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A Framework Using Semantic Web for Web-Based E Learning System

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Abstract:

E-learning describes the cognitive science principles of effective multimedia learning using electronic educational technology. Cognitive research and theory suggest that selection of appropriate concurrent multimedia modalities may enhance learning, as may application of several other principles. The Semantic Web is an extension of the current Web that allows the meaning of information to be precisely described in terms of well-defined vocabularies that are understood by people and computers. The core of the Semantic Web is ontology, which is used to explicitly represent our conceptualizations. Semantic Web (SW) is a well defined portal that helps in extracting relevant information using many Information Retrieval (IR) techniques. The main contribution of the project is to develop a framework for web-based e-learning system, using the Semantic Web technology. E-learning is being increasing viewed as an important activity in the field of distance and Continuing education.

Web-based courses offer obvious advantages for learners by making access to educational resource very fast, just-in-time and relevant, at any time or place. E-Learning consists of Learning and assessment services. To implement a Semantic Web-based e-learning system, which focus on the RDF data model, OWL ontology language and RAP for parsing RDF documents. there are two primary advantages of our Semantic web-based framework. One is that the proposed model, which contains a hierarchical contents structure and semantic relationships between concepts, can provide related useful information for searching and sequencing learning resources in web-based e-learning systems. The other is that it can help a developer or an instructor to develop a learning sequence plan by helping the instructor understand the why and how of the learning process.

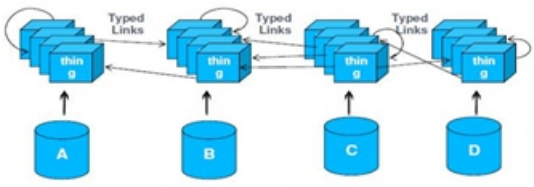
Keywords:

E-Learning, Semantic Web technology, Learning systems, IR Techniques, Ontology.

Introduction:

The Semantic Web is an extension of the Web through standards by the World Wide Web Consortium (W3C). The standards promote common data formats and exchange protocols on the Web, most fundamentally the Resource Description Framework (RDF). According to the W3C, "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries". The term was coined by Tim Berners-Lee for a web of data that can be processed by machines. While its critics have questioned its feasibility, proponents argue that applications in industry, biology and human sciences research have already proven the validity of the original concept. The 2001 Scientific American article by Berners-Lee, Handler, and Lassila described an expected evolution of the existing Web to a Semantic Web.In 2006, Berners-Lee and colleagues stated that: "This simple idea...remains largely unrealized". In 2013, more than four million Web domains contained Semantic Web markup.

Solution: Web of Data:



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SEMANTICWEB SOLUTIONS:

The Semantic Web takes the solution further. It involves publishing in languages specifically designed for data: Resource Description Framework (RDF), Web Ontology Language (OWL), and Extensible Markup Language (XML). HTML describes documents and the links between them. RDF, OWL, and XML, by contrast, can describe arbitrary things such as people, meetings, or airplane parts.These technologies are combined in order to provide descriptions that supplement or replace the content of Web documents. Thus, content may manifest itself as descriptive data stored in Web-accessible databases, or as markup within documents (particularly, in Extensible HTML (XHTML) interspersed with XML, or, more often, purely in XML, with layout or rendering cues stored separately). The machine-readable descriptions enable content managers to add meaning to the content, i.e., to describe the structure of the knowledge we have about that content. In this way, a machine can process knowledge itself, instead of text, using processes similar to human deductive reasoning and inference, thereby obtaining more meaningful results and helping computers to perform automated information gathering and research.An example of a tag that would be used in a non-semantic web page:

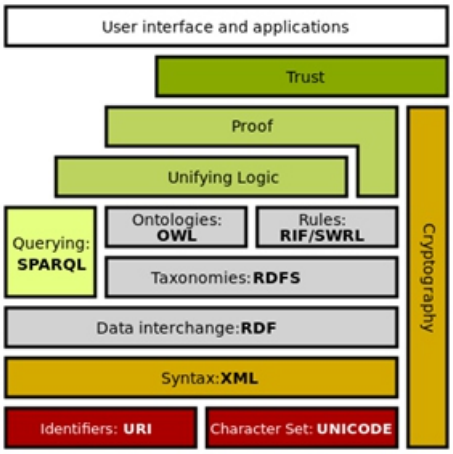
<item>blog</item>
Encoding similar information in a semantic web page might look like this:
<itemrdf:about=”http://example.org/semantic-web/”>Semantic Web</item>

