International Journal Of Engineering Research And Development
e- ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 14, Issue 9 (September Ver. I 2018), PP.63-67

Nigerian Geography Ontology for Semantic Web Applications

Aliyu Rufai Yauri ,S B. A Mohammed
Information and C Communication Technology Department
Electric and Electronics Engineering Department
Kebbi State University of Science and Technology, Nigeria.
Corresponding Author: Aliyu Rufai Yauri

ABSTRACT: *Semantic Web was introduced to overcome the challenges of the current Search engines where retrieval process is based on traditional keyword search. Retrieval based on traditional keyword search lacks semantics and as a result a lot of irrelevant results are returned. In Semantic Web, retrieval process is based on semantic which returned a more precise and relevant results. The main building block of Semantic Web is ontology. Therefore ontology is needed to build Semantic Web retrieval application. There are various ontologies developed on different domains in recent years. However in Ontology development process, each domain has its own peculiar challenges. In this paper,Nigerian Geography Ontology was developed. The developed ontology is used to build a Nigerian Geography knowledge-base which can be used for the developmentvarious Semantic Web applications related to Nigerian Geography.*

KEYWORDS: *Ontology, Semantic Web, Geography, Nigeria, Retrieval*

Date of Submission: 03-11-2018 Date of acceptance: 17-11-2018

I. INTRODUCTION

To overcome the shortcomings of the traditional keyword search system, the concept of the semantic web was introduced by the W3C consortium. In the semantic web approach data is given a well-defined format that models the meaning of information on the web, as well as applications and services, so as to discover, annotate, process and publish data that is encoded in them (Zou, Finin, & Chen, 2004.). This is done to facilitate semantic searches of well-defined data, where computers understand the user's query intention and retrieve corresponding results based on matching concepts rather than keywords (Solskinnsbakk, 2012). Ontology is the main building block of semantic web (Andrew and Matthew, 2009). In simple terms ontology can be seen as objects that may exist in a particular domain and the relationships that may exist between the objects. Ontology can be seen as a deliberate semantic description of what is generally known about some real world phenomena in a domain of interest using concepts and relationship abstractions in a representation that is readable by both man and machine (Olawande Daramola, Mathew Adigunb, Charles Ayo,2009). With ontology, computer process data semantically instead of traditional keyword as in the current search engine. Therefore results returned by semantic Web applications are based on understanding of the user query and document itself. Computer understand the meaning of user query and has the knowledge of meaning of documents in the knowledgebase. For example, a query where is Sokoto located? In traditional keyword search, hundreds of pages are returned by Google because it does not understand the meaning of the query. Semantic Web application will give the exact answer because it understand exactly what the query is all about that the user is looking for location of Sokoto State.

This paper presents a developed Nigeria GeographyOntology. The developed Ontology has scope by concentrating on Nigerian Geographical locations. This will contain concepts on various locations in Nigeria and these concepts are related to each other. The developed ontology can be used to develop several Semantic Web Applications related to Nigerian Geographical locations. For exams an application can be developed to search for states that are in every geographical location in Nigeria. Various tourist attraction places in each of the states could also be searched. An application can be developed with the developed ontology to teach school children about the daily state and capital they learn on daily basis. A semantic search mechanism can be developed to enable them search for capital of every state and get answer within the matter of seconds. A visualization capability could also be present to visualize various geographical location of Nigeria using protégée plug-in Onto Graf.

This paper is presented as follow; chapter 1 introduction, section 2 literature review, section 3 Nigeria Geographical Location Ontology, chapter 4 evaluation, section 5 conclusion, section 6 reference.

II. LITERATURE REVIEW

The concept of the semantic web enables data to be stored in such a way that it is given well-defined meanings that facilitate easy interpretation by both computers and people .The main building block of the semantic web is ontology, which transforms web content into a machine-readable format that can be manipulated (Ahmed & Gerhard, 2007). Ontology is the main building block of the semantic web which transforms web content into a machine-readable and format that can be manipulated (Ahmed & Gerhard, 2007). Ontology, in other words Web Ontology Language (OWL), is commonly defined as formal, and explicit specifications of shared conceptualization. Formal signifies ontology as a machine-readable format. Whereas, the concepts or entities used are explicitly described, shared, and displayed, ontology is concept that captures knowledge in a widely acceptable standard, and its conceptualization reflects ontology as a notion that identifies entities in the real world (Hu, 2004). In other words ontology can simply be seen as the study of entities that exist in the real world, and the things they have in common (Lawson, 2004). Ontology facilitates standards for integrating and sharing data in a conceptual schema. Objects, entities or concepts are identified and annotated with the relationships that exist between them.

