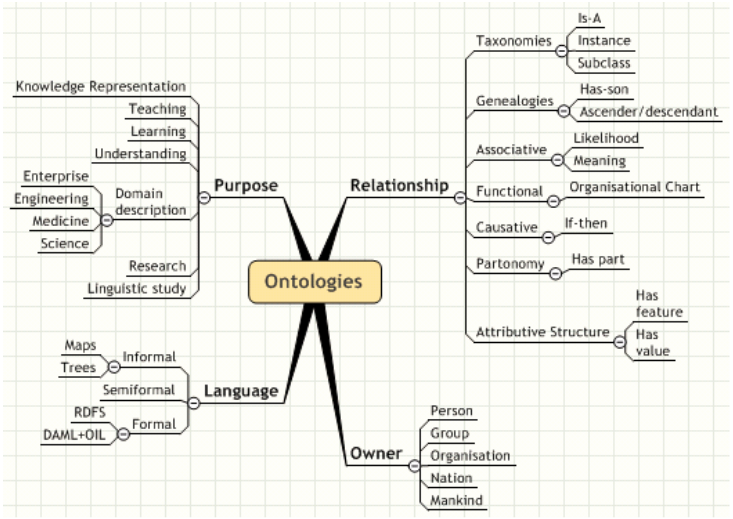

Figure 1. Classification of ontologies

Here we present a method which is called *Four-step Algorithm* [5] to create an ontology:

Step1. Goals, strategy and boundary identification: Identifying the purpose of the ontology and the needs for the domain knowledge acquisition.

Step2. Glossary development or meta-concept identification: This time consuming step is devoted to gathering all the information relevant to the described domain.

Step3. Laddering, including categorization and specification: Having all the essential objects and concepts of the domain in hand, the next step is to define the main levels of abstraction, property and relationship of each concept.

Step4. Refinement: The final step is devoted to updating the visual structure by excluding any excessiveness, synonymy, and contradictions. Meanwhile, we also follow Gestalt (good form) principles by M. Wertheimer [16] to achieve the harmony. As mentioned before, the main goal of the final step is try to create a beautiful ontology.

Knowledge Portal Construction for International Student Service

In this section, for illustration of a practical ontology development for knowledge portal, the described ideas are implemented in a system design for international student service.

International students are continually facing the problem of searching and applying through today's information system which is needed to analyze massive volumes and varieties of data. This situation is not only limited to students, but also took place to organizations and educators. Thus, based on web-based technology, knowledge portal is required and developed to facilitate users finding relevant, domain-specific information by using university database. The portal should provide access to information related to a wide variety of activities [12]. In the first place it will probably concentrate on teaching and learning and student administration, other areas will also needed to be considered: student's life service, financial assistant, passport and visa service, etc.

Members of students and visitors will have different system requirements. But in general, there are some similar parts could be regarded, the following table summarizes the most highly ranked (see Table 1):

Table 1. General Student Service Requirement

Study Information	
	New Student
	Current Student
	Graduating Students
Life Service Information	
	Student Services
	Employment
	Student Union
	Entertainment
Passport and Visa Service	
	Passport Service
	Visa Service
Financial Service	
	Scholarships
	Graduate Assistantships
	Loans

Ontology Design

Following the aforementioned 4-step algorithm, we try to describe the exact practical procedures on each step by representing all the visual structures.

Step 1. Purpose and Goals Identification. It is important to analyze the purpose and proposed usage of the ontology at the beginning of development of process. User requirements analysis is a key part of the user-centered design process, which increases the likelihood that an implemented system matches users' needs and behaviors [6]. If adopted, it could help to overcome some of obstacles to a successful portal implementation of the university information system.

Goals analyze: A university is seeking to provide useful information for international student. Each parts should be integrate, tactic and available. The data will help student to:

- Providing useful and up-to-date information about university and program.
- Helping and guiding news to apply the program and make consultation.
- Information for current and graduating student.
- On arrival service, daily service and activity consultation.
- Passport and Visa service
- Financial Assistant

Step 2. Glossary development or meta-concept identification. The second step is devoted to gathering all the information relevant to the described domain. To achieve this goal, we collected the terms of two sides which are from the point of view of student and point of view of university, expecting to cover all the possible situations that will be referred. The terms and concepts from these sources are combined to build a single glossary (see Table 2).

