

THEMES-BASED CLASSIFICATION FOR AL-QURAN KNOWLEDGE ONTOLOGY

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Abstract— Al-Quran knowledge representations involved classification of Al-Quran verses for providing better understanding of the readers. In the current era of social media challenges, the representation of knowledge must be understood by human and computer in order to ensure the correctness of Al-Quran semantics are persevered. Current approaches used conventional methods such as taxonomy, hierarchy or tree structure, which only provides a concept definition without linked to other sources of knowledge explanation. This research aims to develop the Al-Quran Ontology by using theme-based classification approach. The ontology model for Al-Quran is developed based on the Al-Quran knowledge theme defined in *Syammil Al-Quran Miracle the Reference*. The theme-based ontology approach has shown that the Al-Quran knowledge can be classified and presented systematically. This will encourage the development of applications for Al-Quran readers. Moreover, the ontology structure that representing the theme concepts in Al-Quran was reviewed and validated by the domain experts in Al-Quran knowledge.

Keywords— knowledge representation, knowledge classification, thematic, Al-Quran Ontology, Islamic Information

I. INTRODUCTION

Al-Quran is the eternal miracle of Islam. It is the complete and best guide to living one's life and seeking Allah's pleasure. Al-Quran consisted of 30 Divisions (Juz), 114 Chapters (surah), 6236 Verses (ayat), and less than 80,000 words. The verse may contain one or more sentences to form the verse. A group of verses will form a chapter with the given names (e.g., Al-Baqarah, Ali-Imran, An-Nisa). The concept of Al-Quran knowledge is defined by using the Quran hierarchy as determined by the sequence of divisions, chapters, and verses. These are the most important components for presenting the verse as final references of the particular Al-Quran concepts in a systematic manner. Understanding the Al-Quran knowledge required appropriate teachers, which is sometime difficult to be available at all times. However, computer technology can support the learners to understand the Al-Quran easily, especially by using web and mobile-based technology. Mostly, the approaches to presents the Al-Quran knowledge is using the tree-structure hierarchy, which makes it difficult to identify the actual meaning of the concept in the Al-Quran [9]. Therefore, this research used an ontology approach to represent Al-Quran concepts that can be classified and organized according to specific themes. Ontology is an approach to

formalize an explicit specification of a shared conceptualization [4].

Representation and classification approach, which can be understood by machines and humans is essential to help users find and identify the precise semantics of knowledge that explained by the Al-Quran. Currently, several approaches using taxonomies, hierarchical, tree structure, paradigm, and the only facet analysis clarifies the meaning of the concept of knowledge directly without linking it to other possible explanations. Furthermore, there are verses in the Al-Quran, which is called *Mutashabihat* that not explain the meaning of the verses directly, as if to conceal the purpose of the actual concept of Islamic knowledge. As a result, the search for the concept of Islamic knowledge cannot be accurately reflected in the semantics of the knowledge concept explained by the Al-Quran [11].

This study aims to examine the representation and classification methods of the contents of Al-Quran by themes and concepts that have been reviewed by domain experts to facilitate ordinary users to seek and understand the knowledge of the Quran. Ontological approach will be used to represent classification knowledge themes and concepts in the Quran, while the method of background knowledge will be used to improve the accuracy of the semantics of the search made on the Al-Quran ontology. In particular, this study will develop a model for Al-Quran ontology, which will determine a new strategy for knowledge-based searching of Al-Quran. An application prototype is developed to demonstrate the usability of Al-Quran ontology in a web environment. The results are expected to increase the level of end user understanding through the computer applications and offer a new approach to search and surf the knowledge of the Al-Quran.

