

# The Implementation of Semantic Web Technology in Traditional Plant Medicine

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**Abstract.** Medical records are a documentation of patients health data that should be having by a doctor or a health worker during the examination process. This data collection commonly was performed manually, so it is difficult to access it or copy it. This research discusses about medical records system that easily accessed by implementation of Semantic Web Technology. Semantic Web can make the data more meaningful as long as it has a good definition. A component in a Semantic Web, RDF, can modify data into a semantic text. In this research, database form medical records will be mapped with RDF format. RDF map should run first by using D2R server. This running process will provide and endpoint that can be accessed by a user to get a medical records database.

The data will be accessed using the SPARQL query. The data in this research are a secondary data taken from the manual of diagnosis and therapy. The results show that medical records in the database can be accessed by using keywords from anamneses, visual examination and patients diagnose. In addition, this system also can display the database of medicinal plants. Medical plants data taken from different database, although it can be implemented a mapping for accessing it.

**Key-Words:** Medical records, Semantic Web, RDF, mapping, RDF mapping, SPARQL Query

## 1. Introduction

This website can be used as one of a tool to develop electronic medical records. This tool enables a person who has authority (patients and doctors) to access health data everywhere and anywhere. The semantic web is a technique that allows a machine to determine a meaning the content of the website

Semantic web technologies developed to make a web more intelligent, not only search by keywords, but to interpret the words in the web so it gives a maximum results. Data in the table can be accessed using an RDF map, so accessing data not directly into the database.

Accessing data which not directly through the database, will allow users to get the data. Data can also be accessed as needed. In this research, the system also displays data from different databases that have implemented the RDF mapping that is database of medicinal plants

## 2. Material and Methode

### 2.1. Semantic Web

The semantic web is intended to provide a data that will be used by software systems such as World Wide Web” (WWW), which provide a collection of web pages to read by the user. The concept of the semantic web is the integration and use of data can be obtained from different sources [1].

The semantic Web is a technology that allows websites can be easy to understand by the machine so that the information contained in is presented appropriately with the needs of capable users. By using semantic technology allows web to create new knowledge by drawing conclusions from the existing knowledge [2].

The basic principles of the semantic web are implemented in the layer below:

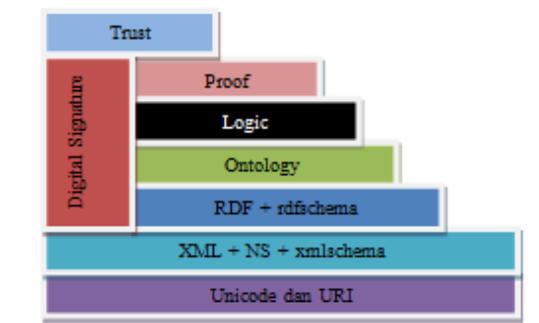


Figure 1 Layer semantic web [3]

Unicode and URI layers serve to provide identifying objects in the Semantic Web. XML layer, namespace and schema definitions are ensuring semantic web is able to integrate with other XML standard basis. RDF layer and RDF Schema serve to make statements about objects with URIs and interpret vocabulary that can be made by URIs. Ontology layer supports the evaluation of the vocabulary so it is can define the relationships between different concepts. Digital Signature layer to detect changes in the document. Logic layer allows the rule to be executed by “proof” layer and simultaneously evaluating an application to be approved and trusted [3].

## 2.2. RDF (Resource Description Framework)

In the semantic web, the information will be displayed as a collection of statements called statements consisting of the 3 parts: subject, predicate and object. Because it consists of three parts, the statements also known as triple. Statement in this form, naturally formed into a directed graph, with the subject and the object of each statement as a node and the predicate as edges. The data model is the one used by the semantic web, which is referred to as the Resource Description Framework (RDF) [4].

## 2.3. SPARQL

SPARQL (Simple Protocol And RDF Query Language) is closely related to the structure of RDF itself. Query of RDF graph can be formed from a variety of data or a combination of a lot of data RDF and used to query the data. SPARQL is a query language like SQL in conventional databases and is a standard RDF query language that has been set by the W3C. SPARQL is a combination of the standard query language and data access protocol that is not only capable of querying RDF graph, but also all data sources that have been mapped in the RDF form. A query using SPARQL can consist of triple patterns, conjunctions (or), and disjunction (and) [5].

