RDFS-Based Information Representation of Indonesian Traditional Jamu

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Abstract—The need for information related to the Indonesian traditional herbal drink, jamu, has increased in the recent years as jamu becomes a more economical option for alternative treatment. Experts in jamu are needed to provide information such as the type of jamu to drink, how to brew it, or where to get it. These experts may have different concepts and/or abilities to recognize symptoms resulting in different opinions. For this reason, we propose a system that has the ability to comprehend jamu related information and manage that information into knowledge. This knowledge can then be accessed by the public to give them an insight on how to treat a certain disease. For this system, a standard model is needed to represent all the information concerning jamu. An ontology is used to model the knowledge from the jamu information with RDFS knowledge base to describe the schema.

Index Terms—Indonesian Traditional Jamu, RDF, ontology

I. INTRODUCTION

Indonesian traditional jamu is widely used in Indonesia as a more economical alternative treatment. However, there is a lack of information management regarding jamu which causes inadequate knowledge of the benefits of jamu for the public. To obtain information on jamu, one has to ask someone who is considered an expert in jamu. Considering the different opinions from different jamu experts, a standard model is needed to represent jamu. This model consisting of jamu information can then be used by a system to be managed and accessed by the public. One of the ways to achieve this is to create RDFS-based semantic web containing jamu information.

Our research problem covers how RDFS-based knowledge representation model can be used to manage information concerning Indonesian traditional jamu. Information on how to make jamu can usually be obtained by people through jamu recipes. A jamu recipe consists of the benefits, ingredients and directions to make that particular jamu. This research uses several jamu recipe books [1][2][3] to gather all the necessary information which will then be transformed into RDFS-based semantic web that represents Indonesian traditional jamu.

There are some previous works that implement RDF as the basis data model for developing information system. Those works provide a big picture about implementing RDF in developing model data of Indonesian Traditional Jamu. Supriheryantono [4] represented an organization structure of a banking company based on RDF. The company’s information structure was modeled in the form of an ontology, making it easier for users to obtain information. Fedila and Mustikasari [5] represented RDF-based lecture materials in a course search application. However, the usability of this application was considered insufficient because of the lack of features to support the ease of search. Related with Indonesian traditional jamu, Wardani, et al. [6] created Ethnomedicine, an ontology that represents expert knowledge on the use of medicinal plants in Indonesia. From these cases we can see the significance of the capability and source of knowledge of a model in representing a domain.

II. BACKGROUND THEORY

A. Indonesian Traditional Jamu

Based on the beneficial proof of traditional medicine in Indonesia, the National Agency of Drug and Food Control of Indonesia (BPOM) has classified traditional medicine into three categories namely jamu, standardized herbal medicine and phytomedicine. Empirical, pre-clinical and clinical data are used to prove the benefits of jamu, standardized herbal medicine and phytomedicine respectively. Jamu is a traditional medicine derived from different medicinal plants with certain composition concocted by following a set of instructions in a recipe. Jamu can be consumed in the form of hot drink, powder, liquid, tablet, or capsule [7].

According to Sujatno (cited in [7]), the role of jamu as medicine in society refers to the use of jamu for promotive, preventive, curative and rehabilitative purposes. The following lists the purpose of jamu along with examples of diseases that can be treated by it: 1) Curative, to treat an illness as well as to replace or complement the use of modern medicine (cough, diarrhea, hypertension and cholesterol); 2) Promotive, for health and physical fitness purposes (adult health, child growth); 3) Preventive, to prevent sickness (anti-common colds, anti-stress); and 4) Rehabilitative, for health recovery purpose.

Apart from health purposes, jamu can also be used for beauty treatments such as spa treatment. Jamu is also beneficial for increasing sexual stamina for men and providing intimate care for women [7].
B. Semantic Web

Semantic web can be described as a web that transforms information into knowledge so that its content can be understood by computer. The computer then intelligently uses the meaning of the web content to search, merge and process the web content which can only occur when the intended meaning, i.e. semantic, is given explicitly and can be processed [8, p. 11]. RDF two terms can be linked using a binary property so that information written in a format readable by machine. With relationship between resources. RDF document is depicted as a directed graph. These terms and properties are properties can be reused as interrelated terms with other terms and properties. RDF vocabulary and RDFS vocabulary can be categorized as string. XML-Schema is used to define the data type [8, p. 20]. The data in RDF has literal values. However, when the data type is undefined, it is considered as string. XML-Schema is used to define the data type [8, p. 37]. The triple concept is a concept resulted from the serialization of RDF. This concept consists of subject, predicate and object.

