



## Semantic Web for Virtual University Using XML and Relational Database

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### ABSTRACT

In this paper a development of virtual university semantic web service is focused. This approach uses XML, relational database and development of a web application to store, retrieve, and transfer operative notes between database and XML file. To provide an additional management features for this suggested approach, a proposed web application is designed to be intelligent. In addition, the system analysis phase contains a detailed study of various operations performed internally or externally by running system. Activities of the system analysis phase follow iterative approaches where the deliverable is refined in incremental steps. In the system design phase, Entity-relationship (ER diagram) and normalization are used to design a database using MySQL. The XML format for operative data is designed using Document Type Declaration (DTD) and XML schema. The interchange model is designed using context diagram, dataflow diagram, system flowchart, and process specification. The proposed web application is developed using VB.Net Interface and VRML modeling 3dmax. Finally, the proposed approach files are transmitted in XML, PDF and HTML formats.

### Keywords:

Virtual Guide; Semantic Web; XML Relational Database.



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## 1. INTRODUCTION

Today, XML- extensible Markup Language is a general-purpose specification for creating custom markup [1]. It is classified as an extensible language, because it allows the user to define the mark-up elements. XML's purpose is to aid information systems in sharing structured data, especially via the internet, to encode documents, and to serialize data.

XML is invading the world of computers and occupying most of its fields. It is widely spreading over the internet, networks, information systems, software and operating systems, DBMS, search tools, web development and services, communication protocols and other fields. Due to the huge amount of XML structured data being circulated, controlling XML data becomes imperative for various purposes and aims [2].

Currently, web services interact by passing XML data, with data types specified using XML Schema. Simple Object Access Protocol [SOAP] can be used as the communication protocol [3], and the I/O signatures for web services are given by Web Services Description Language [WSDL] [4]. UDDI stands for Universal Description, Discovery and Integration [5] and provides the means to publish and discover web services through a UDDI registry.

The Semantic Web is an extension of the World Wide Web with new technologies and standards that enable interpretation and processing of data and useful information for extraction by a computer. The World Wide Web Consortium (W3C) recommends XML, XML Schema, RDF, RDF Schema and Web Ontology Language (OWL) as standards and tools for the implementation of the Semantic Web [6]. Ontologies work as the main component in knowledge representation for the Semantic Web. It is a data model that represents a set of concepts and the relationships between those concepts within a domain.

The Virtual Guide for Students or Visitor in University features an interactive map backed with the Campus guide Multimedia Engine Custom Interactive Map System to allow Virtual Guide University to update and republish any aspect of the map or even change the base map artwork and interactive hotspots when the campus map artwork is updated. Content-managed custom layers allow for highlighting of buildings/locations or the placement of icons.

While relational database is the most common used type of database intends to provide information for students of faculty and university. This system specific video guide allows the University to develop presentations aimed at different prospective student constituencies or Visitors.

A virtual guide is a simulation of an existing location, usually composed of a sequence of video images. They also may use other multimedia elements such as sound effects, music, narration, and text.

The virtual guide is often used to describe a variety of video and photographic based media.

Virtual Enterprise (VE) is regarded as the most competitive management model of enterprises that faces the resource of the globe. Globalization leads to an efficient new business paradigm of VE, where companies increasingly concentrate on their core competencies and outsource all other functions to their partners on an application basis [7].

The paper aims to present The Virtual Guide for Students or Visitor in University as an introduction to Student Services for (Declaration, Mapping and Schedule Lectures) and Navigation Service. Student services are where you can find all the information about college that you need whether it's Lectures, tests, instructions, or anything else.

## 2. RELATED WORKS

Digital Right Management or DRM [8] is essentially a modular architecture for modeling access and usage control in the application level. DRM/ Enterprise -DRM systems are used as distributed architectures for implementing access and usage control.

This paper [9] was focused on development of a surgical operation data interchange model using XML and relational database and development of a web application to store, retrieve and transfer operative note data between database and XML file.

