A Survey Paper on Ontology Concepts in Semantic Web Technology and it's Applications

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Abstract:- Semantic Web is an advanced form of the World Wide Web (WWW) to collect, manipulate and interpret the information. It is an intelligent incarnation that provides classification, identical access to the property and transforms the available information into machine readable format. To make up the information in to machine readable format, "Ontology" concept was introduced by the semantic web technology. Ontology concept is approved by World Wide Web Consortium (W3C). It is a collection of interrelated concepts of semantic web that are modeled based on the defined finite set of conditions in information integration and knowledge management. Ontology provides solutions to some issues like document detection, end-to-end service validation, endorsement, concealment, association, data veracity and allocation of isolated parts of information problems. It is said to be a good technique to embody the available data in machine processable format. Implementing ontology in an OWL (Ontology Web Language) depends on some ontology tool support which is said to be complex and time consuming process. Several research fellows and development organizations have designed a number of ontology building environments and algorithms for different applications. A survey of various ontology concepts, building environments, ontology designing tools and the algorithms developed in semantic web technology is presented in the paper which mainly concentrates on the real time applications.

Keywords:- *Semantic Web, Ontology, World Wide Web Consortium (W3C), Web Ontology Language (OWL), Satellite data.*

I. INTRODUCTION

World Wide Web (WWW) is an information space which provides the user to access and share the information via internet. It consists of three standard representations namely Uniform Resource Locator (URL), HyperText Transfer Protocol (HTTP) and HyperText Mark-up Language (HTML). The information that is available over the web are in various formats like audio, video, text and image are presented in HTML. These formats presented are said to be individualistic in defining and forming the denotation of the context. Generally the information accessible are said to be unstructured so it is very tricky to extort and valid the information. Although some hunt engines and display scrapers are developed they are not said to be resourceful and require extreme physical pre-processing like crafting a schematic concept, clearing uncooked data, physically classifying the credentials into catalog and post processing.

"Web Service" concept was introduced in web technology to amplify the incorporation and interoperability to access the information. Web services become extremely trending in production in a small span because of its dynamic nature but some authorization problems were identified [1] because of the heavy raise in numeral services with the passage of time. To solve some existing web based problems like information filtering, confidentiality, security and exaggeration of the context that is available in arrangement above the web, a solution "Semantic Web" base on semantic concept was designed [2] by Tim Berners Lee. Semantic web is a shared exertion by the W3C and it can be used to encourage the universal format for data. The basic concept of semantic web is presented in Fig.1. It cancels vagueness from available data format which has been constituted on the World Wide Web.

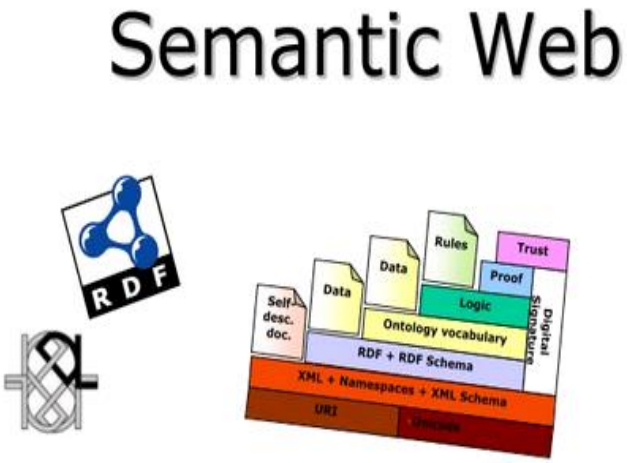

Fig 1:- Basic concept of Semantic Web

Semantic web allow the enclosure of the semantic substance that describe the format in the web pages. Semantic Web has proposed the idea of "Ontology" which is used to structure the information in to machine processable format [3]. The three basic categories in which the ontology concept is subdivided are namely given as Ontology Instance (OI), Natural Language Ontology (NLO) and Domain Ontology (DO). The ontology cloud is presented in Fig.2. Produced linguistic token which are acquired from natural language proclamation can be related by NLO language, the knowledge of a particular domain is represented by using DO and automatic object based web pages are generated by OI.