## 2.4. D2R Server

D2R Server is a tool for publishing content from relational databases in the Semantic Web. The content of the database, mapped in the RDF with mapping which was declared to specify how resources are identified and how property values in generate of the content database. D2R Server allows RDF and HTML browsers to redirect content from non-RDF databases and allow the application to query the database using the SPARQL query language with SPARQL protocol [6]. D2R Server architecture in figure 2.

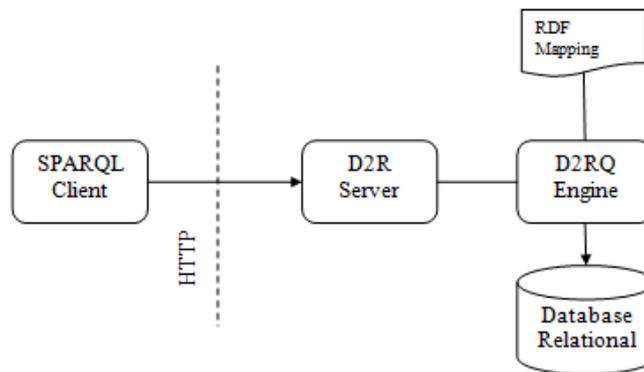


Figure 2. D2R Server architecture

## 2.5. Design Systems

In this research, the author will build two web-based applications that are used to implement semantic web technologies in the a doctor's documentation of patient data. The first applications using JSP in the encoding while the second application using PHP. It takes 3 pieces servers in this study. The first server application contains JSP, D2R Server and Medical Resume database, web server both are traditional plants that provide endpoint that allows flexible data access, while a third server is used to store a PHP application that will do the query from the first server and the second to produce the data which have more information. Figure 3 below is the system architecture of this research.

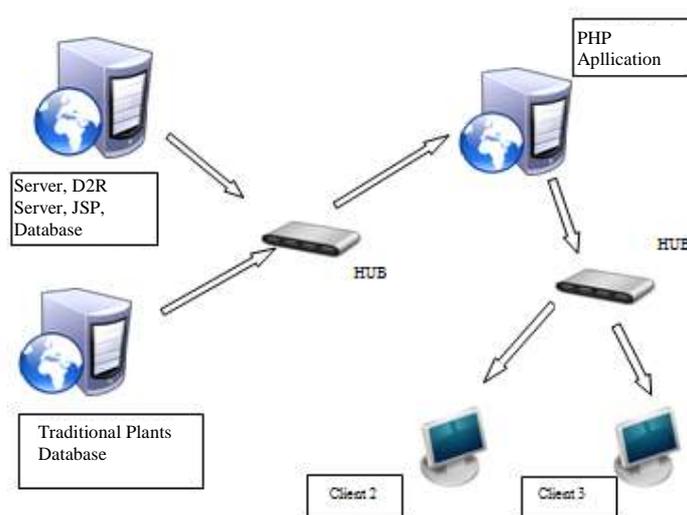


Figure 3 System Architecture

## 2.6. Design of JSP Application

JSP application used to enter the data of medical resume. This application used to input data-of patient so it can be stored into the database.