In this paper [10] a system is presented, which provides access to distributed data sources using Semantic Web technology. While it was primarily designed for data sharing and scientific collaboration, it is regarded as a base technology useful for many other Semantic Web applications. The proposed system allows to retrieve data using SPARQL queries, data sources can register and abandon freely, and all RDF Schema or OWL vocabularies can be used to describe their data, as long as they are accessible on the Web. Data heterogeneity is addressed by RDF-wrappers like D2R- Server placed on top of local information systems. A query does not directly refer to actual endpoints; instead it contains graph patterns adhering to a virtual data set. A mediator finally pulls and joins RDF data from different endpoints providing a transparent on-the-fly view to the end-user.

In [11] the authors presented the characteristic of disaster management is different in different disaster relief information, knowledge, standardization of operating procedures and the feasibility of the rescue program. Knowledge-sharing and case retrieval is to develop case-based intelligent decision support system facing the most important issue. Disaster rescue command for decision-making, the use of Web Ontology Language that state the information and knowledge of characteristics of the earthquake disaster rescue, a case-based reasoning and logic to describe the rescue planning business processes.

In [12] proposed an ontology-based information retrieval model to improve effectiveness of information retrieval. The ontology embedded in the proposal model is a fuzzy taxonomy generated automatically from the documents.

In [13] authors introduce semantic web technology to the design of civil aviation airport emergency management system and presents implemented details through researching on key technology. The semantic data management has been implemented through developing a simulation system and the rapid generation of rescue scheme has also been realized by means of ontology and rules, which provides aid-decision making of airport with efficient technological support.

### 3. METHODOLOGY

#### A. The System Analysis

Analysis is a detailed study of various operations performed by a system and their relationships within and outside the system.

Assuming that a new system is to be developed, the next phase is system analysis. Analysis involved a detailed study of the current system, leading to specifications of a new system.

#### 3.1 Analysis Phase Activities

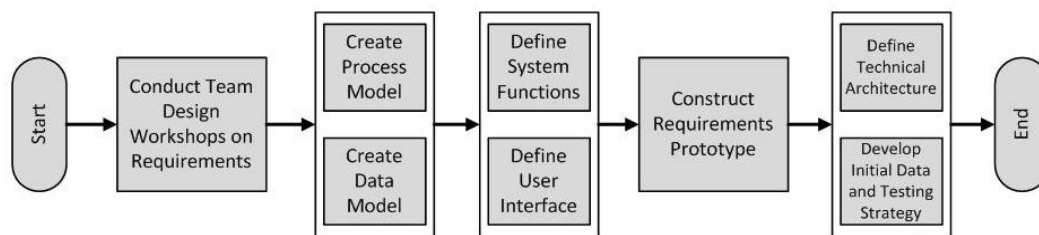


Figure 1: Analysis Phase Activities

##### 3.1.1 Analysis Phase Technical Activities Diagram

The analysis activities in the figure 1 above are shown in linear sequence only for presentational reasons. In reality the activities are performed in parallel and furthermore, many of them following an iterative approaches where the deliverable is refined in incremental steps.

##### 3.1.2 Conduct to Design Workshops on Requirements

All stakeholders should be engaged as early as possible in the team activity for specifying the requirements. One or more workshops, depending on the scale of the application, should be organized to get user input on the subsequent analysis phase activities.

##### 3.1.3 Create Process Model

Purpose: To describe the work processes supported by the system.

The process model is based on the Virtual Guide for Students or Visitor in University system context diagram created in the investigation phase. The processes identified in the context diagram need to be decomposed into sub-processes on sufficient level of detail, and described briefly in text. The process model should also indicate which process is automated, which are kept manual.

##### 3.1.4 Create Data Model

Purpose: To describe all the data processed by the Virtual Guide for Students or Visitor in University system.

The data model is developed by expanding and refining the data context diagram produced in the investigation phase. All the data and its attributes are being specified at this phase. Various methods for data representations exist, such as:

entity - relationship model: serves best database application design.

object (oriented) model: serves best object oriented software design.

information hierarchy diagram: commonly used in application design.

##### 3.1.5 System Functions (Transactions)

Purpose: To define all functions to be performed by the Virtual Guide for Students or Visitor in University system.

The system functions will be defined on the basis of the process and data models created in the previous activity. Functional decomposition typically starts from a single process defined in the process model. The process is subdivided down to its component functions which represent activities of the given process.

##### 3.1.6 User Interface Requirements

Purpose: To define the basic requirements to be followed in the user interface development (VB.Net Interface and VRML modeling 3dmax).