Tim Berners-Lee calls the resulting network of Linked Data the Giant Global Graph, in contrast to the HTML-based World Wide Web. Berners-Lee posits that if the past was document sharing, the future is data sharing. His answer to the question of “how” provides three points of instruction. One, a URL should point to the data. Two, anyone accessing the URL should get data back. Three, relationships in the data should point to additional URLs with data.

Components:

The term “Semantic Web” is often used more specifically to refer to the formats and technologies that enable it. The collection, structuring and recovery of linked data are enabled by technologies that provide a formal description of concepts, terms, and relationships within a given knowledge domain. These technologies are specified as W3C standards and include:

•Resource Description Framework (RDF), a general method for describing information
•RDF Schema (RDFS)
•Simple Knowledge Organization System (SKOS)
•SPARQL, an RDF query language
•Notation3 (N3), designed with human-readability in mind
•N-Triples, a format for storing and transmitting data
•Turtle (Terse RDF Triple Language)
•Web Ontology Language (OWL), a family of knowledge representation languages
•Rule Interchange Format (RIF), a framework of web rule language dialects supporting rule interchange on the Web



The Semantic Web Stack:

The Semantic Web Stack illustrates the architecture of the Semantic Web. The functions and relationships of the components can be summarized as follows:

•XML provides an elemental syntax for content structure within documents, yet associates no semantics with the meaning of the content contained within. XML is not at present a necessary component of Semantic Web technologies in most cases, as alternative syntaxes exists, such as Turtle. Turtle is a de facto standard, but has not been through a formal standardization process.

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•XML Schema is a language for providing and restricting the structure and content of elements contained within XML documents.
•RDF is a simple language for expressing data models, which refer to objects ("web resources") and their relationships. An RDF-based model can be represented in a variety of syntaxes, e.g., RDF/XML, N3, Turtle, and RDFa. RDF is a fundamental standard of the Semantic Web.
•RDF Schema extends RDF and is a vocabulary for describing properties and classes of RDF-based resources, with semantics for generalized-hierarchies of such properties and classes.
•OWL adds more vocabulary for describing properties and classes: among others, relations between classes (e.g. disjointness), cardinality (e.g. "exactly one"), equality, richer typing of properties, characteristics of properties (e.g. symmetry), and enumerated classes.
•SPARQL is a protocol and query language for semantic web data sources.
•RIF is the W3C Rule Interchange Format. It's an XML language for expressing Web rules which computers can execute. RIF provides multiple versions, called dialects. It includes a RIF Basic Logic Dialect (RIF-BLD) and RIF Production Rules Dialect (RIF PRD).

Applications:

The intent is to enhance the usability and usefulness of the Web and its interconnected resources through:
• Servers which expose existing data systems using the RDF and SPARQL standards. Many converters to RDF exist from different applications. Relational databases are an important source. The semantic web server attaches to the existing system without affecting its operation.
• Documents "marked up" with semantic information (an extension of the HTML <meta> tags used in today's Web pages to supply information for Web search engines using web crawlers). This could be machine-understandable information about the human-understandable content of the document (such as the creator, title, description, etc.) or it could be purely metadata representing a set of facts (such as resources and services elsewhere on the site). Note that anything that can be identified with a Uniform Resource Identifier (URI) can be described, so the semantic web can reason about animals, people, places, ideas, etc. Semantic markup is often generated automatically, rather than manually.
• Common metadata vocabularies (ontologies) and maps between vocabularies that allow document creators to know how to mark up their documents so that agents can use the information in the supplied metadata (so that Author in the sense of 'the Author of the page' won't be confused with Author in the sense of a book that is the subject of a book review)
• Automated agents to perform tasks for users of the semantic web using this data
• Web-based services (often with agents of their own) to supply information specifically to agents, for example, a Trust service that an agent could ask if some online store has a history of poor service or spamming

