

A Conceptual Roadmap of Semantic Web based Support System for Self-learning of Science

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ABSTRACT

The development of Web technologies, deployment of Artificial Intelligence (AI) techniques and methodology are providing the innovative ideas and facilities for construction of technology-based application systems. Such technologies are used in diversity of areas for innovative effective and efficient outcomes. Teaching and learning are the immense need of human for their development and existence. During the pandemic of COVID-19, it was totally depending on technology and people are frequently use to technology. Most of the people depend on self-learning by using various resources and technologies. At present, Semantic Web (SW) is a growing technology which is used by various research communities and application developers to develop the system intelligently. However, I am emphasizing my attention to scratch the roadmap of Semantic Web based Support System for Self-learning in Science (S5) that will be especially useful for self-learning in science domain. This paper will describe the perceptions of Semantic Web technology for self-learning especially for science domain.

KEYWORDS:- Artificial Intelligence, Semantic Web, Self-learning System, Intelligent System

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I. INTRODUCTION

At present, technologies are growing up day by day and human being is capable to capture the advantage of these technologies in various applications. Learning is a major and essential activity for the development of human being. Technology is enhanced the learning and people have frequently utilized the technology for self-learning, e-learning and annotating with e-resources etc. The learners have required distinguish learning contents according to requirements. For example, a learner with a particular educational need, he/she is typically visiting one or several online educational websites, exploring their contents and offers, collecting information about the courses (study programs, requirements, needed tools, prices, etc.), choosing most appropriate course and preferences and finally he/she has decided to registering it. Another learner that is self-learner, he/she requires to get the knowledge on a particular domain, generally he/she is visiting the various e-learning resources, collecting the information from these resources and concise them to acquire the requirements and this process can be known as self-learning. This kind of browsing is too time consuming and also difficult to observe the relevancy. Self-learning is the methodology of learning to sustain an ability of a person to grab the information, knowledge and skills which are needy to himself. They explore the various resources and e-resources like as text books, reference books, Wikipedia and e-contents etc. to retain the knowledge about the required areas. Self-learning processes require to become fast and at a time when learners need the contents. Speed means not only provide the suitable content of the learning material (highly specified, not too general), but also facilitate the powerful mechanism for organizing such material.

Therefore, we need to easy accessibility of contents, it's efficiency and reliability regarding the expectation. With growing of technology and its commodities, people are more dependent on them to getting the knowledge what they are required. The revolutionary generation of the web which is known as Semantic Web, is observing as a promising technology for implementing various applications. The Semantic Web scratches an environment in which human and machine agents will communicate with each other semantically [1]. Semantic Web enables the contents as semantically annotated (enriched) learning objects [2]. One of the immense characteristics of Semantic Web is 'shared understanding' which is relay by the ontology. Hence, Semantic Web is the emerging technology which is very useful to develop various applications with intelligent effects. In this

paper, I am trying to deploy and merge this technology to develop support system for self-learning especially for science education.

II. OBJECTIVES

This paper will highlight the effective use of Semantic Web technology for the self-learning specially for science domain. In this regard, first we will need to analyze the potential of Semantic Web technology and its uses in self-learning in science and will introduce the further technologies used by the layered architecture. We will list the advantages to describe the resources of contents by using ontology. We will also depict a conceptual architecture of Semantic Web based support system for self-learning in science along with some related work.

III. SEMANTIC WEB AND SELF-LEARNING

Semantic Web [7][8] is capable to incorporate the content understandability and processability to machine in which users can work with co-operation. The understandability of contents relays intelligent machine processability. There are various technologies which are used to construct the SW based systems and applications for required domain. In these technologies, some are well developed and some are under-developing. The architecture of SW is depicted in following figure 1:

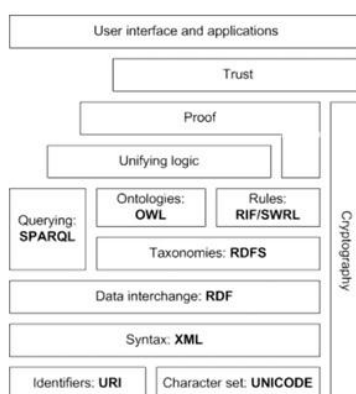


Figure 1. Layered Architecture of Semantic Web [9]

Many researches and research communities has depicted the uses of SW in e-learning [4][5]. There are various support systems and projects which are well developed or under developed to enhance the e-learning. The support system for self-learning specially in science can be also benefited with Semantic Web. Semantic Web will enable the system with metadata and its ontology mechanism which will provide the intelligent searching capability to retrieve the content about the desired topics. There is enormous enhancement in SW based systems and applications development. Some possible enhancement in self-learning with the use of SW technology are listed as following:

Intelligent Knowledge Processing

Semantic Web describes the metadata and conceptualization of resources by using Resource Description Framework (RDF)[11], Resource Description Framework Schema (RDFS)[12] and Ontology Web Language (OWL)[13] that are machine understandable and processable which will provide the intelligent knowledge processing.

Distributed Knowledge Base

Semantic Web will concentrate on distributed knowledge base as well as possible. This characteristic enables efficient and effective content management.