The starting point for the activity is to define who exactly the typical users of the application. Understanding of the user needs is based on analysis of the skills, behavior, expectations, and other relevant characteristics of the user.

Requirements for the user interface present the foundation on the visual design ("look and feel") and the navigation structure. The user organization may have GUI design guidelines, templates, or other standards that need to be followed.

### 3.1.7 Technical Architecture Requirements

**Purpose:** To define the technical architecture requirements that are required to operate and support the application. The technical architecture requirements include:

- Hardware and software requirements and constraints.
- Networking requirements and constraints, especially the performance.
- System interface requirements.
- The system security and control requirements
- Operational requirements, e.g. performance and capacity needs.

## 3.2 Data Flow Diagram

A DFD provides no information about the timing or ordering of processes, or about whether processes will operate in sequence or in parallel. It is therefore quite different from a flowchart, which shows the flow of control through an algorithm, allowing a reader to determine what operations will be performed, in what order, and under what circumstances, but not what kinds of data will be input to and output from the system, nor where the data will come from and go to, nor where the data will be stored (all of which are shown on a DFD). When it comes to conveying how information data flows through systems (and how that data is transformed in the process), data flow diagrams (DFDs) are the method of choice over technical descriptions for three principal reasons.

DFDs are easier to understand by technical and nontechnical audiences. DFDs can provide a high level system overview, complete with boundaries and connections to other systems. DFDs can provide a detailed representation of system components.

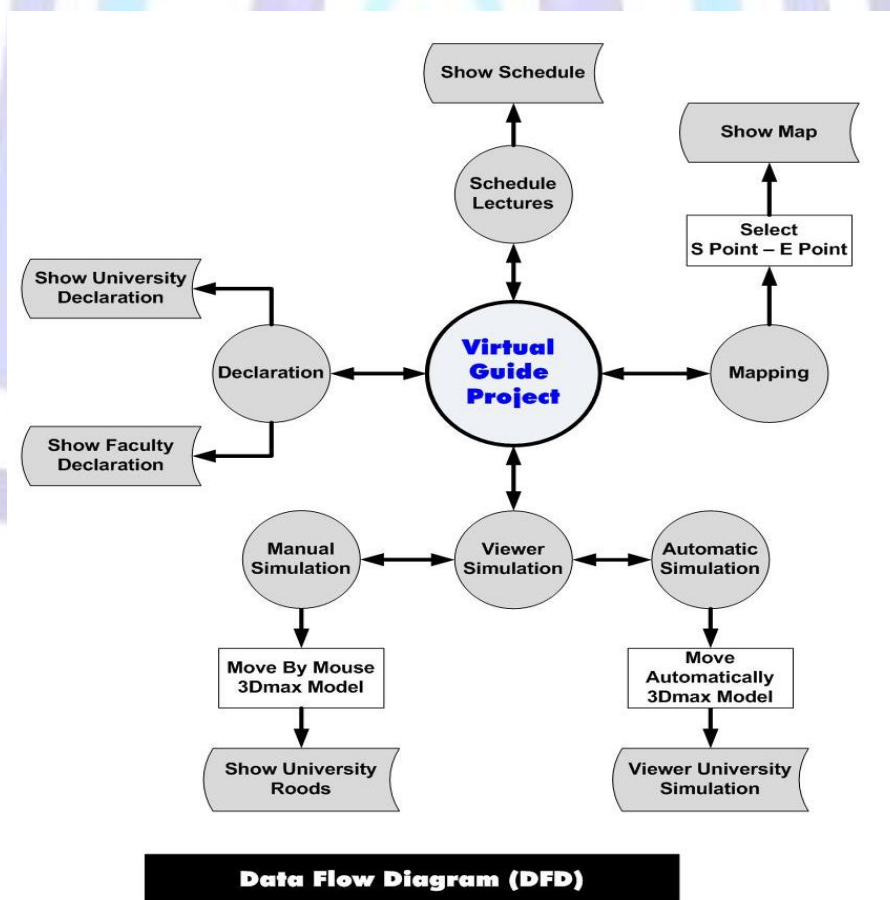


Figure 2: DFD

DFDs help system designers and others during initial analysis stages visualize a current system or one that may be necessary to meet new requirements. Systems analysts prefer working with DFDs, particularly when they require a clear understanding of the boundary between existing systems and postulated systems.