RDF can be defined as a simple model to describe the relationship between resources. RDF document is information written in a format readable by machine. With RDF two terms can be linked using a binary property so that it can form a directed graph. These terms and properties are explained using URIs. Because properties can also be URIs, properties can be reused as interrelated terms with other properties. In RDF, URIs can refer to things that can be identified (for example, someone, vehicle, business, or event). RDF's basic structure was then developed into RDF Schema (RDFS) which can be used to define simple ontologies, so RDFS is also known as a simple ontology language. RDFS is a RDF-specific dictionary that can define the class model and its hierarchy as well as properties with restrictions for domains and ranges.

D. Resource Description Framework Schema

RDFS allows user to build an information schema using the terms set by the user. RDFS is unlike FOAF (Friend Of A Friend) where the user is not able to use new terms apart from the vocabulary already set by FOAF [12]. In short, RDF vocabulary and RDFS vocabulary can be categorized into three groups namely class vocabulary, property vocabulary and additional vocabulary.

Class vocabulary

Class vocabulary is a set of terms that focuses on stating class taxonomy/hierarchy. Among them are:

- rdfs:Class for object abstraction;
- rdf:type to instantiate object in a class;
- rdfs:subClassOf to state that a class is a subclass of a certain class;
- rdfs:Resource to state that a class is a resource of a domain;
- rdfs:Literal to state a literal class.

Property vocabulary

Property vocabulary is a set of terms that focuses on the declaration of properties (object property and data type property). Among them are:

- rdfs:Property to state a new term in a certain domain;
- rdfs:subPropertyOf to state a term that inherits rules from the class above it (inheritance);
- rdfs:domain and rdfs:range are to state domain and range boundary in a term.

E. Ontology

Ontology is developed for many reasons including to share common understanding of the structure of information to human or software agents, to reuse domain knowledge, to make domain assumption explicit, to separate domain knowledge from the operational knowledge and to analyze domain knowledge ([10], cited in [11]).

In order to evaluate the ontology, completeness check is developed. Completeness check is a formal framework developed by Cordi and Mascalci [12] to develop and prove the truth and completeness of an ontology. The steps of completeness check are:

1) Domain Analysis: This step consists of domain identification and the ontology's aim and users. Ontology development scenario can also be included in this step. As a result, queries will arise as the foundation of ontology development. These queries are usually in the form of questions called competency questions and must be answered by the ontology.

2) Definition of Needs: This step includes the design of competency questions which are brainstorming, putting details into scenarios which will become the motivation of ontology development, trimming and identifying specific software/hardware obstacles.

3) Informal Ontology Specification: Here, ontology graphic is provided to represent the relation between different concepts in the ontology.

4) Formal Ontology Specification: The fourth step covers the definition of the ontology using formal language.

5) Testing, Validation and Verification: The main validation method used in this step is testing the ontology with informal competency questions. In doing so, adjustments to the competency questions can be done so that it can define the needs of the ontology.

6) Completeness Check: The last step uses “partially automated” approach. The completeness check can be fully done automatically once the informal competency questions/queries are implemented as a system. This is done by running the system according to the competency questions. The ontology is considered as complete when every competency question has been answered by the result.
of system implementation.

F. Ad-hoc Information Retrieval

Information Retrieval (IR) is the activity of finding documents from a large set of documents relevant to the user’s query [13]. Resources are retrieved based on the user’s query. The metrics to measure the system’s performance are precision, recall, and accuracy.

Recall is defined as the fraction of items taken from a set of relevant items, precision is the fraction of relevant items among the retrieved items whereas accuracy is the fraction of correctly classified items, both relevant and irrelevant [13].