II. AL-QURAN ONTOLOGY

A. Classification of Knowledge Concepts

Al-Quran verses can be more than one sentence or part of sentences. A group of verses will form a chapter with a given unique name for explaining about the content of the chapter. All chapters and verses can be identified by numbers such as 2:255 refers to Chapter 2 (*Al-Baqarah*) and Verse 255 (known as *Al-Kursi* verses). The concept of Al-Quran knowledge is defined by the structure of content hierarchy of divisions, chapters and verses, which can be classified by the appropriate

themes. The theme approach (i.e., thematic) is a way of teaching and learning in such a way that many areas of the knowledge are integrated and connected within a theme. Therefore, it allows learning to be less fragmented and more natural [5]. The number of verses and chapters may share similar themes such as faith (*Iman*) and deed (*Akhlak*). Therefore, the definition of concepts will be based on classification of themes that referred in *Syammil Al-Quran Miracle the Reference* [9]. The correct verses on the theme are identified by using a hierarchy structure of Al-Quran contents as illustrated in Figure 1.

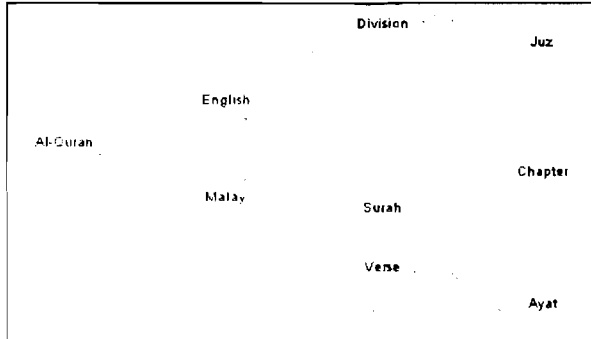


Fig. 1. The Al-Quran Contents Hierarchy

B. Ontology Model of Al-Quran

The ontology is used to present the content of Al-Quran in a systematic and structured manner by mapping the meaning of themes toward the appropriate verses of Al-Quran, which provides the correct semantics of the Al-Quran knowledge. The model of Al-Quran ontology is developed and illustrated as shown in Figure 2.

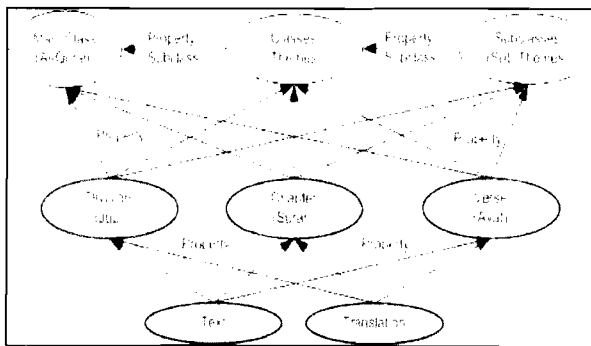


Fig. 2. The Al-Quran Ontology Model

Based on the Figure 2, the Al-Quran ontology model comprises of classes (the themes), sub-classes (the sub-themes), property (the relationship between the themes or sub-themes) and individual (the verses). The individual is referred to the particular verses (text and translation), which is represented by sequence of Division (Juz), Chapter (Surah) and Verse (Ayat). The ontology model specification is defined in terms and ontology structure as presented in Table 1.

TABLE 1. THE AL-QURAN ONTOLOGY SPECIFICATION

Terms	Ontology 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 (Div.2, Chap.2, Verse 44) <p>اتذفرون الناس بالكفر وتفسون انفسكم وانتم تتلون الكتب افلا تعقلون</p> <p><i>Do you order righteousness of the people and forget yourselves while you recite the Scripture? Then will you not reason?</i></p>

The themes, which has been reviewed by the experts in the Al-Quran knowledge was defined as concepts used in the ontology structure. The detail specification of the theme will be defined as sub-classes of the theme and required a correct property to represent the actual semantics of the knowledge. Therefore, the model of Al-Quran ontology is defined in following form:

$$\text{Al-Quran Ontology Model} = (CT, CS_{ij}, P, I_{(i,n)})$$

- Where: CT – Class for main themes in Al-Quran
- CS – Class (sub-class) for sub-themes in Al-Quran
- P – Properties for relationship between classes to another class/sub-class
- I – Individual for verses that referred by the theme

Given the Al-Quran knowledge themes, the ontology of Al-Quran is constructed by defining the CT, CS, P and I. The class is created for each primitive concept of themes and sub-themes. Whereby, property P is created for domain of P that set to be the class corresponding to the primitive concept of CT and CS. Therefore, each relation of P is a defined class is created. The created class is defined in the form: $C_p \equiv C_1 \cap C_2 \cap \dots \cap C_n$, where C is the class representing the concept mapped to P. Each C_i class is derived from the themes or sub-themes definition.

