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Benefits of semantic approach in the learning environment

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Abstract

Mobile devices are mainly lack of regular user interfaces that facilitate the human-computer interaction and the access to network resources. However, almost all commercial applications contain their mobile versions. If we consider the importance of business and learning environments, there are still many new opportunities to integrate mobile devices with web-based services. Development of Educational Semantic Web and the implications for Web-based teaching and learning attracts great attention. This study focuses on creating a web site with semantic features taken from a student survey conducted to learn their e-learning awareness and developing an efficient search mechanism among mobile users in the learning environment. The ontology working in mobile devices benefits from adapting context and content information from a centralized system into a significant data mining application.

Keywords: Semantic web; content information; hashing mechanisms; data search; mobile ontology

1. Introduction

Thanks to Today's technological advances, Semantic web is a very useful tool that makes information more meaningful and understandable to people and computers. System developers find relationships between tagged information using ontology that provides the common logic and structure for web pages. The small program portions called as software agents can easily locate and combine information from different sources. Agents focus on your interest such as a person, subject or activity and check the web, find the information and exchange it with other agents. Semantic Web declares the knowledge embedded in many Web-based systems to integrate information in an intelligent way and provides semantic-based access to the Internet (Gómez-Pérez and Corcho, 2002). Gaeta, Orciuoli and Ritrovato (2009); Gavrilova, Gorovoy and Petrashen (2009) presented life-cycle of ontologies for the information coming from different sources to support collaboration within virtual communities. Khriyenko (2007) stated that Next-generation integration systems would utilize different methods like Semantic Web Services, Agent Technologies and Mobility. They focused on graphical user interfaces that would help interoperation and collaboration of different processes for users. In this study, we will improve a search mechanism based on content hashing in mobile peer devices and address the issues of leveraging Semantic Web for knowledge representation in the area of education.

The aim of this paper is to outline the issues of educational adaptability and personalization based on the Semantic Web. We will develop an automatic knowledge processing in an ad hoc environment where students use their notebooks and smart telephones and increase interoperability between distributed mobile nodes and centralized

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systems. The next section gives an introductory remark for why we need semantic architectures. Section 3 explains the relation between Semantic Web and Education. We address our studies in a model and explain our novel searching mechanism for an effective information retrieval from the institutional resources in Section 4. Finally, a brief summary of our solutions and findings concludes the paper.

2. Need for Semantic Architectures

Current web pages based on Hypertext Markup Language (HTML) technology display only the text and images with links to original web pages and do not identify their meaning. But semantic architectures use tags for every words in the page and enable system programmers to find relationships between them by semantic rules and ontological data. Semantic web makes a reasonable response for your search by employing software agents that can locate the necessary information and build meaningful data collections. Semantic web relate any search value to other concepts, keywords defined in the ontology. The progress towards the Semantic Web vision includes several strands (Warren, 2006): extracting semantics from unstructured texts, developing predefined semantics for the WWW, creating a framework of Semantic Web standards (like ontology description languages), and implementing tools for managing ontologies. Escudeiro and Escudeiro (2009) evaluated the learning packages and hypertext systems and confirmed them as useful mediums for searching, learning and recall. They also pointed out that they must include as many alternative modes of usage as possible within the design of a particular system. Many existing ontologies take into account the current standards and try to integrate them. So, they contribute to the harmonization of learning standards in different domains.

2.1. Ontological Infrastructures and Education

Students working with their computers connected to Internet, spend much of their time to find useful course materials in a virtual world of huge information resource. They search the web, listen and watch long podcasts and converse with other students in the hopes of finding something. In an educational environment, there are currently different standards for different information models and system administrators try to promote the interoperability among these information systems thorough the semantic approaches. Fang, Zhao and Fan (2008) worked on Web-based education as a popular research and development domain in educational technology. They explained the basics of the Ontology Annotation and indicated the process of building ontology for the learning environment. Biletska et al (2010) proposed an approach using the semantic web technologies (RDFS ontologies) and established rules to convert academic credentials between educational institutions. Brzostowski et al (2010) presented an ontology based service discovery in service oriented architecture. They worked on the identification of the business services in a selected area of the university activities. They showed the importance of the conceptual specification of the ontology based services.