## 2.7. RDF Mapping Design.

Mapping has written by syntax turtle, can be generated directly using D2R Server itself or written according to the template provided by the D2RQ mapping language. In this research, mapping was written based a template that has been determined by D2RQ Mapping Language. RDF Mapping used to access the data in the database of semantic content. Here is an example of RDF mapping tables drugs.

```
# Table medicine
map:medicine a d2rq:ClassMap;
  d2rq:dataStorage map:database;
  d2rq:uriPattern "medicine/@@medicine.id_Obt1|urlify@";
  d2rq:class vocab:medicine;
  d2rq:classDefinitionLabel "medicine";
.
map:medicine__label a d2rq:PropertyBridge;
  d2rq:belongsToClassMap map:medicine;
  d2rq:property rdfs:label;
  d2rq:pattern "@@medicine.NmObt@";
.
map:medicine_id_Obt1 a d2rq:PropertyBridge;
  d2rq:belongsToClassMap map:medicine;
  d2rq:property vocab:id_Obt1;
  d2rq:propertyDefinitionLabel "medicine id_Obt1";
  d2rq:column "medicine.id_Obt1";
.
map:medicine_NmObt a d2rq:PropertyBridge;
  d2rq:belongsToClassMap map:medicine;
  d2rq:property vocab:NmObt;
  d2rq:propertyDefinitionLabel "medicine NmObt";
  d2rq:column "medicine.NmObt";
.
map:medicine_indication a d2rq:PropertyBridge;
  d2rq:belongsToClassMap map:medicine;
  d2rq:property vocab:indicationObt;
  d2rq:propertyDefinitionLabel "medicine indication";
  d2rq:column "medicine.indication";
.
map:medicine_komposisi a d2rq:PropertyBridge;
  d2rq:belongsToClassMap map:medicine;
  d2rq:property vocab:komposisiObt;
  d2rq:propertyDefinitionLabel "medicine composition";
  d2rq:column "medicine.komposisi";
.
map:medicine_id_JObt1 a d2rq:PropertyBridge;
  d2rq:belongsToClassMap map:medicine;
  d2rq:property vocab:Ob_id_JObt1;
  d2rq:refersToClassMap map:jnsobt;
  d2rq:join "medicine.id_JObt1 => jnsobt.id_JObt1";.
```

Mapping written from the table medical resumes which obtained from JSP application. Database of medicinal plants already in an RDF Map so the system can easily access without re-design the RDF Map

## 2.8. PHP Application Design

In this application the data are accessed using SPARQL queries through D2R Server by using the RDF mapping. D2R Server serves as the liaison mapping service to allow SPARQL queries to get the data from the database according to the query made by RDF mapping. Here D2R Server system design.

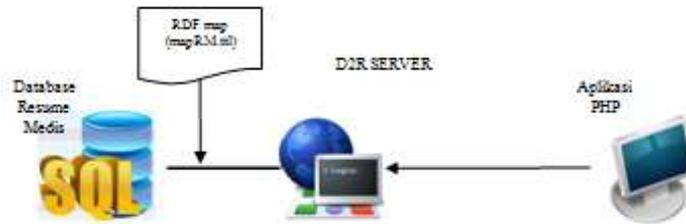


Figure 4. D2R Server Design.

A PHP application design commonly can be seen in Figure 8. In addition to accessing medical resume database, PHP application also accesses the data of traditional medicinal plants, to get the info related to a disease

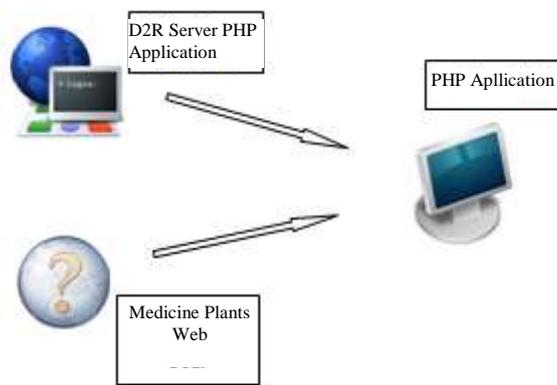


Figure 5. Desain Sistem aplikasi PHP.

Display the home page in this application can be seen in Figure 6.

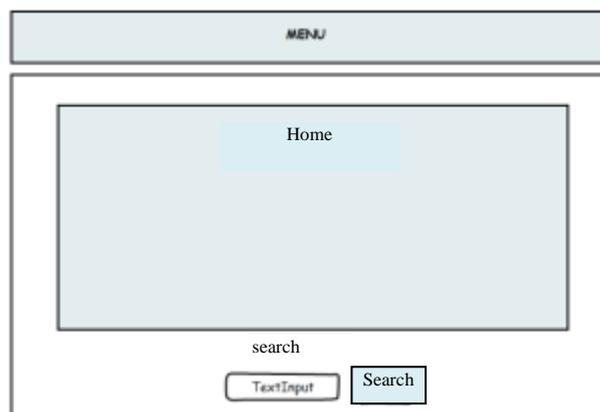


Figure 6. Home Page of PHP application.

