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Ontology-Based Knowledge Representation of Homeopathic Products

Rajan Prasad, Dr.Manuj Darbari, Diwakar Yagyasen

Abstract— This paper highlights the use of semantic web in Homeopathy; it relates the product and diseases. Our work provides a formal system level framework using semantic web which bridges the gap between homeopathy and healthcare sector. We have used Protégé and ISaVIZ tool for linking the two domains. We also used the SPARQL web page as a user interface to shown the ontology in the web page. Our work is helpful to the Homeopathic users and experts to selecting the right medicine on the basis of their symptoms and provides the knowledge about the homeopathic products.

Index Terms Semantic Web;SPARQLWeb Page; Homeopathy; RDF; Arthritis; Medication System ; TopBraid Composer ;

1 Introduction

Homoeopathy is a therapeutic method for treating diseases by applying those medicines which is capable producing similar symptoms as that of the disease from which the patient suffers. It is based on the fixed law that is "Similia Similibus Curentur" which means "Let like be cured by like". As per homoeopathic law to remove and annihilate the disease permanently in its whole extent in the most harmless way from the human being, only a single medicine with accurate potency in a minimum dose at a time and proper repetition of dose is required [4].

Homeopathy is the fastest growing medical science in the world today, faster than Pharmaceutical industry as per the results of most of the surveys down regularly around the world, maximum people want to try Homeopathy as their first option of the complementary health care and those who have already tried[8].

Indian homoeopathy treated market is likely to grow 30% annually and reach a size of 4,600 cr. As the number of takes is growing fast within and outside the country[14].Homoeopathy market is estimated at Rs.26,300 cr. With France being the largest contributor, The last year domestic Homoeopathy market size was about Rs.2,758 Crore in India[9]

There is a huge gap between homeopathy and healthcare industry. This gap will continue to persist due to the lack of hospitals and institutions there are very few institutions for hospitalization and is where a lot of money comes from to add to this The distribution of products in homoeopathy medicine are hardly available in 50-60 outlets in a city compared to the reach of allopathic medicine, But abroad, this is not the case

- *Rajan Prasad is currently pursuing masters degree program in Computer Science engineering in BBDUniversity, India, PH-0522-3911035. E-mail: rajan18781@gmail.com*
- *Dr. Manuj Darbari is currently working as a Professor in BBD University, India, PH-0522-3911031. E-mail: manuj_darbari@acm.org*
- *Diwakar Yagyasen is currently working as a Assistant Professor in BBD University, India, PH-0522-3911031. E-mail: dylucknow@gmail.com*

There may be very few practitioner of homoeopathy but the medicine are very well distributed and has a big market in first world countries[9]. Framework is required which can support of a linking domain in Semantic Web[15].

Ontology is a reasoning-based, explicit, formal interpretation of concepts which can be shared between different applications[1],[2]. Concepts are converted into machine understandable and uniform formats, and can be used by all the instances in a particular area[2]. Ontologies (formally specified concepts) are widely used in the Semantic Web to describe basic terms and relationships. However, the same knowledge is often reflected differently by various ontologies. as a result, misunderstandings and conflicts arise. Therefore it is necessary to establish ontology mappings in order to enhance the understanding that spans different ontologies, thereby resolving this conflict.

The remainder of this paper is organized as follows. We provide the overall background and briefly illustrate the proposed solution to homeopathic integration with ontology in the next section. Then we argue for the running ontology project in current scenario for diffrents domains in Section 3. The formalization of our approach in Section 4. We develope homeopathy ontology section 5 focusing the implementation of ontology using TopBraid Composer. in section 6 is based on output of the ontology with the help of SPARQL Web Page. Section 7.We conclude the paper with a discussion, a summary of our main findings and an outline of future work. Throughout the paper, the Arthritis Disease we used as examples.