Table 2. Glossary of terms and concepts

Applications	*Student Union*	*Transportation*	*Russian*
Applicants		*Address*	*Certification*
Applications Flow	*Medical Service*	*Uni. Program*	*Orientation*
Applicants Requirement	*Equipment Network*	*International Interchange*	*International Education*
On Arrival	*Dormitory Service*	*Passport Service*	*Entrance Check-up*
Housing	*Security Service*	*Visa Service*	*FAQ Contact*
Health Insurance	*Activities*	*Scholarships*	*Full-Time Service*
Expenses	*Off-campus Employers*	*Academic Attestation*	*Education Certification*
Finances			

Step 3. Laddering, categorizing and specifying. After creating all essential objects and concepts, we start to build practical ontology of the system. First we built an initial visual structure of the glossary terms based on a set of preliminary high level concepts and the categorization of the glossary terms.

Utilizing MindGenius [10] we build initial ontological categorization or meta-concept architecture from point of view of university that includes all faculties, departments and staffs, it's a complete description of the university framework (see Fig.2).

Figure 2. Main meta-concepts for knowledge structuring

However, the portal needs to be much more attended to the practical problem, composed more precise concepts and hierarchies by analyzing the glossary and previously visual structure [15]. Students from the first visual map can not easily gain the information or knowledge about their university and campus life. Thus, it is should not only from the view of university but more concerned with students.

Meanwhile, there still seems to be some disadvantages that may need to be adjusted further. One of them is too many branches used in the map which may lead visitors to disordered corner. Users sometimes doesn't have enough time and endurance to navigate from one place to another in internet to find information they want, therefore, a specific, ordered and well-structure configuration is more significant [17]. We modify the previous map to make it more effective and humanizing (see Fig.3).

Figure 3. Adjusted portal's structure

Furthermore, we have to think over all the possibilities that may occur when the foreign students are coming to the university, "What's the real help they want to gain from university, not what's the help university wants to give?" [3] – that's the only way to solve the problem.

The following diagram shows us the solution (see Fig.4). The output of this step is a user-centered ontological map, which covers the domain hierarchically.

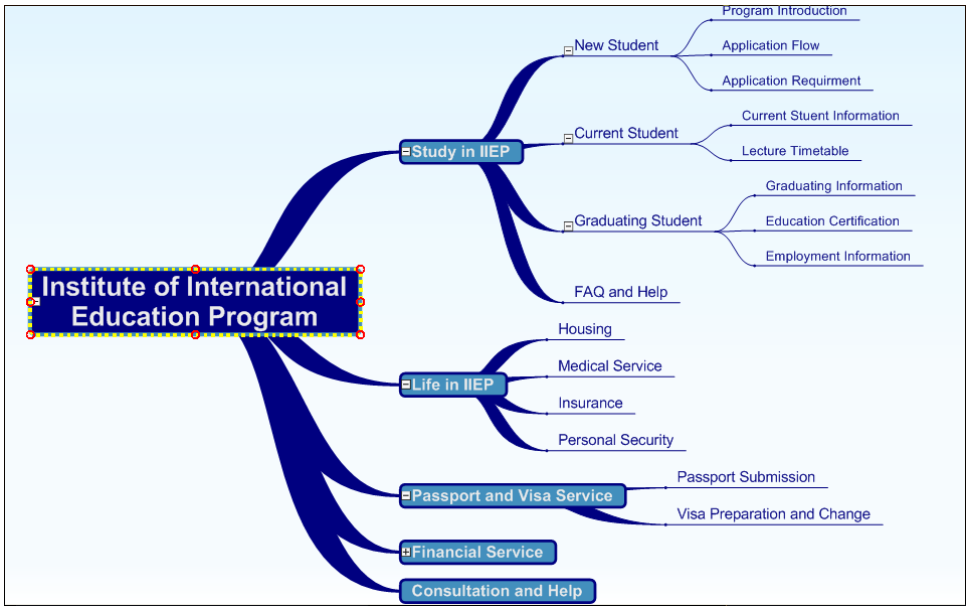

Figure 4. User-centered portal's structure design

Based on the detailed concept map, here we use *Top-Down* structuring strategy to create basic relationships between concepts via filling with term of glossary. The output of is a large and detailed map, which covers the domain hierarchically. The implemented result is shown in Protege 3.3 (see Fig.5 and Fig.6).

Step 4. Refinement and Harmony. To access refinement and harmony, we should update the ontology by taking into consideration of balance and clarity. We removed all the excessiveness, synonymy, and contradictions, then use standard, consistent relationships to simplify understanding.

