International Journal of Advances in Intelligent Informatics
Vol. 3, No. 1, March 2017, pp. 20-26
ISSN: 2442-6571

Solving problem of semantic terminology in digital library

Herlina Jayadianti

Universitas Pembangunan Nasional "Veteran" Yogyakarta, Indonesia
herlinajayadianti@gmail.com

ARTICLE INFO

Article history:
Received November 8, 2016
Revised March 15, 2017
Accepted March 15, 2017

Keywords:
Semantic
Ontology
Digital Library
Different Term
Meaning

ABSTRACT

Effective information access involves the semantic interaction between users in searching activity to diverse information in the Digital Library. This is the focus of this research. The weakness of the online library system that is running is the difficulty of users looking for data collection library. There are many different perceptions that have the same meaning (synonym) in in terms of library collections such as Author and Writer. Therefore, in this research will focus on mapping between terminologies that supports to detect different meaning of perceptions .This technique can be considered as an attempt to understand the difference between perceptions in the interaction between users and information in digital libraries.

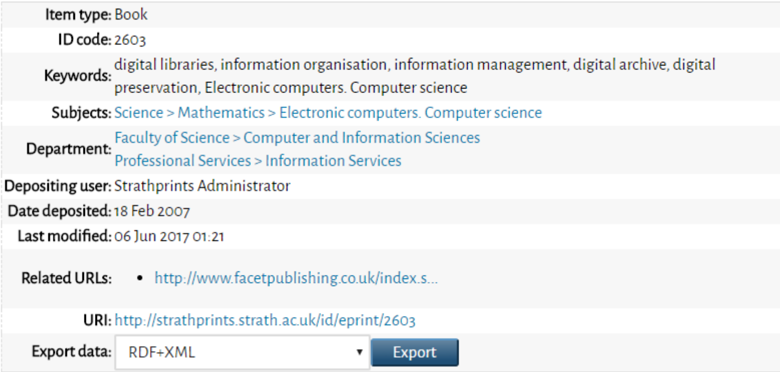
I. Introduction

A Digital library is is a special library with a focused collection of digital objects that can include text, visual material, audio material, video material, stored as electronic media formats , along with means for organizing, storing, and retrieving the files and media contained in the library collection. Digital libraries [1]–[4] can vary immensely in size and scope, and can be maintained by individuals, organizations, or affiliated with established physical library buildings or institutions, or with academic institutions. The digital content may be stored locally, or accessed remotely via computer networks. An electronic library is a type of information retrieval system [5]. Nowadays many digital library are already move to convensional search to semantic search. As is done by University of Strathclyde (uk). They using an RDF-XML [6] , JASON, N-Triple for suppporting a semantic searching process (Fig. 1 and Fig. 2).

Fig. 1. An interface of digital library in univerity of strathclyde

Many studies have been completed by using ontology in a specific domain such as library [8]–[11]. Paper from Thanker also discuss about digital library in Urdu language [8], and paper from Shina complete a research about digital library in Indian language [10]. We can underlined that language problem remains a problem in digital library case study. This research will focus on knowledge management in the digital library UPN Veteran Yogyakarta Indonesia.

DOI: http://dx.doi.org/10.26555/ijain.v3i1.70



Item type:	Book
ID code:	2603
Keywords:	digital libraries, information organisation, information management, digital archive, digital preservation, Electronic computers. Computer science
Subjects:	Science > Mathematics > Electronic computers. Computer science
Department:	Faculty of Science > Computer and Information Sciences Professional Services > Information Services
Depositing user:	Strathprints Administrator
Date deposited:	18 Feb 2007
Last modified:	06 Jun 2017 01:21
Related URLs:	• http://www.facetpublishing.co.uk/index.s...
URI:	http://strathprints.strath.ac.uk/id/eprint/2603
Export data:	RDF+XML Export

Fig. 2. RDF-XML, JASON and N-Triplle sudigital library in univerity of Strathclyde [7]

II. Methontology Methodology

Methontology is among the more comprehensive ontology engineering methodologies as it is one for building ontologies either from scratch, reusing other ontologies as they are, or by a process of re-engineering them. The framework enables the construction of ontologies at the *knowledge level*, *i.e.*, the conceptual level, as opposed to the implementation level. The framework consists of: identification of the ontology development process with the identification of the main activities, such as, (1) Evaluation, (2) configuration, (3) management, (4) conceptualization, (5) integration implementation; (6) a life cycle based on evolving prototypes; and (7) the methodology itself specifying the steps for performing the activities, the techniques used, the outcomes and their evaluation. Methontology methodology identifies three main types of activities: Project management activities; development-oriented activities; and support activities. [12]