2.2. Cooperative Communication Systems

Mobile devices enrich our daily lives and especially receive much more attention in business and education. Social and cooperative wireless networks have a special place for new services. Cooperative wireless network means that mobile devices use their short-range technology to communicate with other mobile devices within their proximity. This means mobile devices can share everything without central servers as if they were in a large wireless environment. The cooperating devices can retrieve a part of the overall information they need from the network. The additional information can then be exchanged among the networking devices. The local exchange is based on network queries and gives more relevant content. Of course, application software running on the mobile devices should determine which users are likely to have more relevant content.

2.3. Mobile Ontology

Mobile ontology is built for the mobile communications domain. It is designed for a standard data exchange format among the mobile nodes in a wireless environment. Campus network is a good candidate to build and run mobile ontology in order to help students in their academic reasoning. It can be constructed by the system and

database administrators who have expertise on semantic web. Once they have a shared and agreed view for the modeling, they can begin to analyze the semantics of exchanged data and shared interfaces of the mobile devices. User and device profiles, local data structure in each device and centralized ontological infrastructure help users locate and transfer required information. Description of technical features in mobile devices and the semantic model of contents are made standard. This provides an enhanced effectiveness on content browsing and preparing semantic queries in search of this content in a distributed environment. The only thing left behind is to reach the right user for the right content. Discovery of the right mobile device namely source of information depends on the flooding of updated local data among mobile peers in the cooperative environment. Semantic description of communication resources and device identifications in XML tags enable all devices understand necessary details through their web based applications.

3. Education and Semantic

Thanks to semantic web it makes information more meaningful to people by making it more understandable to machines. It makes current web smart enough to help us organize and evaluate the learning systems. Everybody aware that the more information the better. Krutz et al (2007) described semantic service description models and supported the creation of service oriented applications in the area of education and training. Their approach enabled the matchmaking algorithm of the service registry and search capabilities. Later, Chiribuca, Hunyadi and Popa (2008) outlined how to apply the Educational Semantic Web. They proposed a modular semantic framework in order to open up, share and reuse educational systems' content and knowledge components. They focused on content creation by proposing ontology-driven authoring tools that reflect the modularization in the educational systems. A sample algorithm was constructed by Lu, Xu and Cai (2009) according to these semantic web thoughts. They designed an intelligent answer-question system, a smart learning navigation system and a smart self-evaluation system in the field of educational technology. They discussed the characters of the autonomous learning model and the problems of the recent e-learning systems.

Karakos (2009) presented an approach for implementing the e-Learning scenario using Semantic Web technologies based on ontology-based descriptions of content, context and structure of the learning materials and benefits the providing of and accessing them. In the light of these studies, the main development areas in semantic web and ontology can be taken into account as how to create an educational knowledge repository, mobile and wireless networks in a personal learning environment and the main actors who will use these resources. Knowledge repository includes cheap and efficient storage resources, necessary course materials, digital libraries, and other sources of references relevant for the students and instructors. It should also have a number of different advantages like articles from scientific repositories, chapters in textbooks for Web-based education. However, there are still a few challenges for Web-based education to provide adaptation and intelligence and develop Web-based courseware.

In an Educational Semantic Web environment, the objective is to spend less time searching for information and more time trying to assess and expand it. Capuano et al (2009) presented a semi-automatic process aimed to speed up and facilitate the realization of domain ontologies for existing educational content and rearranged the learning objects for building personalized e-Learning experience. However, schools and other education providers do not share common languages in describing different course resources. There are two types of user entities in a learning environment (students and instructors). Andreev and Troyanova (2006) concerned with the architectural design of the e-learning environment and concentrated on the service-oriented approach to the design of an e-learning collaborative environment with virtual organization. They also presented an integrated agent-grid approach to e-learning design.