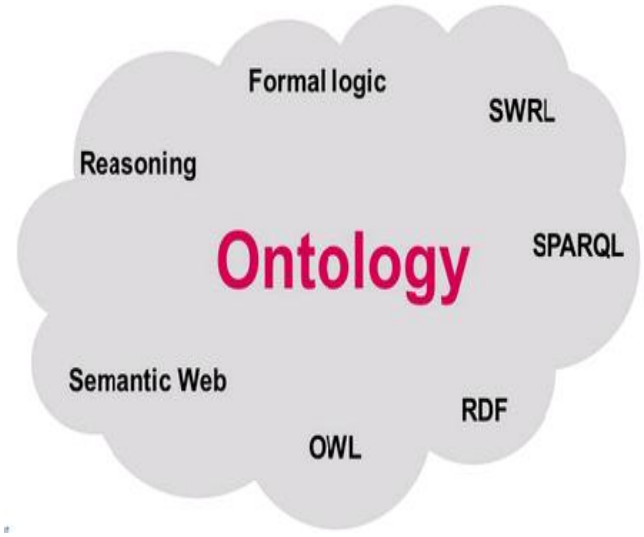

Fig 2:- The Ontology Cloud

Constructing an ontology concept for any application is extremely challengeable research topic since it relays on withdrawal of information from the network and processes it to the machine readable format. RDF, OWL etc are some of the supporting languages used to construct ontology in order to visibly convey semantic stuffing and organize their margins. The developed ontologies are connected in a manner to each other such that it extracts the available concrete information. Due to the enlargement of complex handing out apparatus and large lexical possessions ontology plays a better contribution in the present scenario. Some concepts that are projected and urbanized ontology based resolution are named as Semantic Desktop [4], Semantic Security Web Services (SSWS) and Cultural Heritage [5].

The concept of "ontology" is defined in a general terminology for developers who need to distribute information in that particular field/area. It encompasses some concepts in domain of machine interoperability and relations between them. The reasons that why one should develop ontology concept is given by:

- To allocate regular accepting of the formation of information among public and software perspective.
- To allow reuse of particular domain familiarity.
- To construct the domain supposition unambiguous.
- To divide domain awareness from the equipped awareness.
- To investigate domain familiarity.

The Web Ontology Language (OWL) is a W3C commendation for specifying the concepts of ontologies. This language has been considered to assist superior machine interpretability than the present and previous solutions. It presents more widespread terminology than the plain Extensible Markup Language (XML), Resource Description Framework (RDF) or RDF Schema and improved facilities for expressing the semantics than the presented languages. OWLS has its heredity in DARPA Agent Markup Language + Ontology Interchange Language (DAML+OIL) which is a representation language, that conception, adjust and simplified, were integrated into OWL. Presently, the OWL is said to be an alternative for forming ontologies except there are unique causes to use previous languages like DAML+OIL (compatibility, etc). Observe with producing OWL ontologies demonstrates that though OWL is very animated, in some areas it is not expedient to use it. Occasionally we does not depend up on the usage of all the OWLs complicated concepts. But submission always believes that we could and try to rationale over these thoughts.

Developers of OWL envisages the difficulty and presented three OWL genus, these are the subsets of OWL with diminishing perspicuity namely OWL Full, OWL DL and OWL Lite as shown in the Venn diagrammatic representation Fig.3. Nevertheless, there are proposals to afford easy understandable languages than others OWL Lite, is said to be the least animated of all the other three. This paper is structured as follows; Section II describes about the various ontology concepts, building environments and developed algorithms of semantic web technology in a brief manner. Section III presents a comparison result of the present ontology development algorithms. Finally section IV concludes along with the future enhancement.