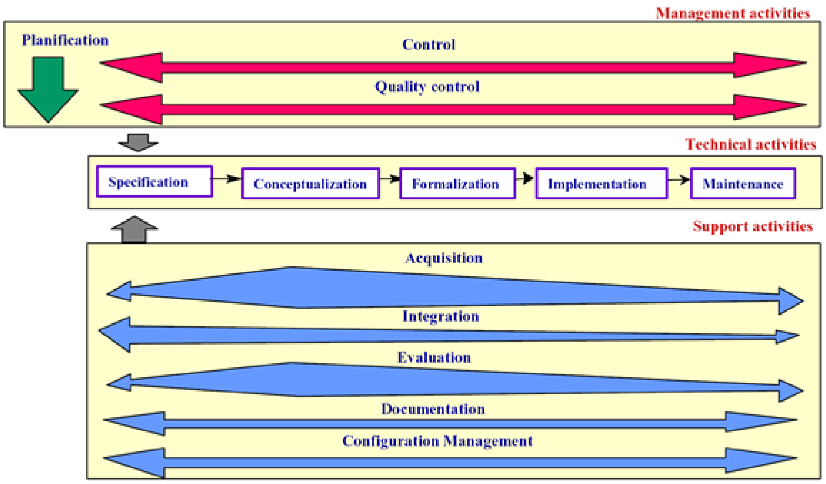


Fig. 3. Mehontology Methodology

- **Planning** identifies which tasks are to be performed, how they will be arranged, how much time and what resources are needed for their completion. This activity is essential for ontologies that need to use ontologies which have already been built or ontologies that require levels of abstraction and generality;
- **Control** guarantees that planned tasks are completed in the manner that they were intended to be performed;
- **Quality assurance** assures that the quality of each and every product outputted (ontology, software and documentation) is satisfactory, describing how these activities are performed.

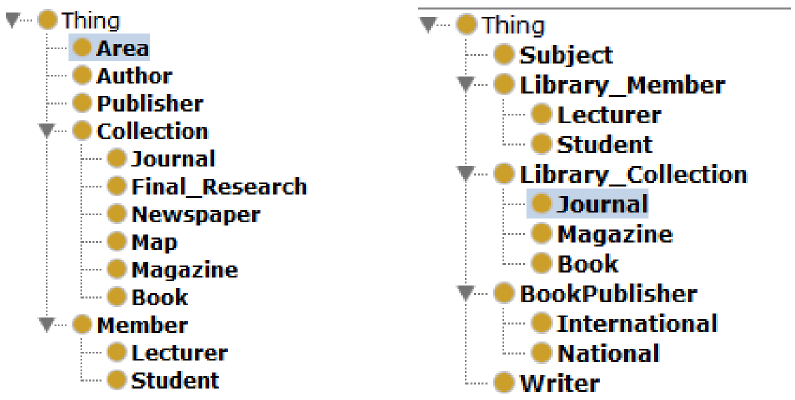
Development-oriented related activities include [12]:

1. Specification: states why the ontology is being built and what are its intended uses and who are the end-users;
2. Conceptualization structures the domain knowledge as meaningful models at the knowledge level;
3. Formalization: transforms the conceptual model into a formal or semi computable model.
4. Implementation: builds computable models in a computational language;
5. Maintenance: updates and corrects the ontology.

Methontology methodology describe very detailed the process to build an ontology for centralized ontology based systems. Methontology ontology includes : the identification of the ontology development process, a life cycle based on evolving prototypes, and particular techniques for carrying out each activity, and on the other hand 101 methodology underlines that the methodology should reflect reality. We are trying to build the proposed model describes the process in detail, and also reflects the reality.

III. Implementation

A digital library [2] is a repository of digital documents of different files formats like.pdf, .doc, .ppt or even plain .txt which can be any journal, newspaper, books, magazines, instruction manuals, presentations and others publications. Nowadays Ontology is very important for making an efficient searching in digital library. Ontology based digital library should have the additional features of semantic based accessing querying and searching the library using a reference ontology to reform the user query and extract only appropriate content from the library. In this section we will present a future face of digital library, it will work for different ontology support. In summary, our works requires available collections in one library [13] associated with each collection in another library [14]. Ontology 1 (Fig. 4a) consists of classes: ***Area, Author, Publisher, Collection, Member*** Ontology 2 (Fig. 4b) consists of classes: ***Subject, Library_Member, Library_Collection, BookPublisher, Writer***.