C. Research Methodology

In order to conduct this research, the appropriate methodology is required to focus on defining the classes.

properties, and individuals of Al-Quran knowledge. Later, the Al-Quran knowledge is possible to develop and validate the semantics correctness. The methodology is described in Figure 3.

Define classes. Based on the Al-Quran structure, each class is subclass to others. Divisions, Chapters and Verses are subclasses to Al-Quran. In other words, the Al-Quran consists of collections of verses that referred as *Division, Chapter, Verse*. The Verse is a subclass to Chapter. Chapter is a subclass to Division as they are all related. The Al-Quran is a root of all the classes. The Al-Quran is divided not only into 30 Divisions, which may be based on the number of verses but also Chapter. Each Chapter or Verse may share similar properties such as main themes Iman (*Faith*) and Akhlaq (*Deed*).

Define properties. In this step, the research will define the related object properties used to describe the relationship between the classes. The relationship between classes needs to be identified by the experts in Al-Quran.

Define individuals. The individual is the explanation about the related classes and properties defined before in the previous steps involved in Al-Quran ontology. There are many terminologies and simple sentences on what the classes and properties were described according to the main themes.

Develop Al-Quran Ontology. All classes, properties (object and data properties) and individuals have to be linked in this phase to represent the knowledge of Al-Quran. The results produced and appeared on the Protégé OWL will represent the correct semantic of Al-Quran knowledge.

Validate Al-Quran Ontology. On the final stage, the information had been collected through reading materials or interviews with Al-Quran experts and a survey has been conducted.

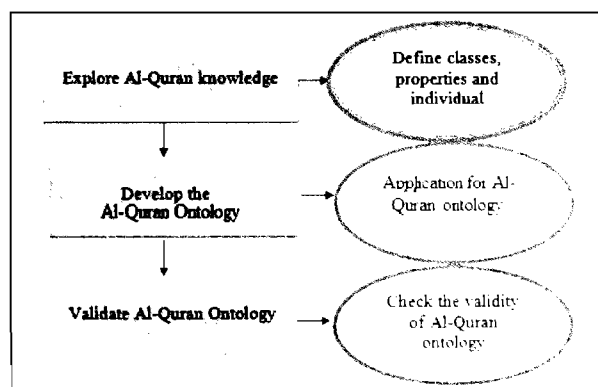


Fig. 3. Research Methodology

D. Ontology Construction

The Al-Quran themes, scope and relationship between the themes were determined based on the *Syammil Al-Quran Miracle the Reference*. This paper demonstrated the construction of ontologies for Iman (*faith*) and Akhlaq (*deed*) main themes. The definition of concepts, properties, and individual are shown in Table 2.

TABLE 2 THE AL-QURAN ONTOLOGY DEFINITIONS

Classes/subclasses (Themes/Sub-themes)	Properties	Classes/subclasses (Themes/Sub-themes)
Faith	obliged to	Allah
	obliged to	Judgment day
Allah	Provider	Guidance
	giving	Grace
Angel	Having	Character
Deed	Contained	Admirable character
Admirable character	Contains	Honest

Interviews have been conducted by Al-Quran experts. The experts have explained in detail about the relationship among the themes and properties. According to the expert's comments, the correction has been made to ensure the Al-Quran knowledge is defined correctly. Then, the ontology was developed by using Protégé-OWL. Protégé-OWL is a tool originally developed for assisting the users in developing large computerized knowledge bases [12]. The emergence of semantic web technologies enhanced the functionalities of Protégé-OWL to build, store, visualize and maintain the ontologies in many different formats such as relational databases, UML, XML, RDF and OWL. Moreover, the ontology structure is based on frame-based approach that is applied in a knowledge representation system [13].

