

Using Themes-Based Ontology for Learning *Al-Quran* Knowledge

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ABSTRACT

Learning Al-Quran knowledge involves the classification of Al-Quran verses into a better understanding for the readers. This research aims to explore a themes based ontology approach to classify Quranic verses. Nowadays, Information and Communication Technologies (ICTs) are becoming increasingly important, which requires Quranic knowledge representation to be understood by both humans and computers. Efforts have been carried by many Muslim scholars and intellectuals in developing ICT applications for Islamic uses, and at the same time promote Islamic knowledge and information through ICT enabling tools which has become a driver for readers all over the world to collect, exchange, share and spread information about Islam. Current approaches use conventional methods to classify knowledge, such as taxonomy, hierarchy or tree structure, which only provides a concept definition without a link to other sources of knowledge. Therefore, due to the significant benefits of the theme based approach, this research uses a theme based classification approach to develop the Quranic Ontology. The ontology model for the Al-Quran was developed based on the Quranic knowledge themes which are defined in the "Syammil Al-Quran" ("Miracle the Reference"). Understanding the depth of Islamic knowledge and teaching needs an established academic method. On the other hand, learning Quranic knowledge through ICT has shown great impact on new learning methods for readers and has proved to be an effective way for enhancing the knowledge of the Al-Quran.

Keywords: e-Learning, knowledge representation, knowledge classification, theme-based approach, *Al-Quran* ontology

INTRODUCTION

The *Al-Quran* is the holy book of Muslims which teaches morals, purification, good deeds, as well as those forbidden by the Almighty *Allah*. The *Al-Quran* provides guidance to mankind, promotes justice, and provides guidance on how to live on earth and with neighbors (Ahmad et al., 2013; Yauri et al., 2012). A related study described that the *Al-Quran* as a source of knowledge on any subject matter concerning the world and the hereafter (Shoaib et al., 2009). As Allah said in the following verses:

This [Qur'an] is enlightenment for mankind and guidance and mercy for a people who are certain [in faith].

(Al-Quran 45:20)

In fact, knowledge in the *Al-Quran* cannot be compared with any scientific text because the Messenger Prophet Muhammad SAW provides real and deep discussions of matters under examination (Ahmad et al., 2013; Shoaib et al., 2009). However, in the current Information Technology (IT) scenario, to learn the *Al-Quran* is a big challenge, whether in the Muslim education system, or in the western education system (Atwell et al., 2010). The search for knowledge in the *Al-Quran* is either unclear or inaccurate, and the search is not based on proper knowledge classification (Khan et al., 2013). These aspects are the major shortcomings of existing research on issues related to learning the *Al-Quran* using ontology.

Ontology defines knowledge or concepts in the *Al-Quran* as classes, and relationship between the classes as properties used to generate rich knowledge from the *Al-Quran*. These concepts refer to the Quranic verses as defined by the structure of the Division (*Juz*), Chapter (*Surah*), and Verse (*Ayat*). Importantly, the knowledge of the *Al-Quran* is identified by Chapter and Verse, which is the most important step of applying an ontology based approach (Ta'a et al., 2014). Several studies indicate that further researches are required to classify knowledge in the *Al-Quran* and establish a semantic search method in order to acquire knowledge in Quranic ontology (Ahmad et al., 2013; Yauri et al., 2012). However, the classification of Quranic knowledge requires a well structured definition of the contents of the *Al-Quran* by Islamic scholars. Thus, this research adopts the classification of Quranic knowledge from the book "*Syaamil Al-Quran Miracle The*

References” (Kementerian Agama Indonesia, 2010). The aim of this paper is to elaborate the use of Quranic ontology for learning the *Al-Quran* and the knowledge of *Al-Quran* are defined according to a theme based classification. The development of Quranic ontology is the most crucial task in order to support the development of an *Al-Quran* learning application.

INFORMATION TECHNOLOGY FOR LEARNING THE AL-QURAN

Learning the *Al-Quran* is a grand challenge in information technology (IT) due to difficulties of trying to represent Quranic knowledge in Information Systems (IS). Despite a lot of applications available for querying the knowledge of the *Al-Quran*, most of the applications lack the production of the actual meaning or translation of the query accordingly (Abbas, 2009). Moreover, the Quranic translations used in such applications are normally written in languages such as Malay or English without the supporting original Quranic text in Arabic. This will distort the meaning of the *Al-Quran* in certain contexts leading to slanderous misrepresentations of the sanctified and miraculous knowledge contained in the *Al-Quran*. Currently, the traditional method uses Division, Chapter, and Verse to provide an interpretation of Quranic knowledge. This gives rise to several fundamental problems, such as incomplete and inaccurate results and in most cases, the search is unable to retrieve the relevant knowledge and verses (Yauri et al., 2012). In addition, ul Ain and Basharat (2011) identified that searching and retrieving Quranic knowledge is unclear or uses classification that is difficult to understand. Most learners such as students, teachers and scholars face difficulty when using the current approach (Saad et al., 2009). These reasons have led the researchers to explore the possibility of classification and searching methods using a theme based approach to develop a Quranic ontology.