Intelligent Knowledge Searching

At present, search engines are not providing the answer of query. It is simply extracting the query related resources and display as results. Semantic Web will provide the well-defined machine processable information resources with their semantics, which will enable the meanings of resources for intelligence searching. The intelligent knowledge processing capability will enable the intelligent searching of information about user's queries.

IV. PROPOSED FRAMEWORK OF S5

With capabilities of SW technology to the enhancement of support system for self-learning in science as described in section 3, we are intended to draw the conceptual framework of SW based Support System for Self-learning. The framework is depicted in figure 2 as following:

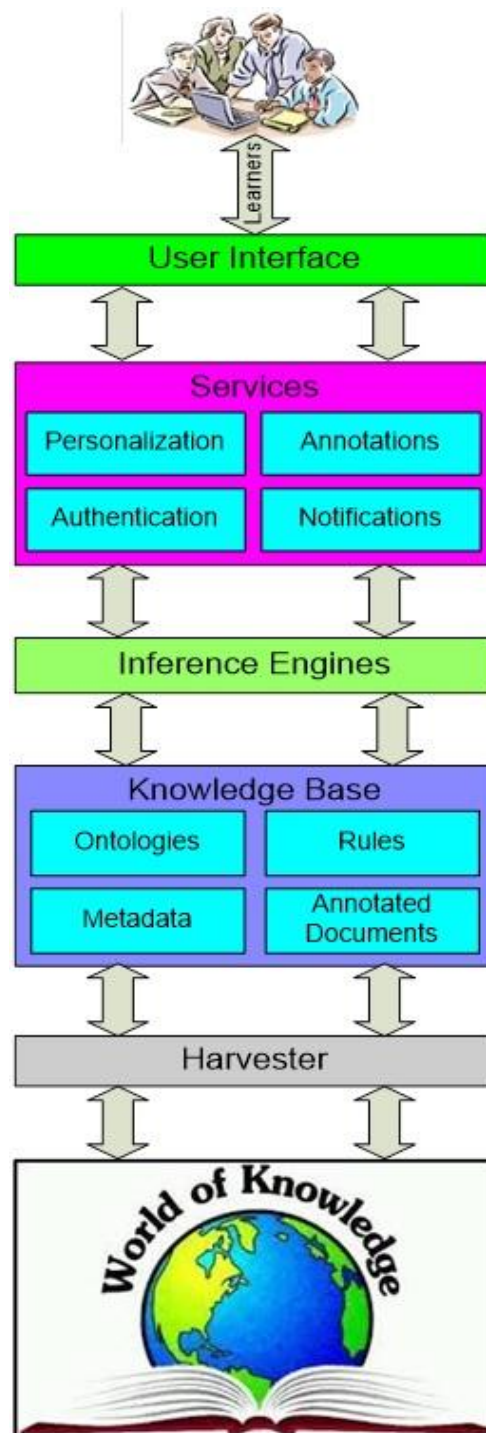


Figure 2. Layered Architecture of S5

In figure 2, it has five major layers which are knowledge world, harvester, knowledge base, inference engine and services layer. The harvester will harvest the knowledge about resources and that knowledge will be stored in the knowledge base. Harvester will work as an extractor which will extract the knowledge of science domain from the various resources. The inference engine will provide the facility of intelligent searching to retrieve the information about query. The engine will use the ontology and reasoning rules to

provide the content about desired query to the learners. The service layer will rely the various services to the learners via user interface.

V. DISCUSSION AND EXPECTED RESULTS

At present, various researchers and its communities are influencing the effort in Semantic Web based systems and applications. Number of researches are available or going on to construct the systems and applications based on SW technology for education, e-learning and self-learning. Here, we have discussed some appropriate contribution of researchers in field of education, e-learning and self-learning. The contribution of C. Xavier Pereira Junior et al. (2019) [6] aims to present a proposal that will be capable to combine Semantic Web and metaheuristic strategies to recommend web-based Learning Objects (LO) on preferences of learners. The recommendation of LO can be possible by the use of existing resources from the Web. In this mechanism, knowledge level and Learning Styles of student, both are considered. K. Almohammadi et al. (2017) [10] have scratched the road map of Semantic Web based system to ensure that contents and e-learning services are tailor-made for adaptive learning which diagnoses the specific needs of each individual for the necessary learning and provides the most appropriate content to enhance the learning process.

Therefore, we have expected that intended conceptual framework will meet the expectations of learners especially in science. The structured representation of knowledge by using RDF, RDFS and OWL will provide the intelligent knowledge management, intelligent knowledge processing and will provide the desired knowledge to the learners.

VI. CONCLUSION

The Semantic Web is new emerging technology which is aiming to provide the web-based information and services that are enforcing the understandable, processable and reusable of content for both humans and machines. It is anticipated that SW technology will influence the next era of self-learning systems and applications. In this manuscript, we have emphasized to intend a conceptual framework enabled with Semantic Web to develop a support system for self-learning in science. We have also elaborated about Semantic Web and its influences towards self-learning. This paper is also depicted the various research efforts and expected results of the intended framework.

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