III. RESEARCH METHODOLOGY

The Indonesian traditional jamu ontology model was developed by conducting literacy studies from several books about traditional herbal medicine. From each book, knowledge extraction was carried out by summarizing each statement in the form of simple sentences consisting of subject, predicate, and object. From each of these statements, categorization will be carried out based on subject and object. From the basis of the categorization, grouping and summarizing the predicate can be used as relations between objects (both as subjects or predicates).

A. Ontology Design

1) Domain Analysis

The domain of this research is related to Indonesian traditional drink jamu which is considered as Indonesian traditional medicine. As illustrated in Fig. 1, jamu kuratif (curative jamu), jamu preventif (preventive jamu), jamu promotif (promotive jamu), and jamu rehabilitasi (rehabilitative jamu) are jamu kesehatan (jamu for health purpose). Jamu keperkasaan (jamu to increase men’s sexual stamina) and jamu kewanitaan (jamu for women’s intimate area) are considered as jamu kesenangan (jamu for pleasure). Jamu kesehatan, jamu kecantikan (jamu for beauty), and jamu kesenangan fall under jamu. The use of each type of jamu is shown in Table I.

The domain of this research is jamu recipe. Specifically, each recipe must have at least the following information:

1. An identity in the form of a name/title.
2. Explicit/implicit information of the benefits of jamu as a solution for diseases/health problems.

3. Information of the name and amount of ingredients.
4. Directions on how to make the jamu.

The purpose of this ontology is to represent information regarding jamu in a semantic web. The ontology allows users to easily obtain information on jamu. Users refer to people who are sick or have health issues and are trying to seek alternative medication as a solution.

SCENARIO 1: Retrieving jamu data

The jamu data is retrieved from several books containing jamu recipes. The data needed are title, ingredients name and amount, as well as directions to make the jamu. The obtained data will be modeled using XML schema (.xsd) resulting in jamu recipe content. The content is inserted into the server in RDF format to enable searching, merging and process upon the content. Information schema on RDF jamu recipe is needed to create RDFS Indonesian traditional jamu. The end product of this process is a semantic web.

TABLE I
THE CLASSIFICATION OF JAMU BASED ON ITS USE [7]

<table>
<thead>
<tr>
<th>Jamu</th>
<th>Intended use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jamu kuratif</td>
<td>treat illnesses, as well as to replace or complement the use of modern medicine</td>
</tr>
<tr>
<td>Jamu preventif</td>
<td>to prevent sickness</td>
</tr>
<tr>
<td>Jamu promotif</td>
<td>for health and physical fitness purposes</td>
</tr>
<tr>
<td>Jamu rehabilitasi</td>
<td>for health recovery purpose</td>
</tr>
<tr>
<td>Jamu keperkasaan</td>
<td>for sexual stamina</td>
</tr>
<tr>
<td>Jamu kewanitaan</td>
<td>for women’s intimate area</td>
</tr>
</tbody>
</table>

SCENARIO 2: Personalized Jamu

The result of this process is an ontology that can be used to represent information on jamu in a semantic web. The ontology allows users to easily obtain information on jamu. Users refer to people who are sick or have health issues and are trying to seek alternative medication as a solution.