Modules:

• Creation of RDF File For E-Learning portal using Protégé editor.
•Access RDF File using RDF API for PHP(RAP)
•Execute SPARQL queries

MODULE DESCRIPTION:

Modules	
There are three modules available in Online Learning System:	
Administrator	Administrator can manage various schools, class, and syllabus, Exam Categories, Subjects, Faculties and Students.
Faculty	Faculty can manage his/her own profile. Faculty can manage student details, Exam Schedule and Questions to be asked in Examination.
Student	Student can Manage His/Her own profile. Student can give online examination and view the result. Student can also compare answer with actual answer.

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Functionality	
Administrator	(1)Manage Schools. (2) Manage Class. (3) Manage Subjects. (4) Manage Users. (5) Manage Exam Categories. (6) Manage Subject. (7) Create and Manage Faculty. (8) Create and Manage Students.
Faculty	(1) Manage Own Profile. (2) Create and Manage Exam Schedule. (3) Create Question Bank. (4)Content Upload (5)View Results
Student	(1) Manage Own Profile. (2) Give Examination. (3) View Result. (4)Download Material (5)Maintain Favorite Links

RDF FILE CREATION:

Protégé is a free, open-source platform that provides a growing user community with a suite of tools to construct domain models and knowledge-based applications with ontologies.WebProtégé is an ontology development environment for the Web that makes it easy to create, upload, modify, and share ontologies for collaborative viewing and editing.Web Protégé fully supports the latest OWL 2 Web Ontology Language. The highly configurable user interface creates the perfect environment for beginners and experts alike. Collaboration features abound, including sharing and permissions, threaded notes and discussions, watches and email notifications. RDF/XML, Turtle, OWL/XML, OBO, and other formats available for ontology upload and download.Protégé Desktop is a feature rich ontology editing environment with full support for the OWL 2 Web Ontology Language, and direct in-memory connections to description logic reasoners like Hermit and Pellet. Protégé Desktop supports creation and editing of one or more ontologies in a single workspace via a completely customizable user interface.

Visualization tools allow for interactive navigation of ontology relationships. Advanced explanation support aids in tracking down inconsistencies. Refactor operations available including ontology merging, moving axioms between ontologies, rename of multiple entities, and more.

•W3C standards compliant
•Customizable user interface
•Visualization support
•Ontology refactoring support
•Direct interface to reasoners
•Highly pluggable architecture
•Cross compatible with WebProtégé

Ontologies:

An ontology comprises a set of knowledge terms, including the vocabulary, the semantic interconnections, and some simple rules of inference and logic for some particular topic. Ontologies applied to the Web are creating the Semantic Web. Ontologies provide the necessary armature around which knowledge bases should be built, and set grounds for developing reusable Web-contents, Web services, and applications. Ontologies facilitate knowledge sharing and reuse, i.e. a common understanding of various contents that reaches across people and applications. Technically, an ontology is a text-based piece of reference-knowledge, put somewhere on the Web for agents to consult it when necessary, and represented using the syntax of an ontology representation language.

SYSTEM DESIGN:

System design is the process of defining the architecture, components, modules, and data for a system to satisfy specified requirements. One could see it as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering. If the broader topic of product development blends the perspective of marketing, design, and manufacturing into a single approach to product development, then design is the act of taking the marketing information and creating the design of the product to be manufactured. System design is therefore the process of defining and developing systems to satisfy specified requirements of the user.

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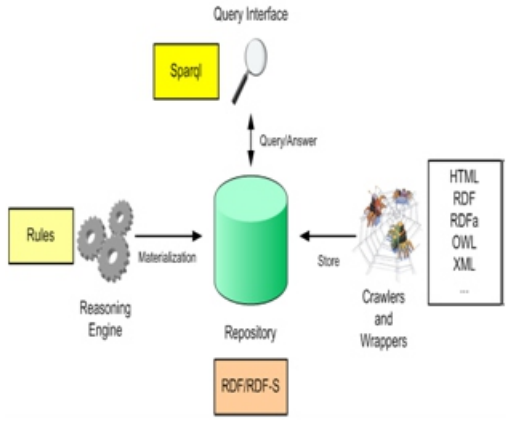

Figure : System Architeture

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and its constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.Implementation is the process of converting a new system design into operation. It is the phase that focuses on the user training, site preparation and file conversion for installing a candidate system. The important factor that should be considered here is that the conversion should not disrupt the functioning of the organization. Each program is tested individually at the time of development using the data and has verified that this program linked together in the way specified in the programs specification, the computer system and its environment is tested to the satisfaction of the user.

