ONTOLOGY SYSTEM DESIGN FOR HERBAL PLANTS

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Abstract- In Indonesia there are at least 30,000 species of plants and 9600 of them are known to have medicinal properties, but only 200 species are utilized because of the lack of public knowledge about herbal plants. This research was conducted to create an android based mobile application containing herbal information because android users are increasing, and to process the data ontology method are used. The data obtained using the literature study will be processed and inserted into the Protégé tools that can be used to build the ontology. Once the data has been entered and mapped the data will be stored into the OWL file, and the data can be accessed using SPARQL. The android app will be built using Android Studio. This application can help increase people's knowledge about herbal plants according to their needs. The objective of this research are increase community knowledge about the function and how to use herbs to cure some diseases, help people's health through the use of herbal plants and facilitate the public in seeking general information about herbs such as names and content in it.

Keywords – Herbal Plants, Ontology System Design, Android, Eight Diseases, SPARQL

1. INTRODUCTION

Nowadays, many people are using smartphones. In Indonesia more than 100 million people use smartphones and of course will continue to grow over time. Indonesia also occupies the fifth position in the number of smartphone users in 2016 [1]. This is also accompanied by the many applications available for the smartphone itself, and by 2016 there are tens of millions of apps downloaded by smartphone users, especially Android users in Google play store. Herbs are selected because in Indonesia alone it has been recorded not less than 30,000 types of plants and among them there are 9,600 species of plants known to have medicinal properties [2]. However, only 200 species or plant species are used as raw materials for traditional medicine industry, it can be concluded that the herbal medicine opportunity in Indonesia is quite wide. Apart from that, globally, the use of herbs as medicines is still very minimal from about 250,000 to 500,000 plants, only 15 percent have been phytochemical researched, while plants that have been biologically tested only 6 percent [3]. Based on this came an idea to create an application containing herbal information that can be used by the community. In conducting this research, there is a goal to be achieved after the study ends, and it is to facilitate the public in searching for general information about an herbal plant such as the biological name for some plants and the compound in it that is also in accordance with their needs.

2. PROPOSED METHODOLOGY

2.1 Ontology

In doing this research, the method to be used is Ontology, this method is chosen because this method is the most appropriate method with the research that will be done, where in the implementation will classify the data of herbal plants and connect based on entities between classes. Based on the object of research that is herbal, ontology have been decided to be used to classify the herbal data. The grouping will be made based on the parameters used for this study, which are groupings based on the type and content present in the herbs.

2.2 Data Colleting Technique

The process of collecting data is done in two ways, the first is an interview to a doctor, which aims to obtain data about common diseases that attack the general public, the second is to conduct a literature study that will be used to obtain data on herbal plants, components, and usability.

2.3 Protege

Protégé shows in Figure 1 is an open source software used for system development that acts as a knowledge management system. Applications developed with Protégé are commonly used in problem solving and decision-making in a domain [14]. The protégé was developed by a team at Standford Center for Biomedical Informatics Research, and Plug-in from Protégé tools can be used to build both simple and complex ontology-based applications. In addition Protégé is also an open source software, quite easy, or has a SPARQL feature that can be used to determine if the query that has been done can run correctly or not.

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Figure 1.   Protege

2.4 Android Studio

In this research, an android mobile app will be created, and the tools to be used are Android Studio. Android Studio is an Integrated Development Environment-Integrated Development Environment (IDE) for Android application development, based on IntelliJ IDEA. In addition to being an IntelliJ code editor and powerful developer tool, Android Studio offers more features to increase your productivity when creating Android apps [12].

3. ANALYSIS AND RESULT

3.1 Identification

At this stage, identification of the needs required by the application to be built, so that the manufacturing process can run smoothly, and produce a good application and appropriate initial goals. To obtain the data, it is necessary to study the literature [7, 10 and 13] on the existing herbs and their usefulness, but also to conduct an interview to a health expert, a doctor, and also to conduct a literature study. There is the list of eight illnesses and 25 of herbals (Table 1) that considered in this research:

- Fever
- Cough
- Influenza
- Sore Throat
- Diarrhea
- Diabetes
- High Blood Pressure
- Malaria