## 2.9. SPARQL Query Design

SPARQL queries used in search menu PHP applications are as follows:

```
SELECT ?id_Res ?number_RM ?name_Patient ?name_Doctor ?tgl ?Ans ?PemFis ?Diagnose WHERE {
    ?dpas vocab:Diagnose_pas ?idp.
    ?idp vocab:ICD ?pas.
    ?idp vocab:nm_Diagnose ?Diagnose.
```

```
?dpas vocab:dp_id_Resume ?idrp.  
?idrp vocab:id_Resume ?id_Res.  
?idrp vocab:rs_No_RM ?no.  
?no vocab:no_RM ?number_RM.  
?no vocab:nama_pas ?name_Patient.  
?idrp vocab:rs_Doctor ?idd.  
?idd vocab:name_dok ?name_Doctor.  
?idrp vocab:Tgl_Bermedicine ?tgl.  
?idrp vocab:Anamnese ?Ans.  
?idrp vocab:PemerFisik ?PemFis.  
filter (regex(?Diagnose,'$kkey','i'))||regex(?Ans,'$kkey','i')||regex(?name_Doctor,'$kkey','i')||regex(?name_Patient,'$kkey','i')  
||regex(?PemFis,'$kkey','i')).  
}  
  
// Searching for tradisional plant medicine data  
  
SELECT DISTINCT * WHERE {  
?c vocab:cara_pemakaian_cara_pemakaian ?cara.  
?c vocab:cara_pemakaian_idbagian_digunakan ?idb.  
?c vocab:cara_pemakaian_idkhasiat ?idk.  
?idk vocab:khasiat_nama_penyakit ?khasiat.  
?idb vocab:bagian_digunakan_idtanaman ?idt.  
?idt vocab:tanaman_idtanaman ?id.  
?id vocab:tanaman_nama_indo ?nama.  
FILTER(regex(?cara,'$kkunci','i')|| regex(?khasiat,'$kkunci','i')|| regex (?nama,'$kkunci','i')).  
}";
```

Searching query is used to perform a query that will display the results of medical records related to keywords. Query results showing medical record according to the keywords. Keywords can use words associated with the name of the patient / doctor, anamnesis, physical examination and diagnosis of patients. Besides displaying patient health data, the system will display the names, also of medicinal plants related to the keywords entered. Data obtained from the Web medicinal plants,

### 3. Result and Discussion

An experiments were conducted to show the result of this study is using the 3 pieces local server. The first server is used to run JSP applications and service D2R Server, while the second server, used to run PHP applications. The third server is used to store data website medicinal plants that can be queried using SPARQL. The second server (PHP) will access the server first and third to get a variety of data search.

First test operates JSP Application JSP Application has 3 level user, consisting of administrators, operators and users.



Figure 7. Interface First Page User

Figure 7 is an initial view user page when the JSP application is activated. Change the user level, simply by logging in. Interface page administrator and operator pages can be seen in figure 8 and figure 9.



**Figure 8.** Interface First Page Administrator



**Figure 9.** Interface First Page Operator

The second experiments are PHP application. PHP application can display data when the D2R Server service has been activated. Figure 10 displays the home page of PHP applications with SPARQL queries.



**Figure 10.** Interface PHP Application Page

Searching is done with use keywords. Keywords entered into the search field and the application will display the search results match those keywords in question. When we enter a name, then it will show the data associated with that name. The keywords will be matched with the data included the patient's name, name of the doctor and the diagnosis. Medicinal plant data displayed on the left lane, as well as patient data, will display the data systematically plant that match those keywords. Figure 10 is an example of the search results that appear after the first search process. From the image search results from disease "Cataract". Figure 11 shows the data more detailed will appear when the link "view more" button is pressed.



**Figure 10.** Interface Searching Result PHP



**Figure 11.** Interface Result Page Detail

#### 4. Conclusion

From this research it can be concluded that by implementing the semantic web technology, the shared (sharing) data anamnesis, physical examination and diagnosis can easily be done. In addition to displaying data from patient data, the system also displays the data of traditional medicinal plants in which the data is displayed based on the efficacy of traditional plant itself. Based on the trial, of 15 keywords used total search patients' health data is divided into 32 data 17 show the data based on the data on physical examination, 17 the data show based on anamnesis and 10 data appear diagnostically owned patient. As for the traditional plant data are shown as total data 20 data.

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