HOME PAGE:

Figure : Screen Showing Home Page

The screen showing Home page which contains the services provided by E-Learning Portal.

LOGIN PAGE:

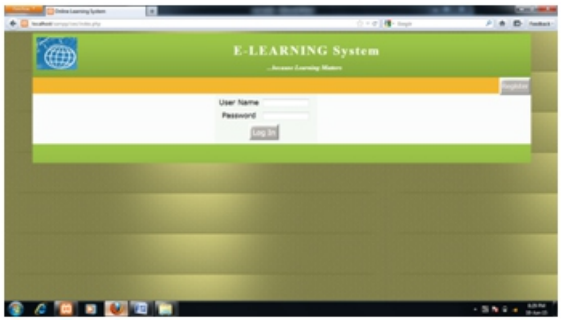

Figure 7.2 Screen Showing Login Page

This Screen showing Login page which contains UserName,Password Fields for any type of User(Student or Staff).

STUDENT WELCOME PAGE:

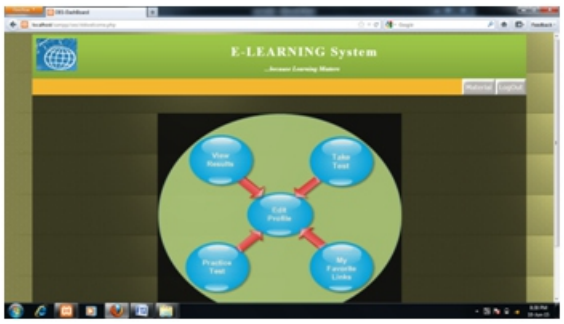

Figure : Screen Showing welcome Page

This Screen showing Welcome page which contains Edit Profile,Take Test,Favourite Links,View Results Services to the Student.

TUTOR WELCOME PAGE:

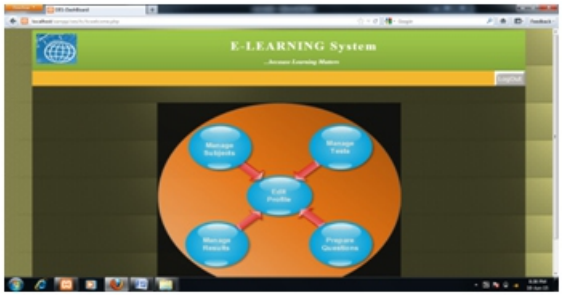

Figure : Screen Showing Faculty welcome Page

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This Screen showing Faculty Welcome page which contains Edit Profile,Manage Tests,Manage Subjects,Manage Results,Prepare Questions Services.

CREATE RDF FILE(PROTÉGÉ EDITOR)

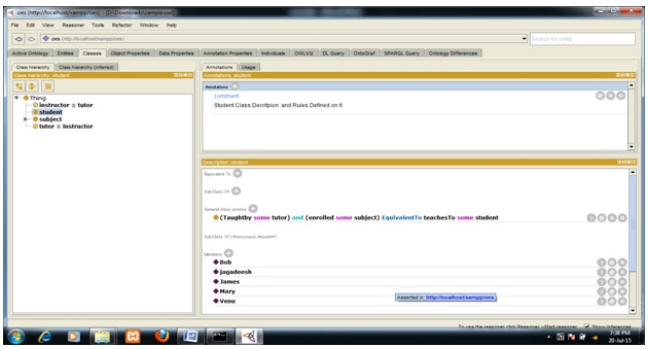

Figure: Screen Showing RDF Creation on Protege

The screen showing how to develop RDF(Vocabulary) Terms, Individuals, Relationships for E-Learning.