Table I. List of Herbs and Related Diseases

No	Herbal	Diseases
1	Ginger	Cough, Diarrhea
2	Turmeric	Cough, Influenza, Fever, Sore Throat, Malaria
3	Jackfruit	Diarrhea
4	Garlic	High Blood Pressure
5	Papaya Leaf	Malaria
6	Bay Leaf	Diabetes, Fever
7	Sambiloto Leaf	Diabetes
8	Bay Leaf	Fever, Sore Throat, Malaria
9	Soursop	Diarrhea
10	Guava	Fever, Sore Throat, Diarrhea
11	Lime	Cough
12	Cinnamon	Diabetes
13	Kencur	Cough
14	Galangal	Fever, Malaria, Diarrhea
15	Mahkota Dewa	Diabetes
16	Tapak Dara	High Blood Pressure
17	Kenanga	Malaria
18	Mengkudu	High Blood Pressure
19	Kumis Kucing	High Blood Pressure
20	Celery	Diarrhea
21	Waru	Fever
22	Pukul Empat	Sore Throat
23	Cendana	Sore Throat
24	Sendok	Diarrhea
25	Cashew Fruit	Diabetes

3.2 Design

This stage describes in Figure 2. Firstly the data collected will be analyzed and will be used as a reference in class and subclass creation on ontology. The process of creating these classes and subclasses will involve the use of the Protégé tools. The second step is to make a determination of the property. At this stage will determine the object property and data properties, which will be required as attribute and relation of each data. First of all object property created based on class and subclass created before, this is because in each class there will have data property respectively. After that will create the property data, this time the creation will be affected by the object property that has been created, this property data will be useful to give name to each class and data to be included into this ontology, because each data will have its own name used to identify any data. The Third step that needs to be done is to classify all data entered into ontology. Each incoming data must have at least one relation with other data, in order to be used or taken based on the relation they have. Herbal plant data will have a relationship with the class description, and class disease. All data will be given relation to each other, after which the data is ready and stored in the form of OWL file, which will be used in application. This process is included in Fourth Step. Then is the creation of a SPARQL query that will be used to retrieve data from the OWL file in Fifth step. The main process in this step is create the query, it must first be specified PREFIX, ie the name of the place where the data is retrieved. In this process WHERE specifies, to constrain the data to be retrieved, by specifying the conditions or conditions to be met to retrieve the data. In the WHERE, there is FILTER, which is useful for classifying data retrieval. The Sixth step is develop the application, starting from the design how the application will look up to the function in the application. Finally, the last step creates a connection between the OWL file containing ontology data that has been created with the created application.
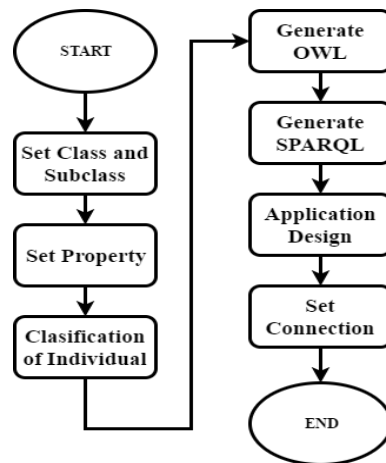

Figure 2. Flowchart System Development

3.3 Construct and Build

Data is the most important element., first the class and subclass must be set in the Protege, and after that, set the property that will became a bride between the class and individual, next from the data must clasified one by one and insert them to protege as an individual and set theri connection, the next step is to generate the OWL file. After that, finish the OWL, create the SPARQL to retrive the data inside the OWL file, then make the Application Design for the Android application that will be created, and the last step is to set the connection between application and OWL file. Figure 3 describes the class structure that have been made in the Protage, from the top is Thing, this is the default class from Protage and it's doesnt matter if don't do anything about this, next is class Herbal, this is the main class for the OWL, and under this class there is two subclasses. The first subclass is Description and the other one is Disease, for the first subclass Description will be filled with information about herbal, about Compound and type of the herbal, Compound subclass will be about the compound in the herbal that's in the OWL, and for the Type subclass will be about what part of the plant that the herbal is from, for example like leaf, root, etc.The other main subclass is disease, in this subclass the content will be illnesses data from interview, but the individual or the data about the illnesses will be putted in the subclass Symptoms.
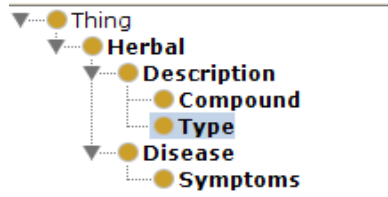
Figure 3. Class & Subclass

Fig 4 is the Object Property that created to make a link between classes and individual, first there is the description but in this research wont using this, but the sub that will use, that is hasCompound that will be used to connect the herbal name and the compound that herbal has, and for the Herbal_Type, is to connect the herbal name, and what type or from what part of plant is that herbal is from. And for the other property that is Disease wont be used either, but the sub will be used that is Needs, this sub has a role to connect the illnesses and the compound that can help cure the illnesses.
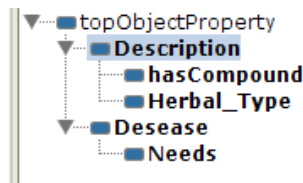