The concepts and properties were defined by using Malay language to help users understand the semantic produced from the Al-Quran ontology. The ontology specification for the Protégé-OWL is defined as shown in Table 3.

TABLE 3. ONTOLOGY SPECIFICATION FOR PROTÉGÉ-OWL

Themes/Sub-Themes	Ontology Setting	
	Classes	Properties
Faith	Faith	Obliged to
	Allah	Allah \subseteq Faith
	Judgment day	Judgment day \subseteq Faith
Allah	Allah	Provider
	Guidance	Giving
	Grace	Guidance \subseteq Allah
		Grace \subseteq Allah
Angel	Angel	Having
	Character	Character \subseteq Angel

A study is needed to identify the theme, concept, and scope related to the themes defined in *Syammil Al-Quran Miracle the Reference*. Information was collected through reading materials and interviewing with several people who expert on Al-Quran. The Al-Quran interpretation and books that clarify the Al-Quran's content was referred. Thus, Iman (*Faith*) and Akhlaq (*Deed*) main themes were chosen as the project scope since it concerned all Muslims and mostly described in Al-Quran. However, due to limited space, this paper will present part of the ontology.

The first step is to create a class hierarchy for *faith* and *deed* as main themes, and other concepts will be defined as

sub-themes. This is shown in Figure 4, Figure 5 and Figure 6. From the sub-themes, the next level of sub-themes is derived. The next task is to define the properties (object properties and data properties) that present the relationship between two classes. Figure 7 shows both properties in relations (e.g., giving, contained) with the classes. Individuals represent the verses have been identified relevant to the main themes, sub-themes and the next levels of themes. The individual value is annotated by text string, but most values are constrained by data literal in a particular format (e.g., date, float, and integer), prior versions of the ontology, and Universal Resource Indicator (URI) referring to other resources. The individual annotations were set according to the classes and properties as shown in Figure 8.

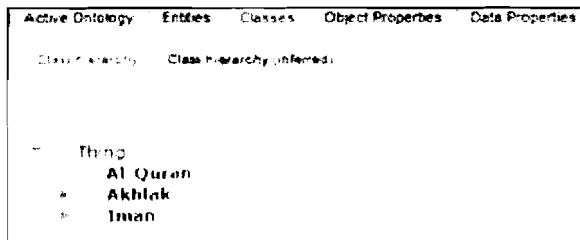


Fig 4. Main Themes (Faith and Deed)

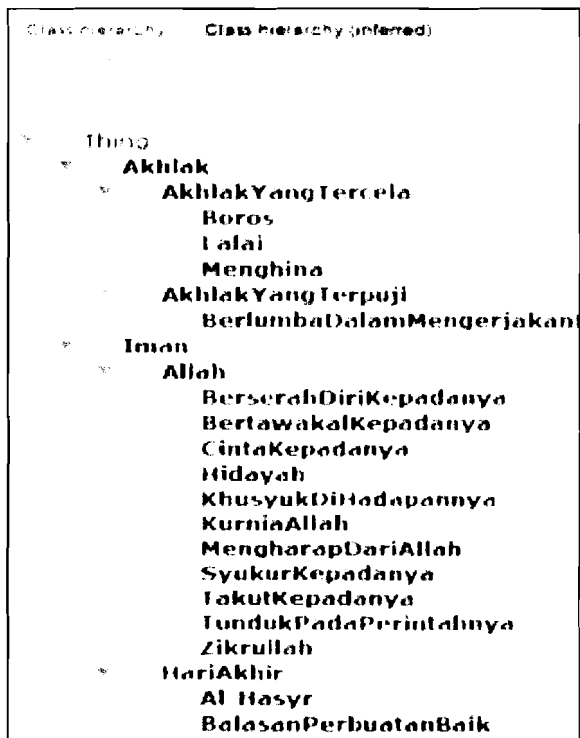


Fig 5. Sub-Themes (Faith and Deed)