TABLE II
LIST OF DISEASES AS A RESULT OF GENERALIZATION

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jantung Koroner</td>
<td>Jantung Koroner</td>
<td></td>
</tr>
<tr>
<td>Jantung Rematik</td>
<td>Jantung Rematik</td>
<td></td>
</tr>
<tr>
<td>Radang Jantung</td>
<td>Radang Jantung</td>
<td></td>
</tr>
<tr>
<td>Kejang Jantung</td>
<td>Kejang Jantung</td>
<td></td>
</tr>
<tr>
<td>Jantung Hipertensif</td>
<td>Jantung Hipertensif</td>
<td></td>
</tr>
<tr>
<td>Serangan Jantung</td>
<td>Serangan Jantung</td>
<td></td>
</tr>
<tr>
<td>Jantung Berdebar</td>
<td>Jantung Berdebar</td>
<td></td>
</tr>
<tr>
<td>Jantung</td>
<td>Jantung</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>Stroke</td>
<td></td>
</tr>
<tr>
<td>AsamUrat</td>
<td>AsamUrat</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Infeksi Penyembuhan Menstruasi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infeksi atau Penyembuhan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mioma Uteri</td>
<td>Mioma Uteri</td>
<td></td>
</tr>
<tr>
<td>Kemandulan Wanita</td>
<td>Kemandulan Wanita</td>
<td></td>
</tr>
<tr>
<td>Gangguan Reproduksi</td>
<td>Gangguan Reproduksi</td>
<td></td>
</tr>
<tr>
<td>Gangguan Hormon</td>
<td>Gangguan Hormon</td>
<td></td>
</tr>
<tr>
<td>Kerasakan Sel Telur</td>
<td>Kerasakan Sel Telur</td>
<td></td>
</tr>
<tr>
<td>Keputihan</td>
<td>Keputihan</td>
<td></td>
</tr>
<tr>
<td>Kemandulan Pri</td>
<td>Kemandulan Pri</td>
<td></td>
</tr>
<tr>
<td>Kerasakan Sperma</td>
<td>Kerasakan Sperma</td>
<td></td>
</tr>
<tr>
<td>Ejakulasi Dini</td>
<td>Ejakulasi Dini</td>
<td></td>
</tr>
<tr>
<td>Gairah Seksual Rendah</td>
<td>Gairah Seksual Rendah</td>
<td></td>
</tr>
<tr>
<td>Stamina Seks Buruk</td>
<td>Stamina Seks Buruk</td>
<td></td>
</tr>
<tr>
<td>Lemah Syawat</td>
<td>Lemah Syawat</td>
<td></td>
</tr>
<tr>
<td>Infeksi</td>
<td>Infeksi</td>
<td></td>
</tr>
<tr>
<td>Impotensi</td>
<td>Impotensi</td>
<td></td>
</tr>
<tr>
<td>Ereks Buruk</td>
<td>Ereks Buruk</td>
<td></td>
</tr>
</tbody>
</table>
SCENARIO 2: Jamu data classification

We obtained a total of 120 jamu recipes. Each title contains herb name, its purpose, and type of disease. The recipes are categorized by its title. The categorization of jamu recipe is carried out by manually separating the sentence structure of the title into subject, predicate, and object as a way to understand the meaning of each jamu recipe. The categorization resulted in 73 jamu kuratif, 6 jamu preventif, 21 jamu keperkasaan, and 20 jamu kewanitaan.

We found some diseases that can be generalized into more common diseases. Therefore, we acquired a total of 17 diseases as seen in Table II.

2) Definition of Needs

The definition of needs in the development of this ontology is found in the following competency questions:

Competency Question 1: What is Indonesian traditional jamu? Indonesian traditional jamu is traditional medicine originated from Indonesia. Its benefits have been proven based on empirical data. Jamu can be produced using jamu recipe and consumed in the form of hot drink, powder, liquid, tablet, or capsule.

Expected answer: The system is able to show all the information related to jamu.

Competency Question 2: What are the categories of Indonesian traditional jamu? Jamu can be classified into 3 categories namely jamu kesehatan (jamu for health purpose), jamu kecantikan (jamu for beauty), and jamu kesenangan (jamu for pleasure). Jamu kesehatan is divided into 4 sub-categories which are jamu kuratif (curative jamu), jamu preventif (preventive jamu), jamu promotif (promotive jamu), and jamu rehabilitation (rehabilitative jamu). Jamu kesenangan (jamu for pleasure) has 2 sub-categories namely jamu keperkasaan (jamu to increase men’s sexual stamina) and jamu kewanitaan (jamu for women’s intimate area).

Expected answer: The system is able to show that the data have been correctly categorized.

Competency Question 3: What are the ingredients of Indonesian traditional jamu? The ingredients of Indonesian traditional jamu are part of medicinal plants, namely root, tuber, stalk, leaf, fruit, and flower.

Expected answer: The system is able to demonstrate the relation between ingredients and jamu.

Competency Question 4: Which diseases can use Indonesian traditional jamu as alternative medicine? Jamu can heal 23 different kinds of diseases.

Expected answer: The system is able to demonstrate the relation between diseases and jamu.

3) Informal Ontology Specification

Fig. 2 visualizes the concept and relation found in Indonesian traditional jamu recipe ontology. The terms of the ontology can be seen in Table III.