2.0 Related Work:

Based on Ontology model there are several project have been successfully completed and now a days these project are used as the commercial product we conclude in brief survey on these project

2.1 Gene Ontology:

It allows developing three structured controlled vocabularies that describe gene products in terms of their associated biological processes, cellular components and molecular functions in a species-independent manner. There are three sepa-

International Journal of Scientific & Engineering Research Volume 5, Issue 2, February-2014
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rate aspects to this effort: [10]. Development and maintenance of the ontologies themselves. Annotation of gene products, which entails making associations between the ontologies and the genes and gene products in the collaborating databases; Development of tools that facilitate the creation, maintenance and use of ontologies

2.2 GALEN:

It allows clinical information to be captured, represented, manipulated, and displayed in a radically more powerful way. It supports reuse of information to integrate medical records, decision support and other clinical systems.[11]

The GALEN CORE Model for representation of the Common Reference Model for Procedures contains the building blocks for defining procedures - the anatomy, surgical deeds, diseases, and their modifiers used in the definitions of surgical procedures. This document describes the structure the CORE model which gives a detailed account of its high level schemata followed by a detailed example of the use of the ontology for a portion of the model of the cardiovascular system and diseases.[11]

2.3 MENELAS:

It allows Hospital Information Systems highlights the fact that most relevant medical information is stored in narrative form, in Patient Discharge Summaries (PDSs). The basic idea of the PDS the transmission of the minimal but sufficient set of data to be used for the next visit of the patient. The two main goals MENELAS contributes to Provide better account of and better access to medical information (PDSs) through natural languages in order to help physicians in their daily practice[12]

3.0 Basic Concepts of Information Modelling

An ontology is an explicit specification of a conceptualization, where a conceptualization is an abstract, simplified view of the world that we want to represent for some purpose[13]. Concept is a thought or notion.[3]. said that the three components for communication are concept, symbol, and thing, Concept Ontologies are organized in hierarchical structures: a set of concepts describing a domain serving as skeleton foundation for a knowledge base. Ontologies is considered as conceptual schemata, intended to represent knowledge in the most formal way. Formal ontologies are represented in logical formalisms, such as Web Ontology Language (OWL), which allow automatic inferencing over them. In the context of database systems, ontology is viewed as a level of abstraction of data models with an intention to model knowledge about individuals, their attributes, and their relationships to other individuals. Ontologies are said to be at the "semantic" level, whereas database schema are models of data at the "logical" or "physical" level.

3.1 Components of an Ontology

There are five kinds of ontology components: classes, relations, functions, formal axioms and instances[13].

a. Classes represent concepts, which can be considered generic entities.
b. Relations represent a type of association between concepts of the domain.
c. Functions are a special case of relations.
d. Formal axioms serve to model sentences that are always true. They are normally coherent description between Concepts/ Properties / Relationships is logical expressions.
e. Instances are used to represent elements or individuals in an ontology.

An ontology can be characterized as comprising of four tuples;

O= <C,R,I,A.>

C is a set of classes representing concepts we wish to reason about in the given domain, such as: Remedy, Diseases, Doses, and Symptoms etc.

R is a set of relations holding between those classes, such as: hasIngredient.

I is a set of instances, where each instance can be an instance of one or more classes and can be linked to other instances by relations, such as: Arthritis, Arthritisan* , Muscular pains etc.

A is set of axioms, such as: if joints pain increasing gradually may be cause of Arthritis,
increase the potency of remedy.

3.2 Ontology and Semantic Web

The OWL, Web Ontology Language is designed for use by applications that need to process the content of information instead of just presenting information to humans. OWL facilitates greater machine interpretability than that supported by XML, RDF, and RDF Schema by providing additional vocabulary along with a formal semantics.

- RDF is a data model for objects and relations between them provides a simple semantics for this data model, and these data models can be represented in an XML syntax.
- RDF Schema is a vocabulary for describing properties and classes of RDF resources, with a semantics for generalization-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"), and characteristics of properties (e.g. inverse).

3.3 OWL and Description Logics

- Description Logics are a family of logics
- Each fragment depend on which operators are supported in the logic
- More supported by operators higher the complexity
- OWL-DL supports the following operators: SubClassOf, equivalentClass, disjointWith, sameIndividualAs, differentFrom, subPropertyOf, inverseOf, transitiveProperty, FunctionalProperty, inverseFunctionalProperty.

International Journal of Scientific & Engineering Research Volume 5, Issue 2, February-2014
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4.0 Modeling of Homeopathy Ontology: A Case Study on Arthritis

In this section we propose the homoeopathy products ontology and symptoms ontology and finally map it with the homeopathy products to the diseases. Table 1 describe the relationship between class and subclass of Medication System.