In the concept of ontology, an entity or object is referred to as the same thing. This research will be using 'concept' to denote an entity or object, while 'relationship' is seen as the things concepts have in common, known as properties. Properties can be classified into object properties and data properties. Object properties represent the semantic relationship between concepts, while data properties define the relationship between a concept and its literals. Annotation of concepts enables better descriptions of the concepts in the form of metadata, facilitating greater meaning for human and machines to easily process and share.

Ontology can be created automatically, semi-automatically, or manually (Erdmann, Maedche, Schnurr, & Staab, 2000). Automatic creation of an ontology involves using an automated tool to automatically generate the ontology from a domain (Balakrishna & Srikanth, 2008). Semi-automatic ontology creation involves a combination of human effort and automated tools (Balakrishna, Moldovan, Tatu, & Olteanu, 2013). Manual ontology is usually complex and time-consuming especially when dealing with a great deal of data (Ahmed & Gerhard, 2010). Manual ontology creation involves the design and creation of an ontology completely by a human expert (Tao, Embley, & Liddle, 2009).

Quite a number of researches have been presented by various researchers on ontology development methodology (Jean Vincent, Fonou-Dombeu, & Magda Huisman, 2011). An ontology development methodology is the process that describes various steps by step procedures that must be performed when building ontology. A domain expert analyses the domain and adds relationships by considering things such as what the ontology will cover, what the ontology will be used for, and the type of questions the ontology will serve. Relationships are added to enrich the ontology knowledge base that serves the semantic search systems. A domain expert therefore needs to look at the objectives of the project, i.e. the expectations of the functionalities using a particular domain. The expert should also consider the domain boundaries by looking at the scope of the domain and considering what should be included and what should not be included in the descriptions added to the concepts. Potential sources of information should also be considered when adding description to the ontology concepts. The domain expert should consider the source of information that will be used to add relationships to the ontology concepts. The sources of information for ontology development can be online sources, textbooks, and articles among others, that are related to the domain. Comprehensive studies of these previously reported ontology development methodologies are provided in (Fernandez Lopex, M, 1999) ,(Syed Malek F. D Syed Mustapha and Emmanuel Ukpe 2013).However, it is important to know that each domain come with different challenges during the development of such domain ontology. Although different ontology development methodologies have been reported previously by different researchers, most of those methodologies are manually based which requires domain expert to analyze the date, identify domain ontology concepts, identify the relationship and link the concepts with relationship. This process is hectic and more venerable to human error. Additionally, ontology development on Nigerians domains are still at its infant stage and therefore required further effort to develop ontology on various domain in order to facilitate the development of semantic web applications.

This paper presents a semi- automatic Ontology development for Nigerian Geography Ontology. The semi-automatic Ontology development involves the development of some section automatically by machine and some section manually. The next section will provide more details on the development of the Ontology

III. NIGERIAN GEOGRAPHICAL LOCATION ONTOLOGY

In this section, a step by step procedure on how the Nigerian Geographical Ontology was developed is presented. Figure 3.1 provides a graphical representation of the methodology used to develop the Geographical location ontology.