Figure 4. Object Property

Fig 5, is the Data Property in this OWL. Data property has a role to define the content of the individual, for example is to define the herbal name, or the compound name etc, for this research only gonna be use to define the name of the individuals. There are 5 data properties that hasCompounName, hasHerbalName, hasNeedsName, hasSymactionsName, and hasTypeName.
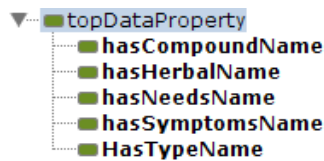

Figure 5. Data Property

Figure 6 describes some individuals that has been inserted to Protege and there is a link between individual and where the individual will be placed in the class, in the rigth side is the link using the Object Property, and also the name using the Data Property, and the left side is where this individual is located in the OWL.
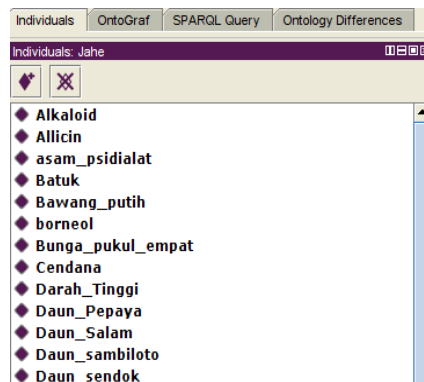

Figure 6. Individual

In order to view the contents or individual of existing classes and subclasses simply by double clicking on the desired class or subclass that has the symbol (+). Individuals in a class will have a blue arrow. The following look at this picture is an example of a display when displaying an individual on an herbal class. In addition, we can also see the relationship between individuals and existing properties in a similar way that is to double click on individuals who have the symbol (+). In Figure 7 shows the relation between the individual and the property, and can see in more detail when doing hover to the existing arrow. Here's an example of a relationship between individuals.
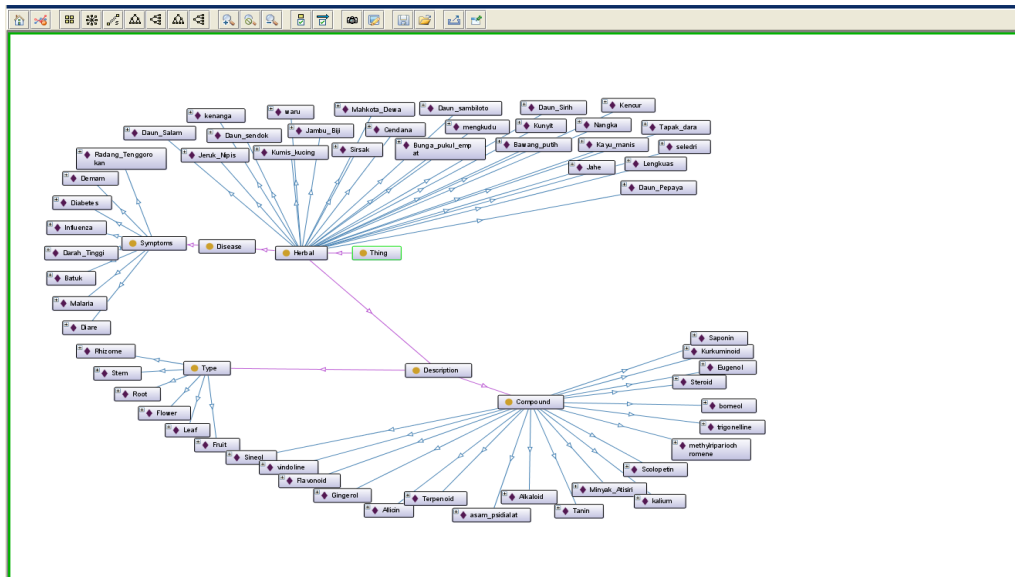

Figure 7. All *Class* with all Individual

Figure 8 shows the application in this research, and this is the home design for the application, it has five navigations that can be choose: Home, Symptoms, Part, Herbal, and About.

Figure 8. Home

In the application, there are Symptoms, Part, and Herbal which have similar function. In these menu, choose form the dropdown list which has been provided then simply press the search button and the result will be put to screen. In the Symptoms it will show some herbal name that can help for the Symptoms which has been selected before, while in the part menu similar to the Symptoms but instead illnesses, there is a dropdown list of plants part name, and if the user chooses one

of them and press the search button, the application will display list of herbal name that you can get from that part of plants, for example user choose fruit and the application will display name of fruit that can be used for medication.