4) Informal Ontology Specification

The following shows the ontology (Fig.2) formalized as TBox:

- Jamu is Indonesian traditional medicine
  - Jamu ⊑ Obat_Tradisional_Indonesia
- Jamu for health purpose is jamu
  - Jamu_Kesehatan ⊑ Jamu
- Jamu for beauty is jamu
  - Jamu_Kecantikan ⊑ Jamu
- Jamu for pleasure is jamu
  - Jamu_Kesenangan ⊑ Jamu
- The intersection of Jamu_Kesehatan, Jamu_Kecantikan, and Jamu_Kesenangan is an empty set
  - Jamu_Kesehatan ∩ Jamu_Kecantikan ∩ Jamu_Kesenangan ⊥
- Curative jamu is jamu for health purpose
  - Jamu_Kuratif ⊑ Jamu_Kesehatan
- Preventive jamu is jamu for health purpose
  - Jamu_Preventif ⊑ Jamu_Kesehatan
- Promotive jamu is jamu for health purpose
  - Jamu_Promotif ⊑ Jamu_Kesehatan
- Rehabilitative jamu is jamu for health purpose
  - Jamu_Rehabilitasi ⊑ Jamu_Kesehatan
- The intersection of Jamu_Kuratif, Jamu_Preventif, and Jamu_Rehabilitasi is an empty set
  - Jamu_Kuratif ∩ Jamu_Preventif ∩ Jamu_Rehabilitasi ⊥
- Jamu to increase men’s sexual stamina is jamu for pleasure
  - Jamu_Keperkasaan ⊑ Jamu_Kesenangan
- Jamu for women’s intimate area is jamu for pleasure
  - Jamu_Kewanitaan ⊑ Jamu_Kesenangan
- The intersection of Jamu_Keperkasaan and Jamu_Kewanitaan is an empty set
  - Jamu_Keperkasaan ∩ Jamu_Kewanitaan ⊥
- Medicinal plant is a jamu ingredient
  - Tanaman_Obat ⊑ Bahan
- Root is a medicinal plant
  - Akar ⊑ Tanaman_Obat

<table>
<thead>
<tr>
<th>No</th>
<th>Property</th>
<th>Domain</th>
<th>Range</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pengobatanAlternatif</td>
<td>Jamu</td>
<td>Penyakit</td>
<td>Object</td>
</tr>
<tr>
<td>2</td>
<td>hasForm</td>
<td>Bahan</td>
<td>Literal</td>
<td>Data type</td>
</tr>
<tr>
<td>3</td>
<td>hasIngredient</td>
<td>Bahan</td>
<td>Person</td>
<td>Object</td>
</tr>
<tr>
<td>4</td>
<td>hasAuthor</td>
<td>String</td>
<td>Data type</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>hasName</td>
<td>String</td>
<td>Data type</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>hasName</td>
<td>Non-negative integer</td>
<td>Data type</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>hasAmount</td>
<td>Bahan</td>
<td>String</td>
<td>Data type</td>
</tr>
<tr>
<td>8</td>
<td>hasUnit</td>
<td>String</td>
<td>Data type</td>
<td></td>
</tr>
</tbody>
</table>

TABLE III

INDONESIAN TRADITIONAL JAMU RECIPE ONTOLOGY PROPERTIES
- Tuber is a medicinal plant
  Umbi ⊑ Tanaman_Obat
- Stalk is a medicinal plant
  Tangkai ⊑ Tanaman_Obat
- Fruit is a medicinal plant
  Buah ⊑ Tanaman_Obat
- Leaf is a medicinal plant
  Daun ⊑ Tanaman_Obat
- Flower is a medicinal plant
  Bunga ⊑ Tanaman_Obat
- The intersection of dari Akar, Umbi, Tangkai, Buah, Daun and Bunga is an empty set
  Akar ⊕ Umbi ⊕ Tangkai ⊕ Buah ⊕ Daun ⊕ Bunga ⊥
- Jamu has ingredients which are medicinal plants
  ∀hasIngredient.Jamu ⊑ Bahan
- Jamu is an alternative medicine for diseases
  Penyakit ⊑ PengobatanAlternatif.Jamu

B. System Testing Design
1) Completeness Check
   Competency questions are the parameters used to evaluate an ontology. There are 4 competency questions. For each question, there will be an example question along with the expected answer used to validate the ontology as seen in Table IV.