### 3.3 Use Case Diagram

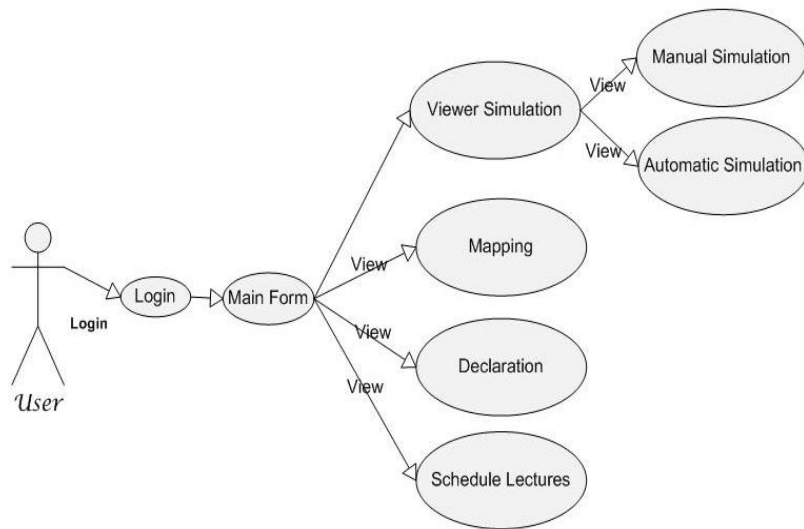


Figure 3: User Case

A use case is a software and system engineering term that describes how a user uses a system to accomplish a particular goal. A use case acts as a software modeling technique that defines the features to be implemented and the resolution of any errors that may be encountered.

#### B. The Design

The purpose of the design of The Virtual Guide for Students or Visitor in University to plan out a system that meets the requirements defined in the analysis phase. In the design phase, we define the means of implementing the solution how the application will be created. To do this, we use the inputs and tools to conduct the key activities, create the outputs, and meet the milestones for this phase.

The purpose of the design phase is to provide a means for assessing the quality of the solution before it has been implemented, when changes are still easy to make it.

### 3.4 Design User Interface

By Visual basic .Net 2008 program we can design all forms such as University Declaration Form, Faculty Declaration Form, Schedule Lectures Form, and Mapping (Start Point – End Point) Form to the Virtual Guide for Students or Visitor in University.

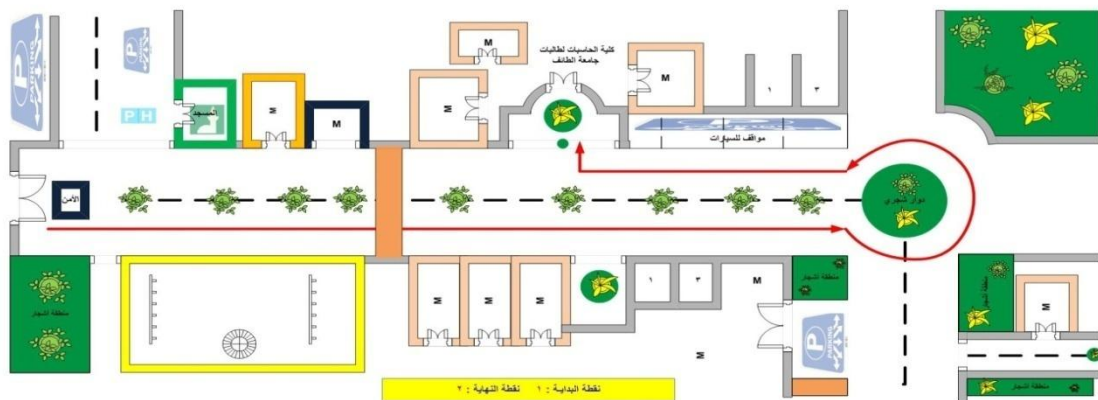


Figure 4: User Interface



User Interface is a very important factor when we design our application. User interface provides a mechanism for end users to interact with the application. End users are called target audience. Designing a good user interface which is easy to use and understand is crucial for a successful application.

### 3.5 Database Design

We can design Virtual Guide database by using SQL Server 2005(Users table, University Declaration table, Faculty Declaration table, Schedule Lectures table, Mapping (Start Point – End Point) table) to the Virtual Guide for Students or Visitor in University.