Class	Sub Class
Medication System	Diseases, Homeopathy, Symptoms
Homoeopathy	Dosage, Ingredient, Products
Products	Balm, Hair Oil, Liquids, Malt, ointments, Shampoos, Tablets
Liquids	Complexes , Dilutions, Mother Tinctures, Syrups & Tonic
Tablets	Bio-combination, Biochemic, complex, Triturations
Diseases	Arthritis
Complex liquids	Arthritisan*

Table 1. Relationship between class and subclass

Class	Instances
Ingredient	Apocynum6x,Aranea Diadema12x,cimicifuga racemosa6x,Euphrasia officinalis6x,Hedera helix5x,Symphytum officinale4x,Viscum album6x
Symptoms	Inflammation and pain of all Joints, Muscular pains, Neuralgic pain, Pain in cases of sciatica ,soothing effect on inflamed membrane, swelling and stiffness of joints, Healing process

Table 2 Class and Instances

Property	Domain	Range	Type
hasIngredient	Homoeopathy	Ingredient	Functional
hasProduct	Medication System	Symptoms	Functional
hasProduces	Medication System	Symptoms	Functional
hasReduces	Medication System	Symptoms	Functional
hasSymptoms	Homoeopathy	Symptoms	Functional
IngredientOf	Homoeopathy	Ingredient	Inverse Functional
SymptomOf	Medication System	Symptoms	Inverse Functional

Table 3. Domain/Range modeling

Table 3 shows the relationship between domain and its range with reference to its linking in terms of properties

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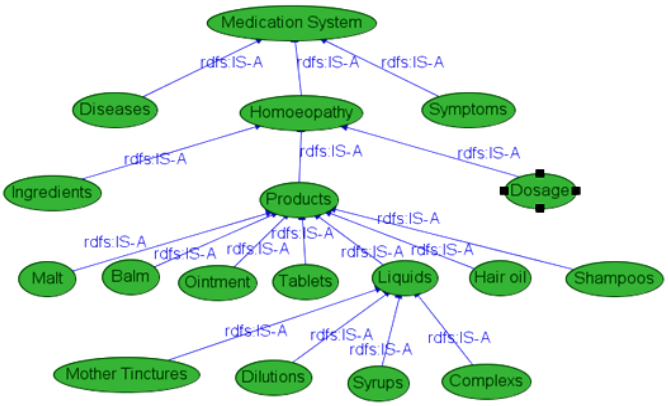

Figure 1 : IS-A Relationship between classes and subclasses

Figure 1. show IS-A relationship between classes and subclasses representing IS-A relationship between dilutions, Syrup, Complex is a part of liquids, which is further grouped into products.

The product forms the basic categorization of Homeopathic as shown by IS-A relationship with its supper class of Medication System.

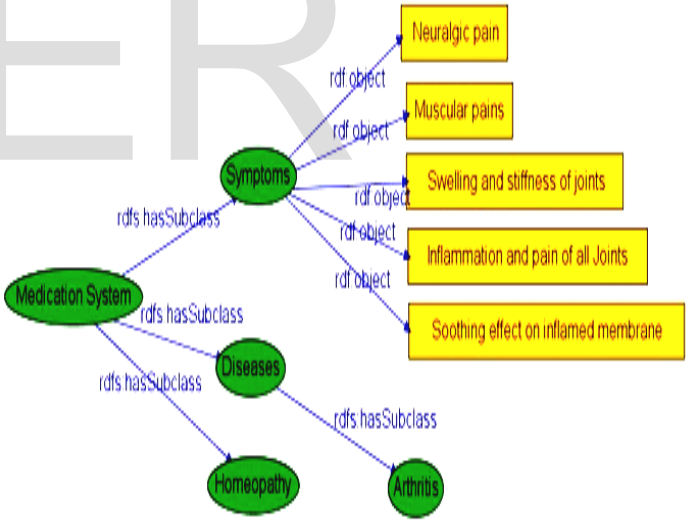

Figure 2 : A Relationship between classes and objects

The figure 2 shows the relationship between classes and objects where classes are having direct relationship with the objects using rdf:object. For example; Symptoms has various objects like inflammation of all joints, Muscular pains, soothing effect on inflamed membrane and swelling and stiffness of joints connected by rdf:object.