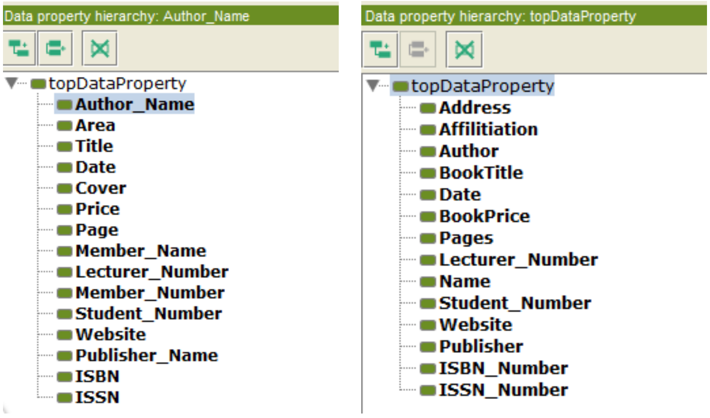


(a) (b)

Fig. 4. Classes in Ontology 1 (a) and Ontology 2 (b)

A. *Properties and Individual in Ontology 1 and Ontology 2*

OWL Properties represent relationships. There are two main types of properties, Object properties and Data type properties. Object properties are relationships between two individuals. In this section we will focus on Object properties; data type properties are described in next section. Object properties link an individual to an individual. OWL also has a third type of property – Annotation properties. Annotation properties can be used to add information (metadata — data about data) to classes, individuals and object/data type properties. Properties or attributes are roughly equivalent to slots in protégé. They are also known as roles in description logics and relations in UML and other object oriented notions. Fig. 5 shows a segment of Data properties in Ontology 1 (5a) and Ontology 2 (5b).



(a) (b)

Fig. 5. Data Property in Ontology 1 (a) and Ontology 2 (b)

DataProperty in Ontology1 (Fig. 5a consists of ***Author_Name, Area, Title, Date, Cover, Price, Page, Member_Name, Lecturer_Number, Member_Number, Student_Number, Website, Publisher_Name, ISBN*** and ***ISSN***. DataProperty in Ontology 2 (Fig. 5b) consists of ***Address, Affiliation, Author, BookTitle, Date, BookPrice, Pages, Lecturer_Number, name, Student_Number, Website, Publisher, ISBN_Number*** and ***ISSN_Number***. OWL allows the meaning of properties to be enriched through the use of property characteristics such as: Functional Properties: If a property is functional, for a given individual, there can be at most one individual that is related to the individual via the property. Functional properties in Ontology Library 1 e.g. ***Published,*** and ***WrittenBy*** are also known as single valued properties and also features.

Individuals, represent objects in the domain that we are interested in. An important difference between ontology and OWL is that OWL does not use the Unique Name Assumption (UNA). OWL allows us to define individuals and to assert properties about them. Individuals can also be used in class descriptions. For example, we could state that the following two URI references actually refer to the same person (Fig. 6)

```
<rdf:Description rdf:about="#Herlina_Jayadianti">
     <owl:sameAs rdf:resource="#H_Jayadianti"/>
</rdf:Description>
```

Fig. 6. URI references refer the same Individual

The owl:sameAs statements are often used in defining mappings between ontologies. It is unrealistic to assume everybody will use the same name to refer to individuals.

Inverse Functional Properties e.g. ***Publish***, and ***Published*** are inverse functional then it means that the inverse property is functional. For a given individual, there can be at most one individual related to that individual via the property. Properties may have a domain and a range specified. Properties link individuals from the domain to individuals from the range. Fig. 7 and Fig. 8 show OWLviz in Ontology 1 and Ontology 2.