**Table 1: User Table**

| Filed Name | Type Data  | Key |
|------------|------------|-----|
| User ID    | AutoNumber | PK  |
| Name       | Text       |     |
| Type       | Text       |     |
| Username   | Text       |     |
| Password   | Text       |     |

**Table 2: Schedule Lectures Table**

| Filed Name             | Type Data  | Key |
|------------------------|------------|-----|
| Schedule Lectures ID   | AutoNumber | PK  |
| Schedule Lectures File | Text       |     |
| User ID                | Number     | FK  |

**Table 3: Mapping Start Point – End Point Table**

| Filed Name              | Type Data  | Key |
|-------------------------|------------|-----|
| Mapping ID              | AutoNumber | PK  |
| Start Point             | Text       |     |
| End Point               | Text       |     |
| Start Point – End Point | Text       |     |
| Map File                | Text       |     |
| User ID                 | Number     | FK  |

A database is a collection of information that is organized so that it can easily be accessed, managed, and updated. In one view, databases can be classified according to types of content: bibliographic, full-text, numeric, and images.

### 3.6 Data Dictionary

A data dictionary is a collection of descriptions of the data objects or items in a data model for the benefit of programmers and others who need to refer to them. A first step in analyzing a system of objects with which users interact is to identify each object and its relationship to other objects. This process is called data modeling and results in a picture of object relationships. After each data object or item is given a descriptive name, its relationship is described (or it becomes part of some structure that implicitly describes relationship), the type of data (such as text or image or binary value) is described, possible predefined values are listed, and a brief textual description is provided. User table, University Declaration table, Faculty Declaration table, Schedule Lectures table, Mapping (Start Point – End Point) table.



### 3.7 Entity-Relationship Diagram (ERD)

An entity-relationship diagram (ERD) is a data modeling technique that graphically illustrates an information system's entities and the relationships between those entities. An ERD is a conceptual and representational model of data used to represent the entity framework infrastructure.

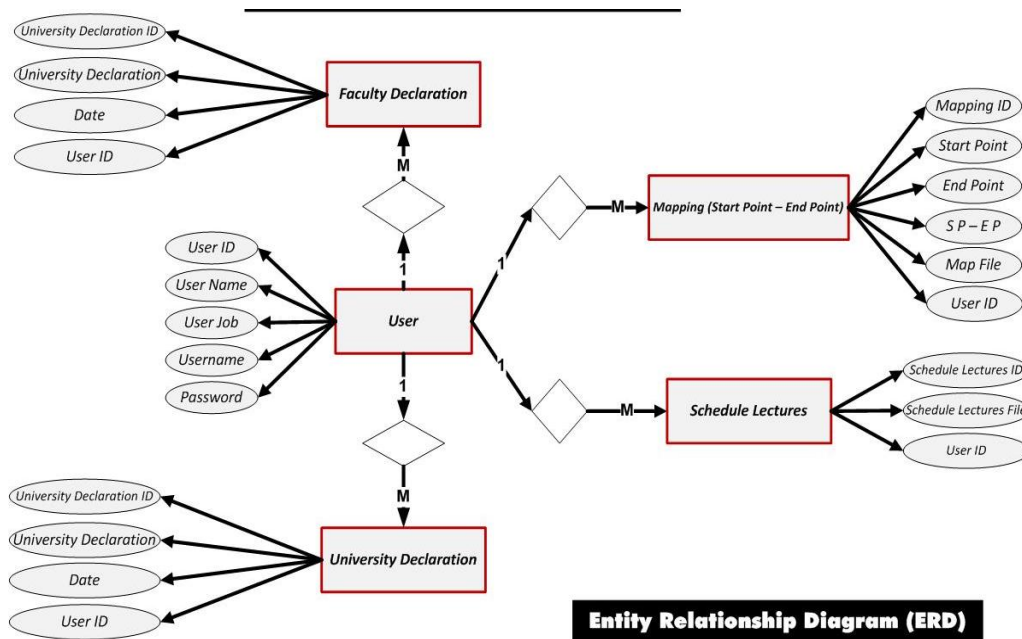


Figure 5: ERD

## 4. SYSTEM ARCHITECTURE

### 4.1 Virtual Reality Modeling Language

Virtual Reality is the use of modeling and simulation to enable a person to interact with a three-dimensional visual representation of a real or imaginary system in an immersive, multi-sensory, and interactive manner .