4. Modeling Personal Computing Devices for Semantic Search

Here we attempt to analyze various techniques applied in adaptive educational systems, in order to find out how such systems can be improved by leveraging the Semantic Web technologies to represent knowledge in different models utilized in these systems. Our discussion is grounded on the basic idea that the Semantic Web initiative tries to improve the current state of the Web by using semantic descriptions of Web resources, and thus enabling knowledge sharing on the Web (Hendler, 2001). The key components are ontologies that formally define concepts shared by a community. In this way, one can search Web resources based on their real meaning defined by

ontological metadata, instead of using text-based keywords. Fok and Ip (2005) proposed a framework of a Personalized Instruction planner (PIP) that searches and annotates the educational content. Their approach is based on an ontology-driven and incremental approach by using the multi-agents infrastructure of a Personalized Education System (PES). Gaeta et al (2005) outlined new approaches to education and training environments and compared different technological infrastructures in traditional Semantic Grid to prove the effectiveness of innovative learning approaches for future Education. Khan and Hardas (2007) presented a Course knowledge ontology associated with a course and concepts for educational resources for that course. They made it applicable not only to the domain of education but also to the other domains in which knowledge can be represented as a structured hierarchy.

Web mining uses data mining technologies to find required information from structured or unstructured web documents. Internet is a major resource in performing research and education related activities for students. There are various attempts to model the integration and interoperability of web pages for an efficient knowledge management. Our proposed searching mechanism consists of keyword values taken from the mobile ontology in the network servers and a hashing algorithm working on each mobile node used by the students. Figure 1 explains our methodological steps in detail.

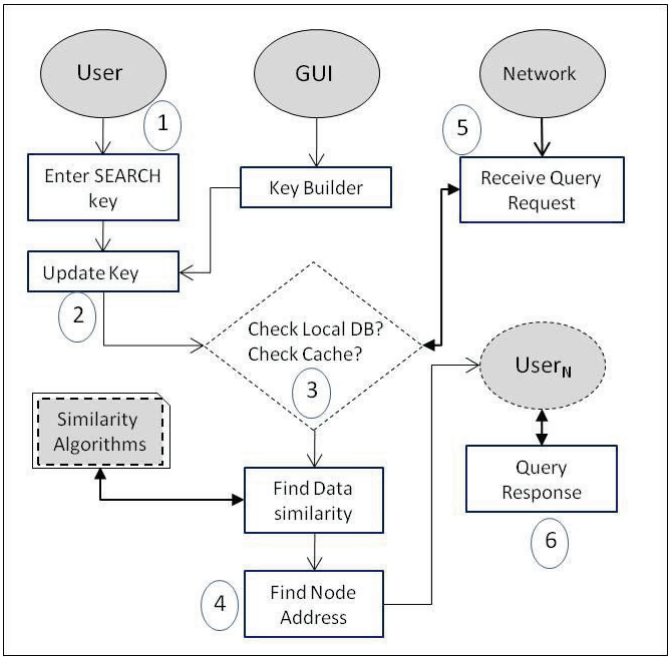

Figure 1. Methodological steps for query request and response

There are 6 different steps that require different processes/algorithm to run. First one is the query formulation and begins with the user's editing in the search keyword box which is the first user interface. Whenever the user selects (drop-down lists) or types (auto-complete) a single word by the help of query builder, the client device has two options. It either checks the previous query results and makes a query word comparison in the local database or sends the query into the network encapsulated in an XML message envelope. After the query is forwarded into a new mobile node, keyword matching is done by using the necessary similarity algorithms and later the hash value is detected in order to see the associated information which is tried to retrieve as the result of the query. All the possible values and keywords are known in advance and this make it easier to organize a perfect Distributed Hash Table in advance. The hash table created for each node is flooded into the network by web services since flooding is the simple forwarding of a packet between neighbour nodes and used for distributing routing information. The tables within the nodes would tell us exactly where to find the proper response. If there is a proper response, the

information value is sent back to the requester since its network identification written in the request. The user in the source node accepts this or makes another query request. If there are still unanswered queries, a new query is formulated as an HTTP request in order to ask the web server for semantic comparison.

5. Conclusion

In this paper, we have attempted to investigate the current state of semantic web architectures used in the learning environments. We have outlined the specification of different learning activities and discussed the integration and interoperability of existing ontologies in Educational Institutions. We proposed an intelligent searching mechanism based on predefined semantic concepts and hashing and similarity algorithms.

We have faced with a few challenges: interoperability among different courses since they need different ontological structures; database integration in different mobile devices; difficulty in establishing necessary XML syntax; semantic conceptualization for keywords.

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