Figure 2 can be enhance to further lower level of ingredients and its relationship with the constituent of the ingredients for example HederaHelix, has the direct relationship to the ingredients with rdf:object relationship

International Journal of Scientific & Engineering Research Volume 5, Issue 2, February-2014
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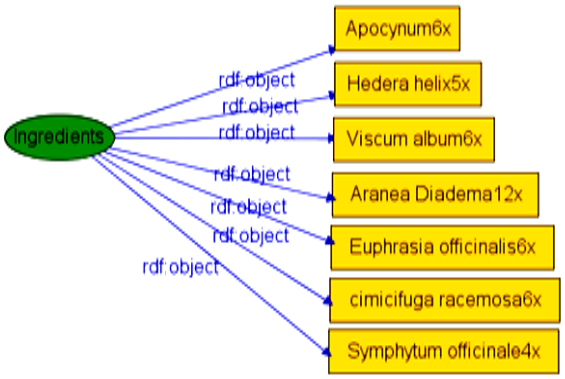

Figure 3: Relationship between Classes and Objects in terms of Ingredients.

Figure 2 can be enhanced further to lower level of Homeopathic product and it's relationship with the constitutes of the ingredients for example; Apocynum, Hedera helix, Viscum album , Aranea Diadema, Euphrasia Officinalis, Symphytum officinale and cimicifuga racemosa has the direct relationship to the ingredients with rdf:object relationship.

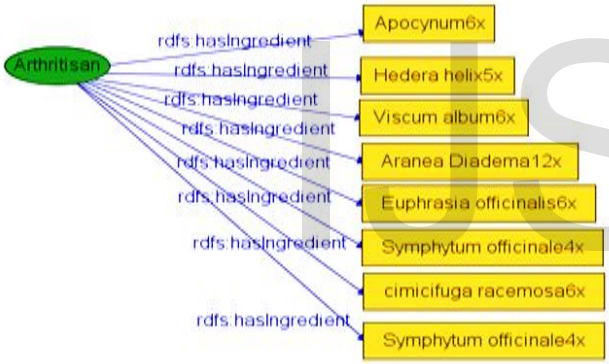

Figure 4: Relationship between Product and Ingredients

5.0 IMPLEMENTATION: we have used the TopBraid Composer(TBC), which supports modeling environment for developing Semantic Web ontologies and building Semantic applications. Fully compliant with W3C standards, Composer offers comprehensive support for developing, managing and testing configurations of knowledge models and their instance knowledge bases. TopBraid Composer is the leading industrial-strength RDF editor and OWL ontology editor [6]. The Fig.5 is shows the Form View of the Homeopathy ontology. For inferences we have used the Jena Rule with inbuilt functionality in TBC, when we run this model then the following output is generated in Form View as shown in Figure 5

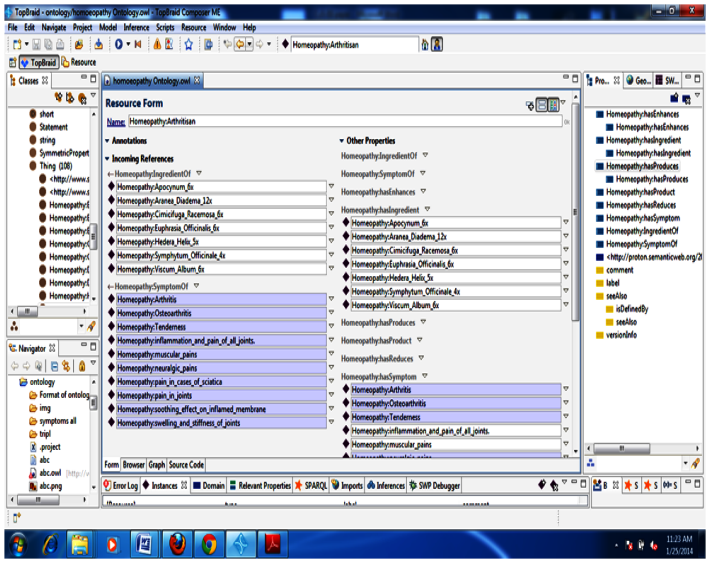

Figure.5 form view of Homeopathy Ontology Project.