By 3dmax program we can design the Manual Simulation and Automatic Simulation to the Virtual Guide for Students or Visitor in University.

The Virtual Reality Modeling Language provides a possible solution to these teaching challenges. Because VRML represent 3D scene graphs as an interchange format rather than a program, multiple small VRML models can be quickly composed into larger scenes. This approach permits construction of elaborate and consistent worlds from multiple independently created student application.

### 4.2 XML

Extensible Markup Language (XML) is a set of rules for encoding documents in machine-readable form. The design goals of XML emphasize simplicity, generality, and usability over the Internet. It is a textual data format with strong support via Unicode for the languages of the world. Although the design of XML focuses on documents, it is widely used for the representation of arbitrary data structures, for example in web services. Another area that is closely related to XML and Web databases is content management. The Applications of XML is shown in figure 6.

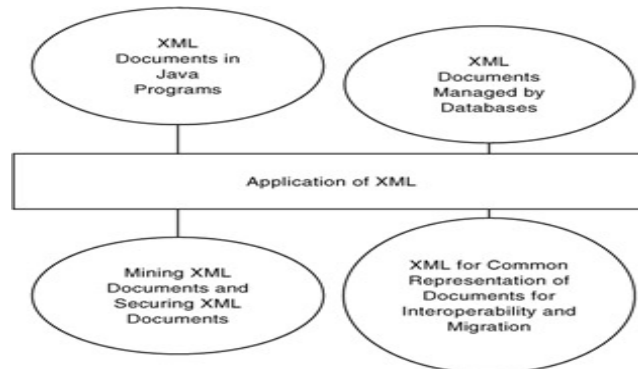


Figure 6: Applications of XML

A core data representation format for semantic web is Resource Description Framework (RDF). RDF is a framework for representing information about resources in a graph form. It was primarily intended for representing metadata about WWW resources, such as the title, author, and modification date of a Web page, but it can be used for storing any other data. It is based on triples subject-predicate-object that form graph of data. All data in the semantic web use RDF as the primary representation language. The normative syntax for serializing RDF is XML in the RDF/XML form. Formal semantics of RDF is defined as well.

### 4.3 Ontologies

Describe entities and relationships among entities. The concept of metadata has evolved over the years starting from data dictionaries to database schemas and now to ontologies, XML, XML schemas, RDF, and RDF schemas. XML and RDF are a special way of representing the various ontologies. Ontologies could describe vehicles, people, animals, as well as relationships among people, events, and many other things.

One of the questions I am often asked is what the difference is between ontologies and XML. Whereas XML specifies the structure of a document, ontologies specify semantics of various applications. The challenge is to integrate the structure with the semantics to provide a complete set of interoperable mechanisms.

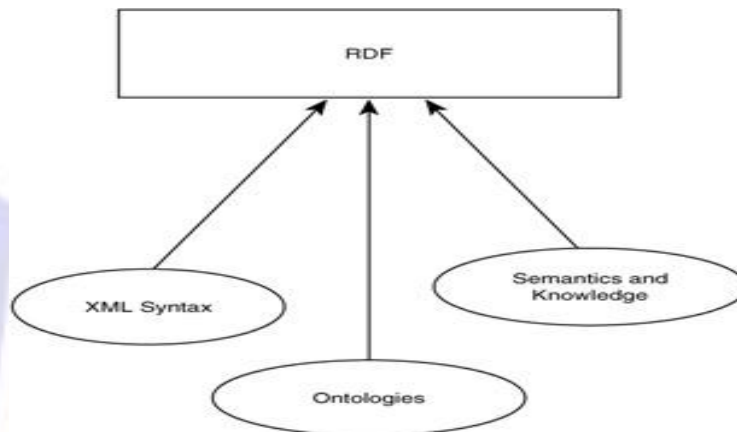


Figure 7: XML and RDF

### 4.4 Ontologies in Semantic Web

Ontology is a data model, which can be used to describe a set of concepts and the relationships between those concepts within a domain. Ontology works as the main component in knowledge representation for the Semantic Web. Research groups in both America and Europe developed Ontology modeling languages as The DARPA Agent Markup Language (DAML) and Ontology Inference Layer (OIL). (The W3C Web Ontology Working Group has considered DAML+OIL as the starting point for the introduction of standardized and accepted ontology language for the Semantic Web as Web Ontology Language (OWL) [14]. OWL has three sublanguages: OWL Full, OWL DL and OWL Lite [15-18].