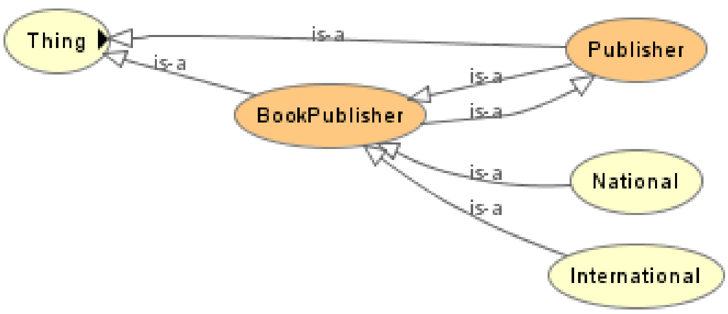


Fig. 7. Equivalences between Terms (Publisher ≡ BookPublisher) from Ontology 1

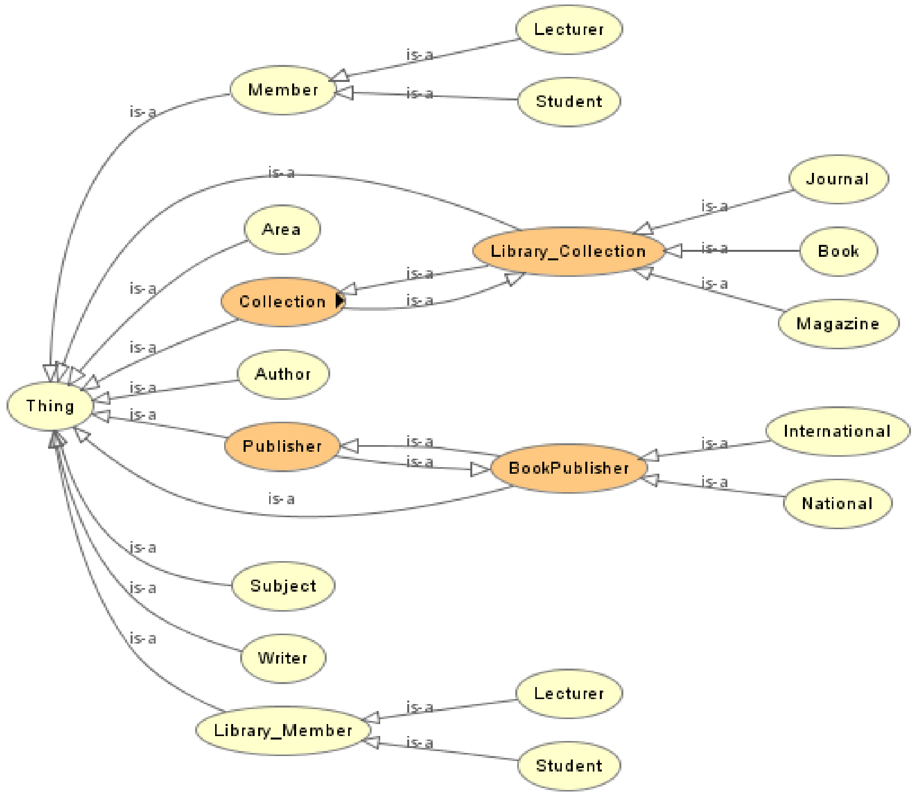


Fig. 8. Equivalences between Terms (Publisher ≡ BookPublisher) from Ontology 2

The concepts or classes "***Publisher***", "***Author***" in ontology 1 (Fig. 7) and "***BookPublisher***", "***Writer***" in ontology 2 (Fig. 8) are equivalent, they similarity refer to the same degree as being able to publisher concepts, but we can say that probably class or concept "***Publisher***" is more common than concept "***BookPublisher***" or maybe not. Next is an example of the SPARQL query notation in the ontology 1 and Ontology Library 2 (Fig. 9 and 10). In Notation below Class "***Writer***" connected with Class "***Collcetion***" in IRI [14]. `HasWritten` is an `ObjectProperties` that used in Ontology 2. Class "***Writer***", `ObjectProperties` "***Writen***" Class "***Book***". The next step, each class unless Class "***Lecturer***" will given values as filters. "***Writen_By***" is `ObjectProperties` that used in ontology Library 2, i.e. ***Book***: ***Writen_By ?Lecturer ? Publisher*** : ***Publisher_Name*** ? value1. ? ***Writer***: ***Name*** ? value2. FILTER (?value1 = 'McGraw-Hill'). FILTER (?value2 = 'herlina jayadianti').}.

```
Prefix
:<http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-
ontology-252#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
SELECT ?Book
WHERE { ?Book :Published ?Publisher.
?Book :Written ?Writer.
?Publisher :Publisher ?value1.
?Writer :Name ?value2.
FILTER (?value1= 'McGraw-Hill').
FILTER (?value2 = 'Herlina jayadianti').}
```