THEME BASED AL-QURAN ONTOLOGY

The ontology used to represent knowledge in a more structured manner using a thematic approach is also known as theme classification to support the understanding of the particular knowledge among the learners (Jones

et al., 2011). Therefore, the use of ontology to capture the semantics of the information domain has been successfully applied in some research fields, including Quranic knowledge (Staab & Studer, 2010). Current approaches uses conventional methods such as taxonomy, topic map or tree structure, which only provides the definition of the concept without linking it to other possibilities of Quranic knowledge (Ahmad et al., 2013). It is difficult to obtain accurate knowledge using these approaches because knowledge is traditionally classified without proper reasoning connecting it to other related knowledge. Therefore, this research also has explored semantic based searching approach in thematic classification of Quranic knowledge.

Theme-Based Learning Approach

The thematic approach is a method for teaching and learning where many areas of knowledge are integrated and connected within a theme. It allows learning to be less fragmented and more natural (Hislop, 2013). The theme is defined as a unit derived from a pattern such as “topic”, “vocabulary”, “meaning”, and identified by bringing together components or fragments of ideas and experiences, which would normally be meaningless when viewed alone (Aronson, 1994; Braun & Clarke, 2006). Quranic knowledge has been analyzed by scholars according to theme-based classification in the book entitled “*Syaamil Al-Quran Miracle The References*” (Kementerian Agama Indonesia, 2010) or “*Al-Qur’an - The Miracle of Miracles*” (Deedat, 1991). This research has adopted the themes defined by the Indonesian Ministry of Religious Affairs (Kementerian Agama Indonesia) (2010) in “*Syaamil Al-Quran Miracle The References*” written in Indonesian language which is almost similar to the Malay language. The themes were defined according to four main topics in the *Al-Quran*: Faith (*Iman*), Deed (*Akhlak*), Way/Path (*Syariah*), and Life/Journey (*Sirah*). Furthermore, these main themes were classified into 15 thematic indexes. The selected themes were chosen for ontology construction and the particular verses of the *Al-Quran* would be linked to the themes to facilitate learner/reader understanding. This paper aims to present the theme based ontology approach to learning Quranic knowledge. The prototype application provides semantic searching functionality for retrieving Quranic knowledge according to thematic classification. Moreover, the classification and searching of Quranic knowledge requires a well structured definition of themes that is supported by the ontology.

Ontology Development

Building the ontology is the foundation in ontology based softwares. Several approaches and tools were developed in order to support the development and maintenance of ontology. However, none of the approaches or tools really covers all aspects of the ontology development process such as an integration, mapping, automation, interoperability, visualization, evaluation, user model and versioning (Tawfik, Giunchiglia & Maltese, 2014). This is because most of the approaches were mainly developed for particular projects or as academic exercises. Moreover, no methods have been accepted as a standard in developing the ontology and some development methodology with tools helps a developer to develop and maintain a particular ontology. Quranic ontology is referred to as domain or task ontologies which represent the generic concepts related to a specific domain or task (i.e., *Al-Quran*). Therefore, the ontology for the *Al-Quran* was developed based on selected themes (i.e., Faith (*Iman*), Deed (*Akhlak*) and Property (*Harta*)). These themes were analyzed to identify the appropriate classes, properties and individuals according to the ontology model as shown in Figure 1.