For querying RDF data as well as RDFS ontology with knowledge bases, a Simple Protocol and RDF Query Language (SPARQL) are available. SPARQL is SQL-like language, but uses RDF triples and resources for both matching part of the query and for returning results of the query. Since RDFS are built on RDF, SPARQL can be used for querying ontology and knowledge bases directly as well. The relation of XML, ontology, semantic web and RDF are shown in Figure 7.

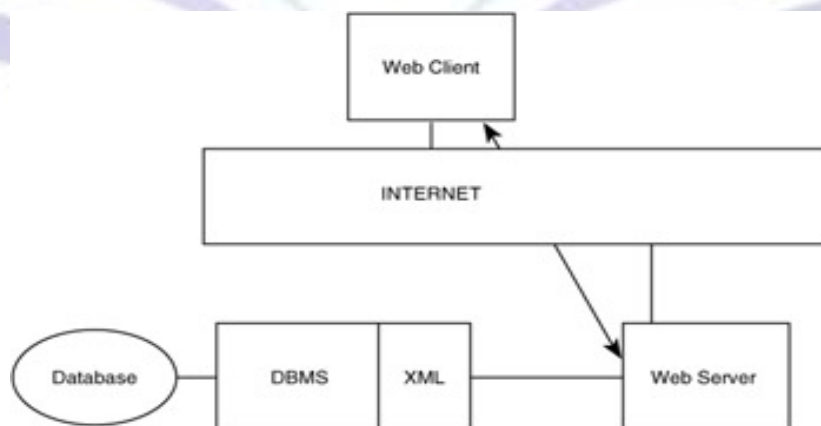


Figure 8: The System Architecture



### 4.5 Semantic Web as a Database

No standard definition of a semantic Web exists. Some say that the Web is where agents process the information. Others say it is based on the publish and subscribe model. Another group says that it is an intelligent database and, therefore, all the techniques developed for managing intelligent databases apply here also. This section examines the latter view. One could consider the semantic Web to be a collection information sources that are interconnected and have to be managed by a database management system. The challenges include modeling the database, integrating the heterogeneous information sources, querying the information and sources, and accessing information; this means developing appropriate indexing techniques.

A multimedia database system includes a multimedia database management system and a multimedia database. A multimedia database management system (MM-DBMS) manages the multimedia database, which contains multimedia data. Multimedia data may include structured data as well as semi structured and unstructured data such as audio, video, text, and images. An MM-DBMS provides support for storing, manipulating, and retrieving multimedia data from a multimedia database. The system architecture is shown in figure 8.

## 5. RESULTS AND TEST THE SYSTEM

The system was evaluated with different users, including developers, and staff. The system has validated by experts in the domain of service web. Tests of the system were carried out by the developers to make sure the system would work correctly as well as the system is web based system. Figures (9, 10 and 11) show the snapshots of the developed system.



Figure 9: Screen Program Home



Figure 10: Screen Three Dimensional

Figure 11: Screen Operating Table

## 6. CONCLUSIONS

In this paper, web semantic services to provide various advantages for facilitating cooperation between the students (visitor) and the university such as (Declaration, Mapping and Schedule Lectures) and Navigation Service. Student services are where you can find all the information about college that you need whether it's Lectures, tests, instructions, or anything else. This system specific video guide allows the University to develop presentations aimed at different prospective student constituencies or Visitors with the Campus guide Multimedia Engine Custom Interactive Map System are proposed. In addition, a new approach, which enables semantic web applications to access data which is stored in the relational databases using a corresponding ontology, is suggested. Also, in the proposed approach, domain ontologies can be used to formulate relational database queries in order to simplify the access of data form underlying sources. Exploring the perspectives and future research steps for seamless and meaningful integration of databases into the semantic web is proposed. XML semantic web software is used in domain of the proposed approach. Finally, many file format types such as XML, PDF and HTML are used.

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