Fig. 9. SPARQL Query example search - Term a book title in RDF/XML

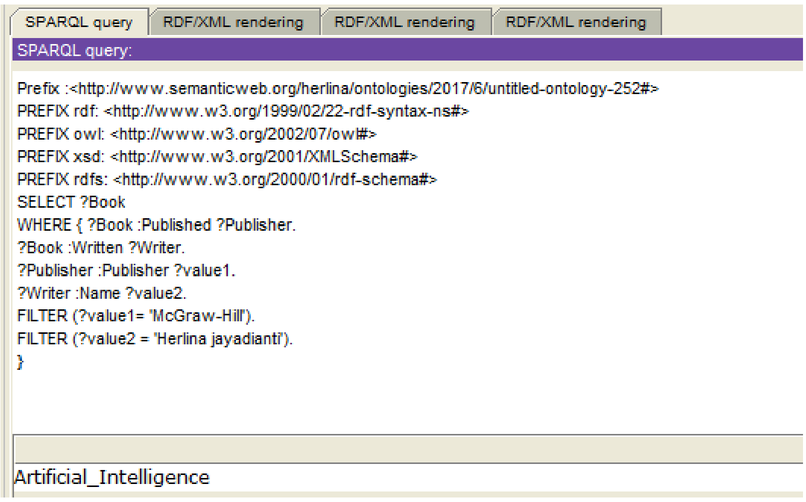


Fig. 10. The result of SPARQL Query - Term a book title

http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-251 is URI or Identifier address for Ontology 1 and http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-252 is URI or Identifier address for ontology 2. URI stands for Uniform Resource Identifier. Fig. 11 describes the manual mapping between term in ontology 1 and Ontology 2.

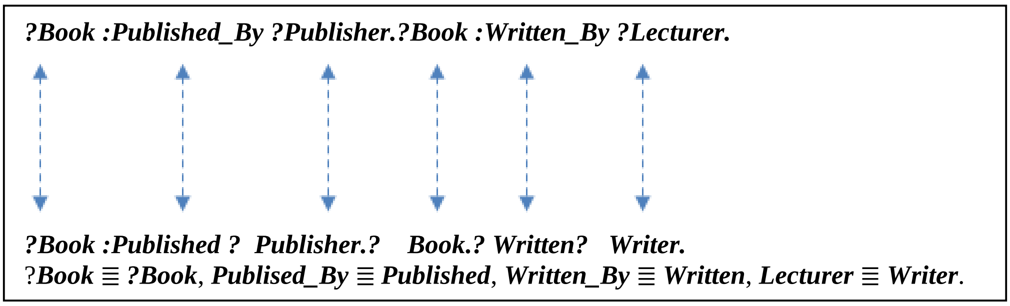
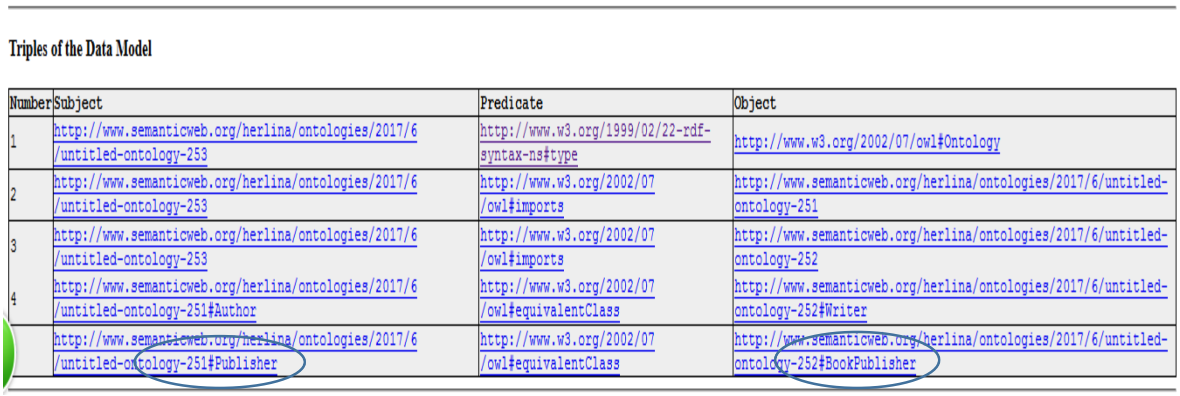