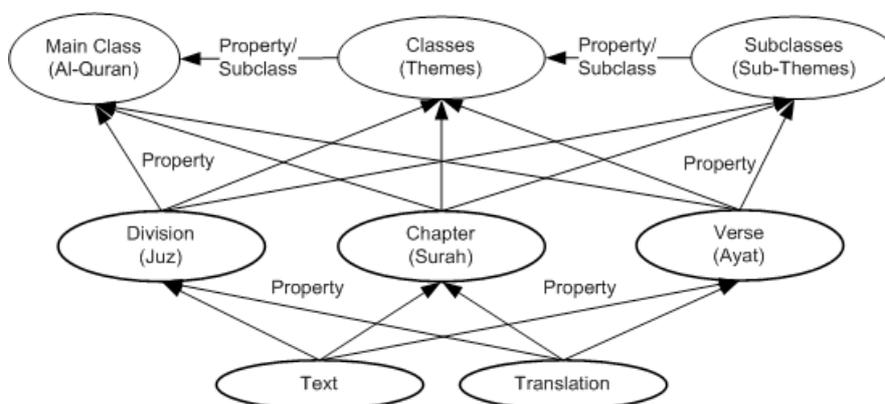


Figure 1: Theme based Ontology Model for the *Al-Quran* (Ta'a et al., 2014)

This is important to establish the ontology that embraces Quranic knowledge, which define the concepts about Faith, Deed and Property. The detailed explanation about the concept, and the relationship between these

concepts and sub-concepts were elaborated further. Protégé-OWL was used as the tool to develop the ontology as shown in Figure 2. Figure 2 presents the concept of Deed which is linked to the sub concepts of Good Deed and Thoughtfulness. With these linkages, the reference verses were annotated by division and chapter.

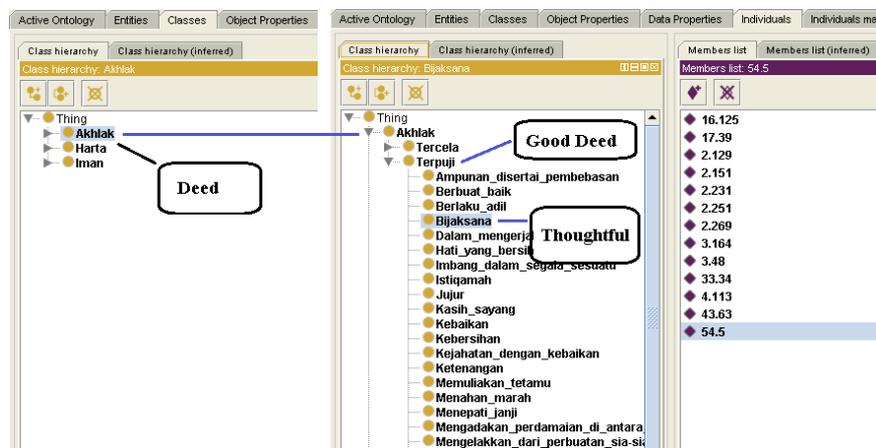


Figure 2: AI-Quran Ontology in Protégé-OWL

Based on Figure 2, the Quranic ontology model comprises classes (the themes), sub-classes (the sub-themes), property (the relationship between the themes or sub-themes) and individual (the verses) that referred to particular verses (text and translation). The verse is represented by the sequence number of chapter and verse. Then, to develop an ontology as shown Figure 2, the specification of the ontology which described the relationship between themes and sub-themes, themes and individual, and axiom are defined in Table 1.

Table 1: Al-Quran Ontology Specification

Terms	Structure	Al-Quran Knowledge Themes
Root	Main class	Al-Quran
Theme(s)	Class / subclass	Faith, Deed
Sub-theme(s)	Class / subclass	Faith (Allah, Judgment day, Books of Allah, Angels, Invisible problems, Believer, Prophets and Messenger) Deed (reprehensible behavior, admirable character)
Division, Chapter, and Verse	Class / subclass	Division, Chapter , and Verse
Relationship	Property	Link between classes to classes, classes to subclasses and, sub-classes to sub-classes. Example: Faith (class) obliged to (property) Judgment day (subclass)
Al-Quran Text and Translation	Individual	Good Deed – (Division:2, Chapter:2, Verse:44) نُوَسِّنُكَ وَرَبِّكَ أَيُّسَّرَ لَكَ أَنْ تُوَظِّمَ أَتَى الْفَأَقْبَاتِ كَلَّ أَنْ تُوَلِّتَ مَنْ تَنْ أَوْ مَكَسُفْنَ أ نُوَلِّقُ عَت Do you order righteousness of the people and forget yourselves while you recite the Scripture? Then will you not reason?