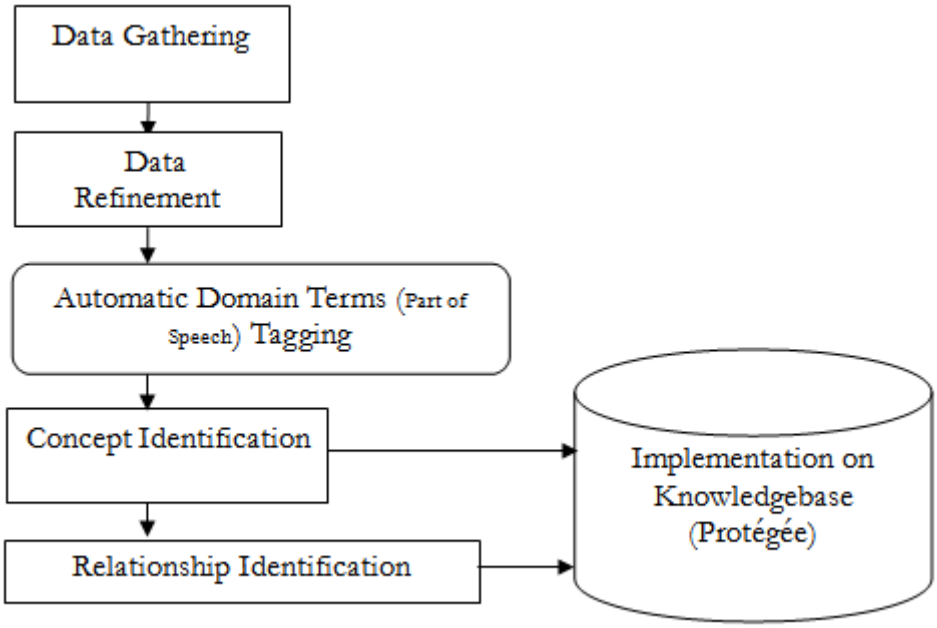

Figure 3.1: Framework of Onion Crop Production Ontology Development Methodology

Figure 3.1 shows the step by step procedures that will be involved in the implementation of this research. The research task for the Development of the onion crop production ontology isdivided into the following stages; Ontologyspecification, Data and requirement gathering, DataRefinement, Automatic Domain Terms (Part of Speech) Tagging, Concept Identification, Relationship Identification and Triple Generation

The first step of the proposed methodology isOntology specification. In this stage domain and scope of the ontology are clearly defined. The onion crop production ontology was started by defining its domain and scope. The ontology will cover onion crop production from land preparation toharvesting.

The second step is Data and Requirement Gathering (Acquiring Domain Knowledge). Here, a deep insight into and a thorough knowledge of the respective domain is prerequisite to construction of any domain ontology. Secondary data was used to generate data about the onion domain.

The next step is Data Normalization and Refinement. This stage also involved the data formalization and organization such that all redundancy is removed and avoided for better presentation. Also it involves making sure that all critical data is not missing.

After normalization, the next step is Automatic Domain Terms (Part of Speech) Tagging. A Part-Of-Speech Tagger (POS Tagger) is a piece of software that reads text in some language and assigns parts of speech to each word (and other token), such as noun, verb, adjective, etc.

From the domain tagged token an automatic Concept Identification is carried out to ascertain terms that are concepts in the onion domain .Concepts that represent the domain are identified and hence implemented by means of classes. This is the stage in which the conceptual model of the ontology is built.

Haven identified concepts of the onion domain, the next thing it identify relationship in order to get triple representation (subject, predicate, object). **Relationships Identification** identifies relationship between concepts in the onion domain

Lastly, after all concepts in onion domain are identified with their corresponding relationship, triple format it generated. Triple is the format in which ontology is represented to link each concept with it corresponding relationship. Triple is represented into (subject, predicate, object) where a subject is a concept, object is also a concept and relationship is what relates the subjects and object.

IV. KNOWLEDGEBASE DEVELOPMENT

In this section, the developed triples representations are stored in knowledgebase. Knowledgebase is a respiratory where triple representation of ontology is stored. There are various knowledgebase soft wares. In this paper Protégée ontology editor was used to store the Nigerian Geography Ontology.protogee is a software that is used to store and edit Ontology. Protogee provides capabilities of retrieval and visualizing stored ontology. Figure 4.1 presents graphical representation of the Nigerian Geography Ontology store in the protégée knowledgebase.