OBJECT PROPERTIES PAGE(PROTÉGÉ)

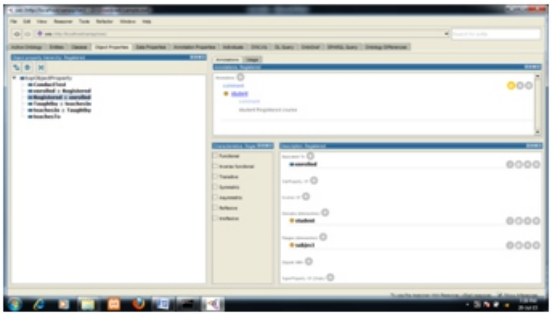

Figure: Screen Showing Object Properties in protege

The screen showing the relationship between tutor and student. the domain and range for student, equivalent term for enrolled were shown in above screen.

TRAVERSE MEMORY MODEL PAGE

The screen showing the traversal of RDF/OWL File using RDF API for PHP(RAP).

STORE RDF INTO DATABASE:

Figure : Screen to Store RDF File in MYSQL

The Screen accepts RDF File as Input and loads the Data(Statements in the form of Triples) into MYSQL

PERFORM SPARQL:

Figure : Screen to Perform SPARQL

The screen showing that the list of subject,predicate,object vlaues(Triples) which are retrieved from Statements table.

SPAPQL(QUERY ENGINE) IN PROTEGE

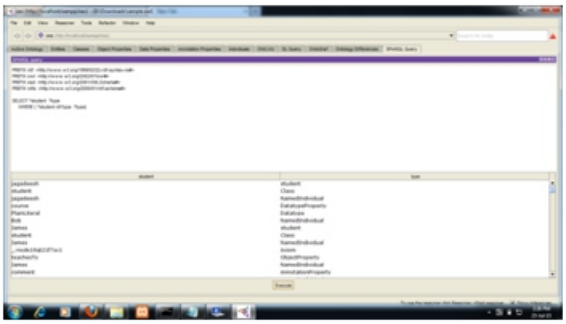

Figure : Screen Showing Data View Page

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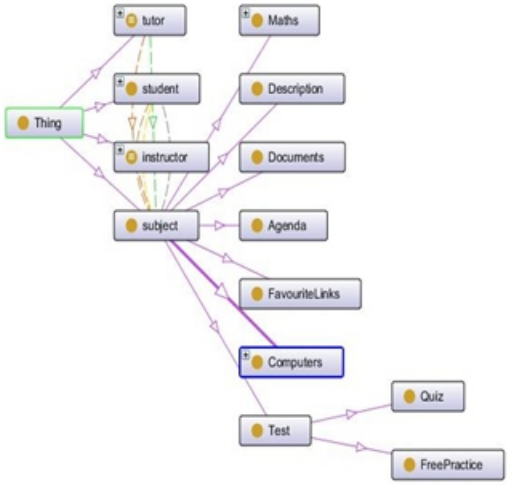
The screen showing various subjects and its corresponding type.

ONTOGRAF IN PROTÉGÉ(GRAPH GENERATED)



CONCLUSION AND FUTURE SCOPE:

The explicit representation of the semantics underlying data, programs, pages, and other web resources, will enable a knowledge-based web that provides a qualitatively new level of service. Automated services will improve in their capacity to assist uses in achieving their goals by "understanding" more of the content on the web and thus providing more accurate filtering, categorization and searching of information sources.To implement a Semantic Web-based e-learning system, which focus on the RDF data model, OWL ontology language and RAP for parsing RDF documents. There are two primary advantages of our Semantic web-based framework. One is that the proposed model, which contains a hierarchical contents structure and semantic relationships between concepts, can provide related useful information for searching and sequencing learning resources in web-based e-learning systems.The other is that it can help a developer or an instructor to develop a learning sequence plan by helping the instructor understand the why and how of the learning process.In our future work the main task is to fulfill the domain ontology and establish an operational ontology base with more granularities to realize intelligent interaction between user and machine and cooperation among computers.

We are planning to implement semantic web mining in parallel distributed environment in all tiers for decision making, and increasing speed and efficiency.

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