Fig. 11. Mapping Term between Ontology 1 and Ontology 2

Next Step is validation in RDF validator. We use RDF validator [15], [16] and converter to validate small snippets of RDF/XML (including N-Triples and Turtle). The data will be converted and outputted in the other format. RDF Validator and Converter is a tool for parsing RDF Statements and validating them against an RDF Schema. RDF ontology validation process for CO is shown in Fig. 12. The validation process between Class **Author** in ontology 1, and Class **Writer** in Ontology 2. Class **Publisher** in ontology 1, and Class **BookPublisher** in Ontology 2. Fig. 13 shows a graph data model between term in ontology 1 and ontology 2 running in RDF Validator. Synonym, ambiguity, and hyponymy problems are a big issue in integration data and we will continue to be our concern on it. A system should not limit the human way of thinking and looking. Humans should be able to do searching process based on their perception and not restricted by syntax.



Triples of the Data Model

Number	Subject	Predicate	Object
1	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-253	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Ontology
2	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-253	http://www.w3.org/2002/07/owl#imports	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-251
3	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-253	http://www.w3.org/2002/07/owl#imports	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-252
4	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-251#Author	http://www.w3.org/2002/07/owl#equivalentClass	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-252#Writer
	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-251#Publisher	http://www.w3.org/2002/07/owl#equivalentClass	http://www.semanticweb.org/herlina/ontologies/2017/6/untitled-ontology-252#BookPublisher

Fig. 12. Validation Results in RDF Validator between ontology 1 and Ontology 2

Fig. 13. Graph of data model in RDF validator

IV. Conclusion

In the future there will be many systems facing problems of integration knowledge and semantic understanding. The problem of sharing knowledge and semantic can be solved by integrating term and maping process. This study has proved that the problem of terminology differences in digital library domain can be solved by ontology.

Acknowledgment

This research supported by LPPM UPN "Veteran" Yogyakarta.

References

[1] T. Saracevic, "Digital library evaluation: Toward evolution of concepts," *Libr. Trends*, vol. 49, no. 2, pp. 350–369, 2000.

[2] G. Chowdhury and S. Chowdhury, *Introduction to digital libraries*. Facet publishing, 2002.

[3] R. Rao *et al.*, "Rich interaction in the digital library," *Commun. ACM*, vol. 38, no. 4, pp. 29–39, 1995.

[4] E. A. Fox and G. Marchionini, "Toward a worldwide digital library," *Commun. ACM*, vol. 41, no. 4, pp. 29–32, 1998.

[5] "Digital library - Wikipedia, the free encyclopedia." .

[6] D. Wu and A. Håkansson, "A Method of Identifying Ontology Domain," *Procedia Comput. Sci.*, vol. 35, pp. 504–513, 2014.

[7] http://strathprints.strath.ac.uk/2603/

[8] R. Thaker and A. Goel, "Domain Specific Ontology based Query processing System for Urdu Language," *Int. J. Comput. Appl.*, vol. 121, no. 13, 2015.

[9] J. Zhai, Y. Liang, and L. Huang, "Linkage Discovery of Linked Data Based on Ontology Reasoning," in *Proceedings of the 17th International Digital Government Research Conference on Digital Government Research*, 2016, pp. 522–524.

[10] B. Sinha, M. Garg, and S. Chandra, "Identification and classification of relations for Indian languages using machine learning approaches for developing a domain specific ontology," in *2016 International Conference on Computational Techniques in Information and Communication Technologies (ICCTICT)*, 2016, pp. 415–420.

[11] M. Vujasinovic, N. Ivezic, and B. Kulvatunyou, "A survey and classification of principles for domain-specific ontology design patterns development," *Appl. Ontol.*, vol. 10, no. 1, pp. 41–69, 2015.

[12] M. Fernández, A. Gómez-Pérez, J. Pazos, and A. Pazos, "Building a chemical ontology using methontology and the ontology design environment," *IEEE Intell. Syst.*, vol. 14, no. 1, pp. 37–46, 1999.

[13] http://www.semanticweb.org/herlina/ontologies/2016/6/untitled-ontology-190

[14] http://www.semanticweb.org/herlina/ontologies/2016/8/untitled-ontology-199

[15] http://www.w3.org/RDF/Validator/

[16] http://www.rdfabout.com/demo/validator/validate.xpd

[17] http://www.semanticweb.org/herlina/ontologies/LibraryCO

[18] http://www.semanticweb.org/herlina/ontologies/library1

[19] http://www.semanticweb.org/herlina/ontologies/Library2