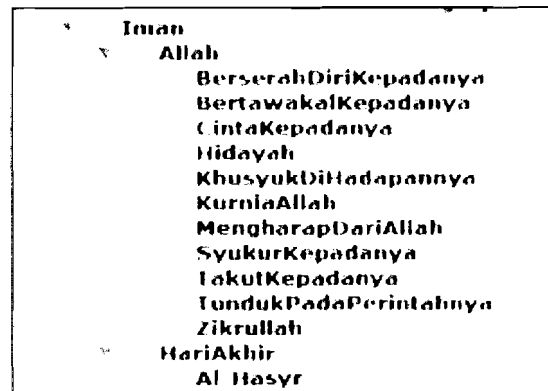


Fig 6. Sub-Sub-Themes (Faith and Deed)

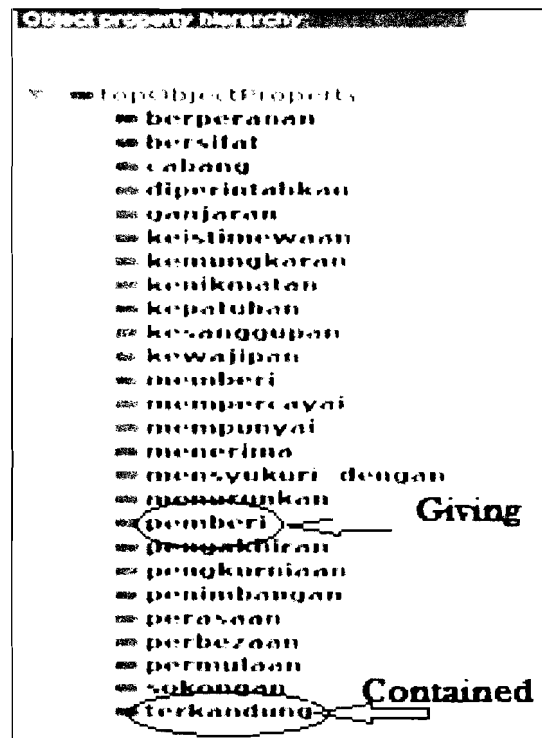


Fig 7. Object Property (Faith and Deed)

understand the Al-Quran knowledge in a systematic way. In information technology environment, the representation and classification approaches must be understood by human and machine in order to ensure the correctness of Al-Quran knowledge semantics presented to the readers. Ontological approach was leading the use of conventional methods such as taxonomy, hierarchy or tree structure to present and classify the Al-Quran knowledge for developing a smart and knowledgeable community of Muslims and Non-Muslim. Non-Muslim can have a better understanding of Al-Quran by referring the Al-Quran knowledge provided by the semantic-based application that will be developed further. Future works will explore the application for benefiting the ontology of Al-Quran to the readers.

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[Session I-4] Services and Applications for ICT Convergence 1

Oct. 22, 08:30-10:00

Chair: Prof. Younghwan You (Pusan National University, Korea)

I-4.1 Evaluation of QoE of Web Services on a Mobile Host over a Wireless LAN by simulator/emulator System

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I-4.2 A Research on QR Code Recognition Enhancement using Pre-constructed Image Matching Scheme

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I-4.3 A Novel License Plate Character Segmentation Method for Different Types of Vehicle License Plates

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I-4.4 Themes-Based Classification for Al-Quran Knowledge Ontology

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I-4.5 Professional and Amateur-produced Video Classification for Copyright Protection

Jeong-hyun Kim, Yong-seok Seo, Won-young Yoo (Electronics and Telecommunications Research Institute, Korea)

[Session I-5] Wireless & Mobile Communication Systems and Infrastructure 1

Oct. 22, 08:20-10:00

Chair: Dr. Young Jin Chun (Qatar University, Qatar)

I-5.1 Secure Antenna Subset Modulation with Coordinate Interleaved Orthogonal Designs

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I-5.2 Capacity Enhancement in Cognitive Radio Wireless Network with Dynamic Spectrum Access

Hela Chamkhia, Mazen O. Hasna (Qatar University, Qatar); Ridha Boualleague (Carthage university, Tunis, Tunisia)