II. LITERATURE SURVEY

Semantic Web is a concept introduced to improve human to machine communication by illustrating the data in a machine readable manner. Ontologies in semantic web are accompanied by documents in an ontology language [6]. Ontology tools are worn for creating, controlling, interpreting and amalgamation of ontologies. They are very important for developing an ontology concept or an algorithm and implementing them in real time applications [7]. A survey of ontology development tools is presented in this paper along with the general ontology tools and its properties. Several development apparatus are unwrapped sources excluding Top Braid Composer. The development platform like Web Onto, We bode and NeOn toolkit offers backup management functionalities whereas; SWOOP and NeOn toolkit affords versioning attributes. With the exception of OilEd and OntoEdit, other tools offers atmosphere to construct ontologies collectively. The tools like protege and NeOn grants much functionality for developing ontologies.

The OWL is designed to process the content of the data and present that information to the humans [8] for further application areas. OWL achieves a better device interpretability of network substance than that sustained by other files like XML, RDF, and Schema (RDF-S) because it supplies an added terminology along with a reserved semantics. OWL has three gradually more significant sublanguages namely: OWL Lite, OWL DL (Description Logic), and OWL Full. A document provides the preface to OWL by relating the quality of each of the sublanguages of OWL proposed by Deborah L. Mc Guinness. Some basic facts of RDF Schema are necessary for accepting the proposed concept. More complete metaphors and widespread examples on the characteristics of Web Ontology Language are also discussed in this paper.