The Herbal menu is for the user that want to know more information about some herbal. In this menu, user can choose herbal name which has been provided then press the search button, and the application will display the infornation about the herbal plant, for example the iformation about the shape of the herbal, the biological name, characteristics, and to the recipe that can be used to cook the herbal for medication.

```
@$modelFactory = ModelFactory::getDefaultModel();
@$modelFactory->load(RDFAPI_INCLUDE_DIR . '../test.owl');
    $querystring = '
    prefix herbal: <http://www.semanticweb.org/david/ontologies/2017/3/untitled-ontology-8#>
    SELECT distinct ?herbal
    WHERE
    {
        ?herbal rdf:type herbal:Herbal.
        ?herbal Herbal:type ?part.
        FILTER
        (
            regex(str(?type),"'.$part.'","i")
        )
    }';
```

Figure 9. Sparql Part

Figure 9 shows SPARQL that has been made to search herbal name base on the part. The SPARQL will be used in the application menu part. In this SPARQL first choose which OWL file that gonna be used, then set the prefix, next step is similar in SQL about how to select, in here select the herbal name, where the herbal part is the same with the part that has been choose by the user.

4. ANALYSIS

There are three category that can be seen about before and after this application is used:

The first category is about how to search general information about herbal name and compound, before the application, need to search from books or ask the expert about herbal or search manualy in the internet that is ok but still takes some time because there are so many information in the internet that is difficult to differentiate between the real information and the fake information. After using this application, to search such information that only need to choose the name of the herbal and the application will display all the information about it, and the information is pretty much true because the information is from book, and journal that has been publish legally.

The second category is help people's health, before using the application, many people in this time and age always depends on chemical drugs, and after the use of the application people will gain more information about herbal and they can see which herbal can help their illness, and of course they gonna save money because some hrebal are relatively cheaper than modern chemical drugs.

The third category is how to search information about how to use herbal plants. Before using the application general people nowadays only have alittle bit of information about herbal, and even in they know about the herbal, not necessarily the know about how to use the herbal so they must go the expert about herbal to know about it. After using the application, to get the information about how to use the herbal is became alot easier than before, because in this application there gonna be alot of information about herbal include how to use or cook the herbal according to their needs.

5. CONCLUSIONS

Ontology system design for hrebal plant based on mobile can be used well based on all the respondents who have used it. Information on herbal plants obtained through literature studies of published books and journals, in this application is used ontology to process input from the user for the results that come out in accordance with the needs of the user. In the application there is a search based on the disease as well as parts of the plant that can be seen to help the user in finding the necessary herbal information. Search results appearing in accordance with previously collected data. In addition, there is a menu of herbal information that displays in detail certain herbal information required by the user.

The design and development of class and subclass of this system is done using ontology method. Class and subclass that is built is Herbal class as the main class that has two subclasses that is class Description and Desease, and subclass also has subclass that is, Compound and Type as subclass Description, and symptoms as subclass Desease.

6. REFERENCES

[1] Yovanda, Y. R. (2016, December 17). Smartphone Users in Indonesia Largest 5th in the World. Taken from Sindonews:

[2] Kominfonewscenter. (2010, July 25). Kominfonewscenter. Taken from kominfonewscenter :.

[3] Riyandi, R. (2017, January 18). Thousands of Herbal Plants in Indonesia Not Optimally Utilized. Taken from Republika:.

[4] Gruber, T. R. (1995). Toward Principles for the Design of Ontologies Used for Knowledge Sharing.

[5] Guarino, N. (1998). Formal Ontology in Information Systems: Proceedings of the 1st International Conference. Trento.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa. (August 1987) "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741.

[7] Herbie, T. (2015). Book of Medicinal Plants. Yogyakarta: Octopus publishing House.

[8] Mooz, H., & Forsberg, K. (2001). A visual explanation of the development methods and strategies including the waterfall, spiral, vee, vee+, and vee++ models.

[9] Alatrish, E. (2013). Comparison Some of Ontology. Comparison Some of Ontology.

[10] Kamboj, V. P. (1999). Herbal medicine. Herbal medicine.

[11] Kapoor, B., & Sharma, S. (2010). A Comparative Study Ontology Building Tools. A Comparative Study Ontology Building Tools.

[12] Neji, H., & Bouallegue, R. (2012). Ontology for Mobile Phone Operating. Ontology for Mobile Phone Operating.

[13] Pal, S. K., & Shukla, Y. (2003). Herbal Medicine: Current Status and the Future. Herbal Medicine: Current Status and the Future.

[14] Pollock, J. T. (2009). Semantic Web for Dummies. Hoboken: Wiley Publishing, Inc.