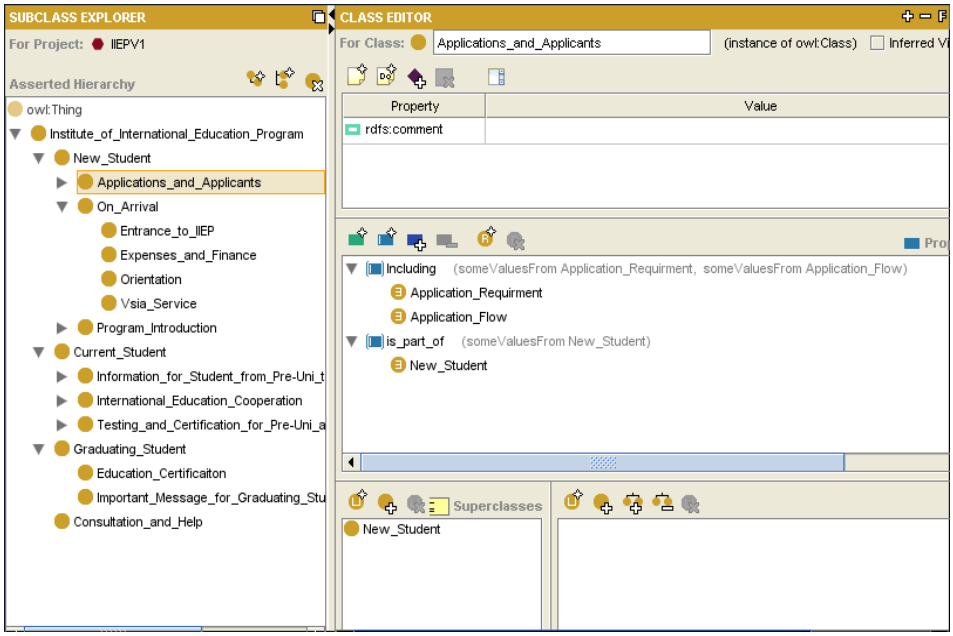

Figure 5. Relationship construction in Protege

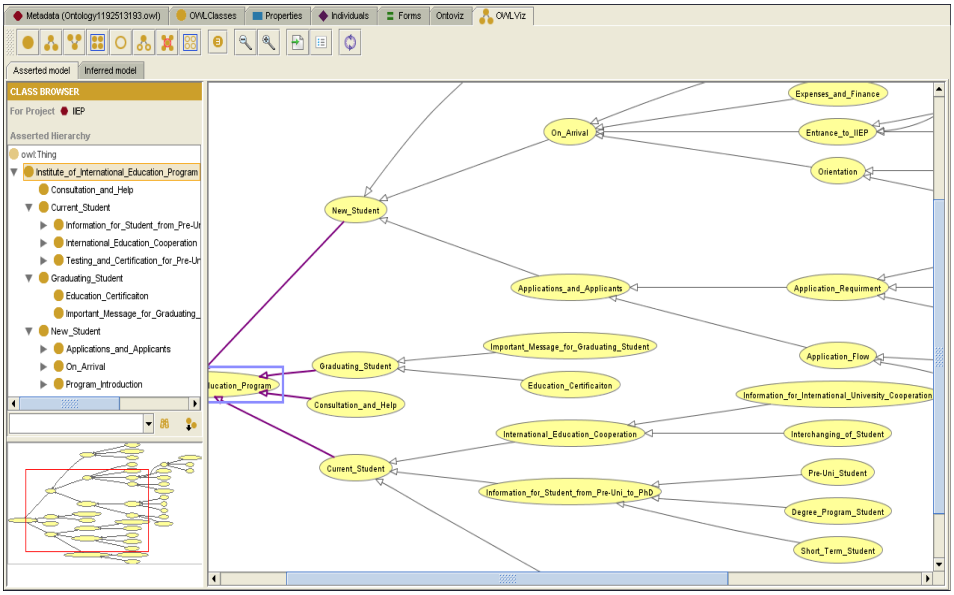

Figure 6. Hierarchical structure construction in Protege

Conclusion

The knowledge portal is a user-centered environment which a user could gain access to information and knowledge from a single internet location. To achieve this goal, we have demonstrated the strategy for designing a system for international student service by using ontology technique which may lay a conceptual foundation and supports for building knowledge portals. The future work is to use web-based technology to implement this design in the university information system.

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