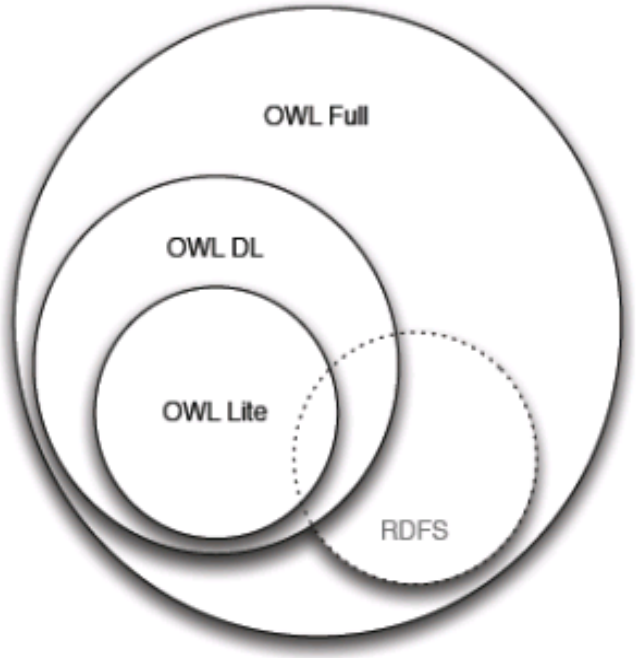

Fig 3:- Sublanguages of OWL

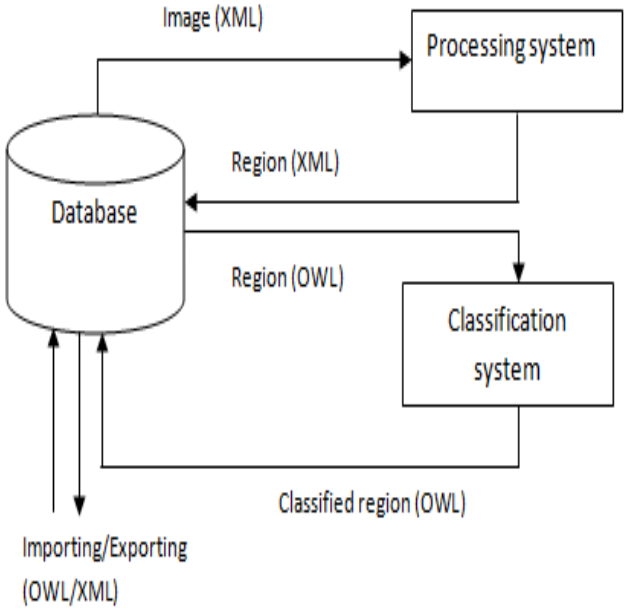

Fig 4:- Architecture of an ontology based data retrieval system

Peter.F.Patel et.al.,[9] has presented a concept of Semantic Web Rule Language (SWRL) that combines the sublanguages of web ontology language (OWL) and Rule Markup Language (RML). It contains OWL DL and OWL Lite, which are the sublanguages of OWL aligned with unary/binary data log, which are the sublanguages of the RML. This paper implements the number of OWL maxims by including described rules. Thus the proposed method enables the rules by combining them with an OWL knowledge base system. A complete explanation of the OWL model theoretic semantics is presented in this paper in order to make available a recognized significance for OWL ontologies and the rules for developing. The rules projected are said to be in the structure of an insinuation among a predecessor (stiff) and the resultant (chief). Such that every time when the state of affairs are individual in the predecessor seize, then the state of affairs specified in the resultant must be seized too.

Major elements of the architecture of a data retrieval system is presented by Jose A. Piedra et.al., [10]. With the intention of achieving a supple and active image retrieval system, this architecture has been designed which incorporates web equipments with new sample pattern detection systems functional to satellite images [PGC05] as shown in Fig.4. More efficiently the picture, sensor and satellite characteristics can be imported/exported and updated. The algorithms developed and the architectures implemented can also be imported/exported and advanced/enhanced from the organization. To make the proposed system capable of importing/exporting facilities it has to be furnished with the development methodologies for data and knowledge exchange. Well known web technologies such as XML [W3C07] are used for data switch over, and the web ontology Language is used for knowledge switch over.

The interoperability of sensor input data and semantics of the same data are considered by Dr.Sunitha Abburu et.al.,[11] through domain ontologies. The proposed methodology provides an effective technical solution by solving some issues like semantic diverseness in the course of semantic ontology. Such knowledge provides ability to exchange and make use of information, capability to build knowledge through data repossession by increasing a powerful notion with the help of domain ontologies. The satellite data semantic interoperability has been accessed by implementing a four phase methodology. This paper presents an evaluation by connecting and assembling the several ontologies to turn up at a basic ontology terminology for sensor annotations. Indian Meteorological satellite observation data were used by this author as a distinctive model in this paper to demonstrate the proposed concepts of ontology.

The available sources are categorized into three concepts namely data, information and knowledge. Each of their formats differs from the other where the structure of knowledge is said to be highly complex to design than the other two. Due its complex structure it is difficult to design the knowledge management concept for traditional information and hard to achieve a common structure for capturing the particular data from the mixed data sources. The basic elements of knowledge resource in the semantic web are presented in Fig.5. Ontology is the best semantic technology to represent knowledge. It provides uniform data structure for the knowledge acquired from mixed data structure.

It enables the sharing of knowledge within and out of the organizations [12] and also supports music applications [13]. Ontology provides a supportive platform for integration of related knowledge sources. The proposed ontology is implemented by using domain ontology (DO) provides an effective, efficient and good framework for knowledge management systems by addressing some major issues of the existing and proposed systems.

Fig 5:- Knowledge resource

M.R.Nayak has identified that the challenges in ocean information systems are Semantic heterogeneity and information overload. The solution is categorized using Semantic Web technologies, taking the inputs from mapping domain ontologies. The concept of interoperability is being addressed through ontologies, which are widely used as a means for solving the information heterogeneity problems in this paper [14]. A methodology to address the interoperability of sensor data and semantics of the data is also considered.