2) Precision, Recall and Accuracy
   The system’s performance in the completeness check process is measured using precision, recall and accuracy. The system’s average percentage of precision, recall and accuracy are calculated using equations (1), (2), and (3).

\[
P = \frac{PCQ_1 + PCQ_2 + PCQ_3 + PCQ_4}{4} \quad (1)
\]
\[
R = \frac{RCQ_1 + RCQ_2 + RCQ_3 + RCQ_4}{4} \quad (2)
\]
\[
A = \frac{ACQ_1 + ACQ_2 + ACQ_3 + ACQ_4}{4} \quad (3)
\]

Information:
- CQ = Competency Question
- Q1 = Question 1
- FF = Formal Form
- EO = Expected Output/Expected answer

IV. RESULT AND DISCUSSION
   The knowledge model for Indonesian traditional herbal medicine can be fully applied to RDFS and RDF. In its application, it consists of the following classes:
   - Jamu class has 3 sub classes namely jamu kesehatan, jamu kecantikan and jamu kesenangan;
   - Bahan (ingredient) has 1 sub class namely tanaman obat

![Fig. 2. Indonesian traditional jamu recipe ontology](image)
(medicinal plant) class. Akar (root), buah (fruit),bunga (flower), daun (leaf), tangkai (stalk) and umbi (tuber) are sub classes of tanaman obat;

- Person class/foaf:Person;
- Penyakit (disease) class.

Besides class implementation, some fundamental properties are implemented. There are:

- pengobatanAlternatif, hasIngredient and hasAuthor are object properties with jamu class as its domain and penyakit class, bahan class and person class respectively as its range;
- hasName, hasAmount and hasUnit are data type properties belonging to bahan class;
- hasForm and hasName are data type properties belonging to jamu class;
- index is an additional data type property belonging to jamu class which aims to simplify the management of jamu recipes in this research;
- rdfs:label property is used by penyakit and person classes for the purpose of data search.

In this research, there are 120 jamu instances already created based on the T-Box RDFS model. Those instances consist of 79 jamu kesehatan instances (73 jamu kuratif instances, 6 jamu preventif instances), 41 jamu kesehatan instances (21 jamu keperkasaan instances and 20 jamu kewenian instances). In total, there are 205 bahan instances which consist of 16 akar instances, 54 buah instances, 7 bunga instances, 80 daun instances, 11 tangkai instances and 31 umbi instances. There are 17 penyakit instances and 2 person instances.

The search function in this system uses SPARQL to return information on jamu objects. From the results of the search experiment, the results of the performance are shown in the Table V. Search experiments that have been conducted are based on 4 questions:

<table>
<thead>
<tr>
<th>TABLE V PRECISION, RECALL, AND ACCURACY RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>CQ 1</td>
</tr>
<tr>
<td>CQ 2</td>
</tr>
<tr>
<td>CQ 3</td>
</tr>
<tr>
<td>CQ 4</td>
</tr>
<tr>
<td>(%)</td>
</tr>
</tbody>
</table>

CQ 1: What Jamu are on the system? Result: The system displays a total of 120 records, all of which are Jamu.

CQ 2: What are the jamu that are jamu kesehatan? Result: The system displays a total of 79 records, all of which are jamu kesehatan.

CQ 3: What are the jamu that contain kencur (tuber)? Result: The system displays a total of 5 records, all of which are jamu containing kencur.

CQ 4: What jamu are used in alternative medicine for uric acid (asam urat)? Result: The system displays a total of 20 records, all of which are jamu used in alternative medicine for uric acid.

V. CONCLUSION

Based on Indonesian traditional jamu medicine literacy that is used in this research, knowledge models have been developed and tested in a controlled system environment. Utilization of SPARQL has succeeded in providing the function of finding jamu information to users. However the jamu representation model that has been developed in this study is not connected with detailed medicinal plant ontology. In addition, this Indonesian traditional jamu model needs to present the consumption rules or the contraindication. These things can be done for further works.

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