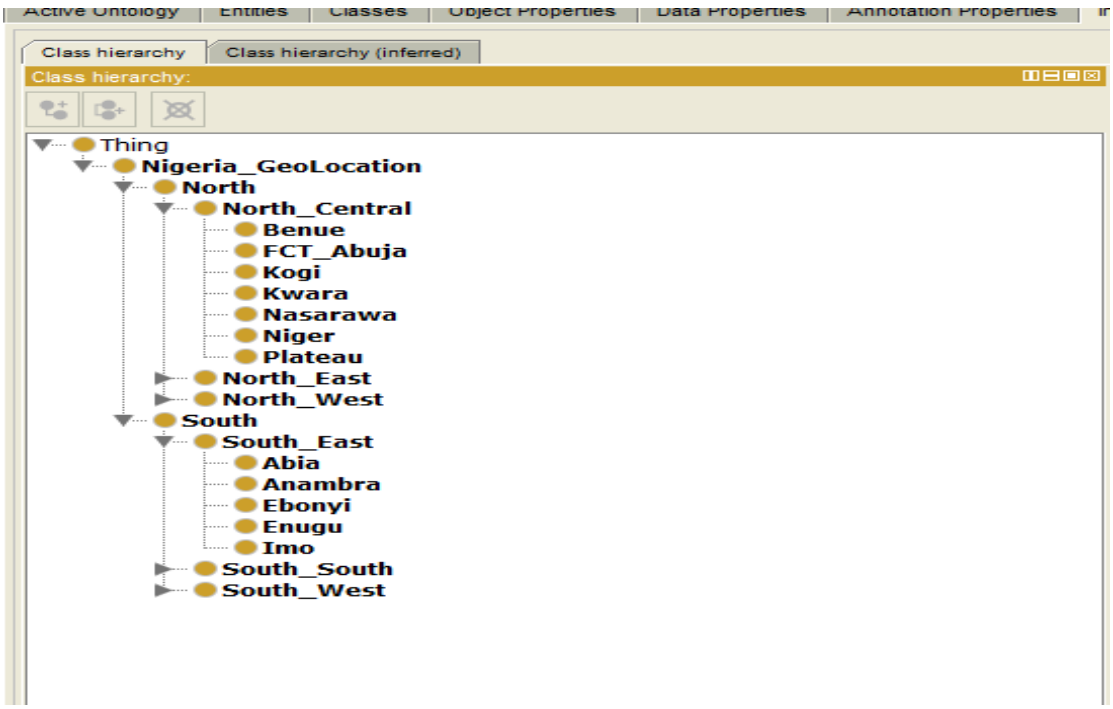

Figure 4. 1: Graphical Representation of Nigerian Geography Ontology in Protégée

In figure4.1 a Nigeria Geography Ontology was presented. The Ontology has "thing" as the root, which is the default protégée starting root. Every Ontology stored in protégée starts with the root concept "thing". Then Nigeira_geoLocation as the roots of the developed ontology. Protogee has a conventional naming style which is underscore(_) in between words of first word to begin small letter and the subsequent word begin with capital letter. Here Nigeira_geoLocation stands for Nigerian Geographical Location. There are three words which were written in protégée conventional naming style.

The Nigeira_geoLocation is the main concept which has sub-concepts under it. Sub_concepts are child nodes of the main concepts. In this Ontology Nigeira_geoLocation has sub_concepts as North and South which is specifying that Nigeria is divided into two regions mainly the North and South. Furthermore, both North and South has sub_concepts as geographical regions that are found in Nigeria. In the North there are threegeographical regions; North_West, North_East,North_Central while the South also has three geographical regions mainly; South_South, South_Wesrt,South_East. In the Ontology, each of the geographical regions has states that are under them. Figure 4.2 provides a visual representation of the Ontology using Ontograf . Ontograf is a plugin in protegee that enables visualization of the Ontology in form of concepts and sub-concepts node connected to each other via relationships.

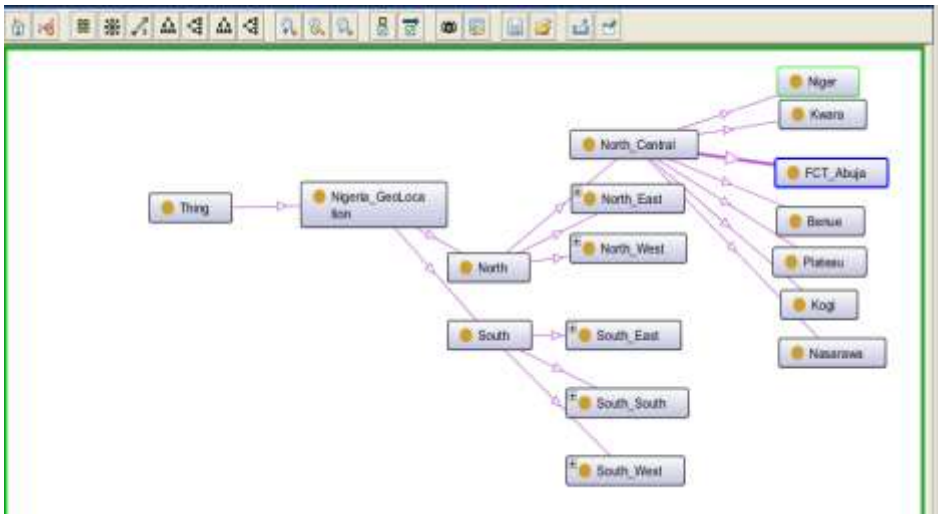

Figure 4.1: Visualization view of the Nigeria Geography Ontology Using OntoGraf

V. EVALUATION

For evaluation, human expert judgment was used. A Nigerian Geography expert judgment was used to validate the developed ontology. In the expert judgment data, various Geographical locations in Nigeria were categorized into concepts and related manually by expert. The semi-automatic approach in this paper was then compared with the expert judgment. The developed geography ontology proved to be 98% accurate with that of expert judgment.