Semantic Search Functionality

The searching functionality is important for learning the *Al-Quran* in the computer system. Most existing Quranic applications provide searching facilities using keyword based search or browsing whole chapters of the *Al-Quran* that reside in the database systems. However, ontology does not necessarily reside in a database, thus requiring a different approach of searching called *semantic search* (Vallet et al., 2005). Semantic search is not new in information retrieval, but applying it for the Quranic ontology domain has recently been in the limelight (Shoaib et al., 2009; Yauri et al., 2012; Khan et al., 2013). Ontology has opened up an extensive space for information to be retrieved and this search utilized a semantic search approach to overcome the problems in traditional based searching methods. This research has developed a searching method adapted from Vallet et al. (2005) as illustrated in Figure 3.

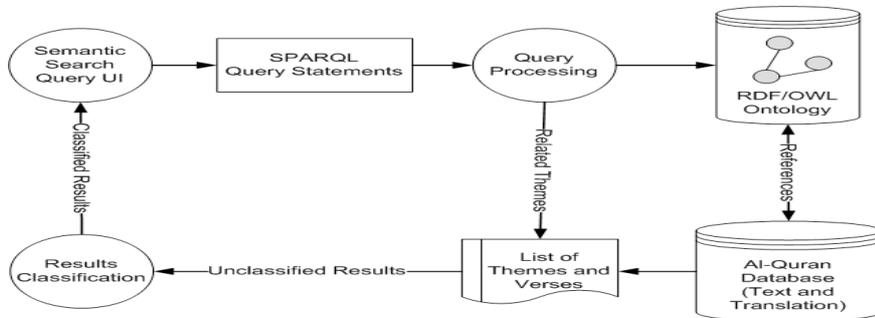


Figure 3: AI-Quran Ontology Searching Framework



Figure 4: Q-Learning Main Menu

PROTOTYPE APPLICATION FOR LEARNING THE AL-QURAN (Q-LEARNING)

A prototype application for learning the *Al-Quran* (Q-Learning) through Quranic ontology has been developed in a web-based environment. The purpose of this application is to provide user friendly interfaces to retrieve Quranic knowledge using the semantic search capabilities as described in the framework shown in Figure 3. The main menu for this application is shown in Figure 4. For the purpose of benchmarking, Q-Learning provides two types of searching facilities: theme based searching and ontology based searching.

Theme-Based Searching

Theme based searching performs a search in the database (i.e., SQL Server) environment, where the ontology data is transformed into database structures. The database schemas store data about themes, sub-themes and related verses reference. Searching is performed by using a query written in normal SQL statements. For example, search for a theme Judgment Day will produce results as shown in Figure 5.

The screenshot shows a search interface with the following components:

- Search Bar:** "Carian Tema" with input "Hari Akhir" and a button "Search for 'Judgment Day'".
- Results Summary:** "Keputusan carian sebanyak 16 rekod".
- Sub-theme:** "Hari Akhir".
- RESULTS:** A list of search results including:
 - Inan pada Hari Akhir
 - Juz 1 Ayat 2.4: Dan juga orang-orang yang beriman kepada Kitab "Al..."
 - Juz 2 Ayat 2.177: Bukanlah perkara kebajikan itu hanya kamu mengahda...
 - Juz 6 Ayat 4.162: Tetapi orang-orang yang teguh serta mendalam ilmu...
 - Juz 10 Ayat 9.19: Adakah kamu sifatkan hanya perbusan memberi minum...
 - Juz 10 Ayat 9.19: Adakah kamu sifatkan hanya perbusan memberi minum...
 - Juz 19 Ayat 27.3: Iaitu mereka yang tetap mendirikan sembahyang dan...
 - Juz 22 Ayat 34.21: Dan sememangnya tiadalah bagi Iblis sebarang kuasa...
 - Nama-nama pada Hari Akhir
 - Tanda-tanda sebelum datangnya Hari Akhir
 - Juz 1 Ayat 2.21: Waheer 25: Kalian manusia! Beribadallah kepada Tuhan ...
- Full Information Table:**

ID	11
IDSurah	2
IDAyat	4
Ayat	وَالَّذِينَ يُؤْمِنُونَ بِمَا أُنزِلَ إِلَيْهِمْ وَمَا أُنزِلَ مِنْ رَبِّهِمْ وَأُولَئِكَ هُمُ الْمُؤْمِنُونَ
AyatBM	Dan juga orang-orang yang beriman kepada Kitab "Al-Quran" yang diturunkan kepadamu (Wahai Muhammad), dan Kitab-kitab yang diturunkan dahulu daripadamu, serta mereka yakin akan (adanya) hari akhirat (dengan sepemahnyanya).
IDSurahAyat	2.4
IDFuz	1
Nama Surah	Al Baqarah
IDAyat Mula	1
IDAyat Akhir	141
Jenis Surah	Madaniyyah

Figure 5: Search Results for Judgment Day Theme

Ontology based Searching

Ontology based searching is a method to search a query in ontology directly by using semantic query language such as SPARQL. Ontology as *graph based* database model defines a query as subject-predicate-object (N-Triples format) statements and produces the results according to this format. SPARQL provides a formal language for a subject-predicate-object query (i.e., meaning-driven query). By using TWINKLE¹ tool, the written SPARQL queries become easier and produce meaningful results. An example of the search for Judgment Day theme is shown in Figure 6.