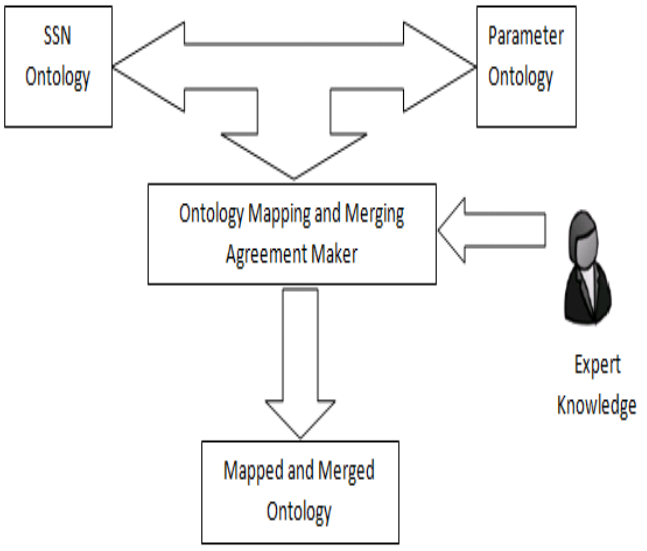

Fig 6:- Multiple ontology mapping and merging technique

The heterogeneities between various sensor networks are reduced through ontology mapping with sensor vocabulary. Sensor Observation Service (SOS) offers an extensive array of interoperability potential for each and every sensor, sensor policy, and networked assemblage of sensors in real-time, annals or virtual atmosphere, through Semantic Sensor ontology (SSN) by implementing mapping and merging technique as shown in Fig.6. The current study allows a valuable and efficient scientific resolution to solve the problems for voluminous data, in terms of semantic heterogeneity. It provides an efficient outcome by reaching interoperability, semantic data recovery and successful visualization with the help of domain ontologies.

Suresh Babu Golla et.al presented an approach [15] that provides a solid relation connecting three diverse ontologies associated to application areas like sickness, spaces and surroundings integrated in a single ontology algorithm. It links the real time apparatus that are inbuilt surrounded by the semantic knowledge base and also explains the interrelationships between them. The proposed methodology provides a sturdy base for beginning a fundamental requirement for a significant healthcare choice building system and its applications. A wide range of best practices of the data sets facilitates the advocacy of the proposed loomed for enhanced admiration, accepting and a range of conclusions in the medical applications. Thus the proposed method is related to health mapping methods, reusability of patient's data and its future applications by solving interoperability issues. It is developed according to mapping the available data features with the developed concepts of ontology by creating the semantic data along with an implication engine for other uncertainties to make it user friendly.

III. COMPARISON AND DISCUSSION

This paper discusses a widespread survey of the ontology expansion tools and algorithms for various applications like Satellite image retrieval system, Ocean data applications, Knowledge based management, Cricket video and Musical applications. Functions and features of various ontology development tools like TopBraid Composer, SWOOP, NeOn, OilEd, protege, OntoEdi, WebOnto and WebODE are discussed in this paper. Many tools are open source and provide versioning features. The tools protege and NeOn provide a better environment to build ontologies and backup management functionalities for developing ontologies.

The ontology development algorithms like Friend Of A Friend (FOAF), Simple Knowledge Organization System (SKOS), GeoNames ontologies, Platform for Ocean Knowledge Management (POKM) and automatic Extract, Transform and Load (ETL) are discussed in this paper. The ontology development algorithms are mainly focused on addressing the accessed data from the sensor interoperability and semantics of the satellite information. The proposed ontologies offers interoperability, competence to put up understanding base and provide the frame work for data retrieval system by developing an effective algorithm through the concept of ontology.

IV. CONCLUSION AND FUTURE ENHANCEMENT

In present scenario, with the sensor scientifically processed improvements in coastal ocean examination more a number of physical, meteorological, chemical, biological and geological attributes are being experimented and prepared to be available. The provincial relations is presently occupied in comprehensive and incorporate textures such data unruffled and supplied from various associations, there is a necessity for direction and development platform for data naming

conference to make it easy for identification, accessing, proper usage and depository of the data. The multiple ontology mapping and merging techniques are also discussed in this paper which are said to be more efficient and user friendly. The future research of this work is to develop ontology based architecture in semantic web technology to convert the available unstructured satellite data into the structured one i.e., the machine readable format and use it for the ocean applications.

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