6.0 RESULT: We are used SPARQL Web Pages framework for building web interfaces which is Semantic Web standards. SWP is a single technology that provides the facility to build applications that interact with RDF data. With SWP, user interface snippets are attached directly to class definitions in ontology models. The framework automatically discover and select the most appropriate user interface for any given resource.

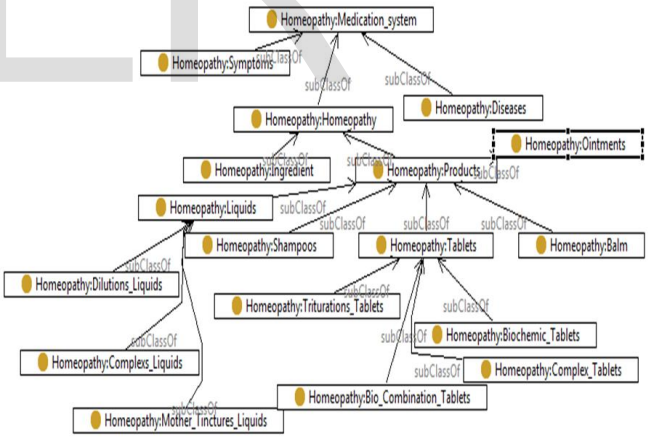

Figure 6. Inferences graph of Homeopathy Ontology

User interface code becomes extremely flexible, modular and model-driven[5]. The Figure.6 displays the "*Inferences graph*" of Homeopathy Ontology using Jena Rule followed by the inferences Homeopathy Ontology using Jena rule Figure 7. And the final output is display in web browser; The experiments have shows that queries can be made on the combined dataset of Homeopathy Ontology, including those that require inferencing to derive. The infrastructure and the ontology have allowed the determination of related information and resources from both is the applications using simple Sparkle Queries. These results indicate that an infrastructure based on the Semantic Web can be used for integrating in Homeopathic

International Journal of Scientific & Engineering Research Volume 5, Issue 2, February-2014
ISSN 2229-5518

Domain and Homeopathic Users.

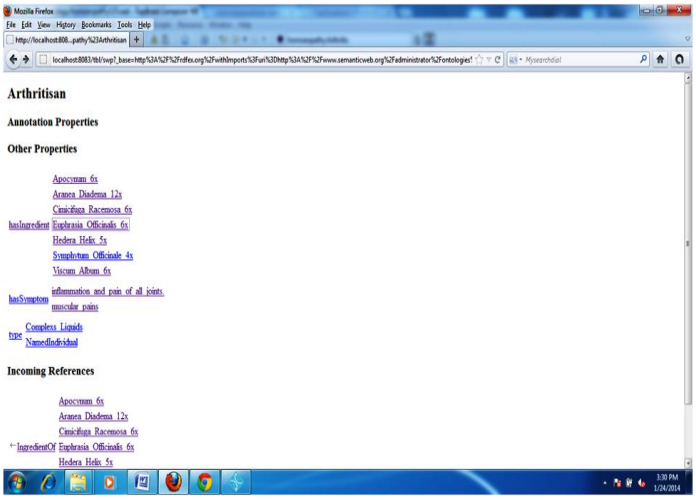

Figure.7 Homeopathy Ontology in web Browser

7.0 CONCLUSION AND FUTURE SCOPE:

Experiments have shown that SPARQL queries can be made on the combined dataset of Homeopathic Ontology, including those that require inferencing to derive. The infrastructure and the ontology have allowed the determination of related information and resources from both applications using Jena rules. These results indicate that an infrastructure based on the Semantic Web can be used for integrating Homeopathic Domain. In this paper brings to a conclusion by providing a perfect relationship between Homeopathic Products and Remedies. The use of Semantic Web in Homeopathy helps the machine to take the appropriate decision regarding symptoms and cure. In future, we will be mapping between symptoms and remedies, Homeopathic Products and Disease. Secondly, we will be exploring in Potency of drugs based on the intensity of the diseases.

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