1 <https://code.google.com/p/twinkle-sparql-tools/>

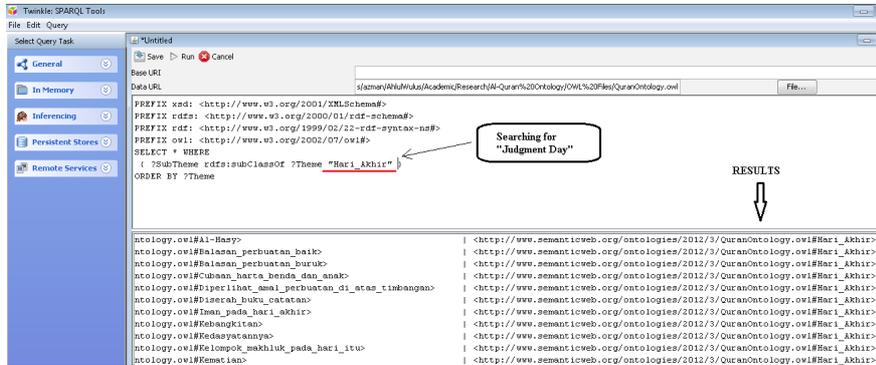


Figure 6: Ontology Searching Results for Judgment Day Theme

EVALUATION AND DISCUSSION

The success of online learning can be measured by how much information can be gathered or retrieved from the online sources (Seiver & Troja, 2014). Much information retrieved from the search will provide more options to understand particular knowledge. The relevance and accuracy of the information retrieved will determine the success of the search method. This paper evaluated the success of searching functionality in Q-Learning for a particular theme (i.e., Judgment Day). The query for searching is performed using two different methods: traditional theme based and ontology based. Both methods were implemented in same computer platform (i.e., Windows 8 operating system). For traditional theme based approach, Microsoft SQL Server was used as a database system. Table 2 shows the benchmark of searching results from both methods.

Table 2: Benchmark of Searching Functionality

Method/Item	Traditional Theme-Based Method	Ontology-Based Method
Main Theme	Faith	Faith
Theme(s)	Judgment Day	Judgment Day
Query Language	SQL (run on .Net apps)	SPARQL (run on TWINKLE)

Number of Records/ Number of N-Triples	16 records	38 N-Triples
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Table 2 shows the results that the ontology based method has produced 38 triples/records compared to traditional theme based method which produced 16 records. This benchmark has shown that the ontology based searching methods produced higher records/triples compared to the traditional theme based method. The matching results will provide a wider range of knowledge to the users learning the *Al-Quran*. Detailed explanations for the information retrieved can be obtained from the various chapters and verses. Even though this benchmark was only performed for one theme, the results highlighted that the semantic based search method has produced multiple answers to the query. This provides rich information for users to be selected and learned. However, further research needs to be done in order to identify specifically the relevant (*recall*) and correctness (*precision*) of searching functionality (Aleksovski, 2008).

CONCLUSION

This paper has presented Q-Learning, the system that uses a theme based ontology approach to learning the *Al-Quran*. The ontology based approach used in Q-Learning has shown the ability to retrieve Quranic knowledge with higher output produced from a particular input theme. The search method is evaluated by benchmarking a search approach in two different environments: traditional theme based and ontology based. The benchmark has shown the success of the ontology based method compared to the traditional theme based method. Moreover, this paper has attempted to contribute towards the theory and practice of using ontologies for learning the *Al-Quran* using information technology, particularly in storing and manipulating vast and complex knowledge as that contained in the *Al-Quran*. Theoretically, this research adds to the literature and provides insightful methods used in the development of semantic searches. This research also presents an integrated information system based on ontology and offers a more systematic approach to be used in Islamic studies. Further research will focus on the relevancy and accuracy of the search functionality without neglecting the importance of Quranic scholars to deliver the truth and accuracy of Quranic contents.

The results are expected to increase the level of understanding of learners through computer applications by offering a new approach to searching and browsing the *Al-Quran*.

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