VI. CONCLUSION

This research has presented a methodology for developing Nigerian Geography Ontology. The approach was based on semi-automatic ontology development approach. The approach proved to be 98% accurate based on expert judgment. However in this work, the Ontology developed focused on Nigerian Geographical Locations. In future, the domain will be further expanded to include more Nigerian Geography concepts. This will improve further chances of retrieving more effective results from the Ontology. Furthermore, a semantic search applications will be developed in order to be able to semantically retrieve data from the Ontology.

REFERENCE

[1]. Ahmed, Z., & Gerhard, D. (2007). Web to Semantic Web & Role of Ontology. In the proceedings of National Conference on Information and Communication Technologies, (NCICT-2007), Pakistan, 9th May 2007.

[2]. Andrew Perez-Lopez, Ryan Blace, Matthew Fisher, John Hebeler. "Semantic Web Programming" Wiley Publishing, Inc. 2009 (Olawande Daramola, Mathew Adigunb, Charles Ayo,2009)

[3]. Balakrishna, M., & Srikanth, M. (2008). Automatic Ontology Creation from Text for National Intelligence Priorities Framework (NIPF).*In Proceeding of 3rd International conference for Ontology for the Intelligent Community (OIC*), Fairfax, VA, USA, Dec 3-4.

[4]. Balakrishna, M., Moldovan, D., Tatu, M., & Olteanu, M. (2013). Semi-Automatic Domain Ontology Creation from Text Resources. *Proceedings of the Twenty-Sixth International Florida Artificial Intelligence Research Society Conference*, 3187–3194.

[5]. Hu, Y. (2004). The Semantic Web : Current Status and Future Directions. [Power Point slides]. Retrieved from http://www.cs.nccu.edu.tw/~jong/pub/mis0601talk.pdf

[6]. Jean Vincent, Fonou-Dombeu, & Magda Huisman, (2011). Combining Ontology Development Methodologies and Semantic Web Platforms for E-government Domain Ontology Development. International Journal of Web & Semantic Technology (IJWesT) Vol.2, No.2, April 2011. Fernandez Lopex. M(1990. Overview of Methodologies for Building Ontologies, Proceedings of the IJCAI-99 Workshop on Ontologies and Problem Solving Methods (KRR5) Stockholm, August 1999, Sweden.

[7]. Lawson, T. (2004) A Conception of Ontology, University of Cambridge, Faculty of Economics, Cambridge.

[8]. M. Erdmann, A. Maedche, H. Schnurr, and S. Staab. (2000). From manual to semi-automatic semantic annotation: About ontology-based text annotation tools. *In, Proceedings of the COLING 2000 Workshop on Semantic Annotation and Intelligent Content*, August 2000.

[9]. Solskinnsbakk, G. (2012). Contextual Semantic Search Navigation, PhD Thesis, Norwegian University of Science and Technology.

[10]. Syed Malek F. D Syed Mustapha and Emmanuel Ukpe, (2013). Agriculture Ontology for Sustainable Development in Nigeria. Journal of Advances in Computing 2013, 3(3): 57-59 DOI: 10.5923/j.ac.20130303.04

[11]. Tao, C., Embley, D. W., & Liddle, S. W. (2009). FOCIH : Form-based Ontology Creation and Information Harvesting. *In Proceedings of the 28th International Conference on Conceptual Modeling* , Gramado, Brazil.

[12]. Zou, Y., Finin, T., & Chen H. (2004). F-OWL: An inference engine for the semantic web, *Proceedings of the Third International Workshop (FAABS), April 16–18, 2004* , USA.

Aliyu Rufai Yauri " Nigerian Geography Ontology for Semantic Web Applications" International Journal Of Engineering Research And Development , vol. 14, no. 09, 2018, pp.63-67