

# Building an Ontology for the Holy Quran Tajweed Provisions: (Meem Sakinah Provisions)

Mohammed Awad Mohammed AtaElfadiel  
College of computer, Open University of the  
Sudan, Sudan  
Department of Computer Science and Information,  
College of Sharia and Islamic Studies at Al-Ahsa,  
Imam Muhammad bin Saud Islamic University,  
Saudi Arabia

Eiman Alsiddig Altayeb Ibrahim  
College of Computer Science and Information  
Technology  
Omdurman Islamic University, Sudan

## ABSTRACT

The Holy Quran reading rules (Tajweed) are extremely important for Muslims in order to read the Qur'an correctly. Nowadays, technology has been used in the daily life, and many people learned through computerized systems, thus there is a need to unification of scientific terms that used in these systems. According to that system developers directed towards building ontologies, depend on knowledge bases as a source of data. The beginning for the authors was at 2017 when they designed their first ontology in Tajweed provisions [1], and as a complement to this, another part of the system is now being built, which is the part related to Meem Sakinah and its provisions. This paper aimed to design an ontology for Meem Sakinah Provisions in order to help in learning and understanding this part of Holy Quran Tajweed. Also, to facilitate the knowledge sharing with other applications of Holy Quran. This Ontology adopted protégé framework with OWL language to represent and define the key concepts in Meem Sakinah Provisions (Izhaar Shafawi, Ikhfa Shafawi and Idghaam Shafawi), and define the relationships between these concepts and its properties.

## Keywords

Ontology; Tajweed; Meem Sakinah; Izhaar Shafawi; Idgham Shafawi; Ikhfa Shafawi.

## 1. INTRODUCTION

The importance of Tajweed provisions based on the fact that it is the only way that Muslims have managed and unify the way of uttering the vocabulary of the Holy Qur'an on the way it was pronounced by the Great Messenger Mohammed (Peace be upon him). As lots of non-Arabs joined Islam, with different lexical tongues, the prevalence of the Pronunciation errors appeared, especially when speaking the sacred words. Muslims found the importance of building Tajweed provisions to teach new Muslims the correct way to pronounce the words of the Holy Qur'an.

The revolution of communications and the internet created an urgent need not only for the exchange of data among the systems, but also for an agreement on the meaning of this data. Data Semantics .

Ontology represents the content according to the concepts and indications to be expressed, relying on the patterns of logic and mathematical reasoning, it also works to define the relationships and links between the different data, and it classifies the content into categories according to the field of use.

Ontology is the cornerstone of efficient exchange of data, as it contains an accurate definition of the semantic meaning of the data to be exchanged. Where these definitions are written in the language of formal logic so that any system can understand and calculate, and even infer from it.

In the last ten years, many applications have appeared in which ontology is extremely important, such as e-government, e-commerce, search engines, electronic libraries, religious applications, ..etc.

## 2. RELATED WORK

As mentioned in [1], the study covered two branches of Holy Quran Tajweed, Articulations Points of the Letters and UN Vowel Noon and Tanween. The researchers designed an ontology that includes these two branches using protégé framework with OWL language to define the basic concepts and the relationships that link these concepts based on the texts mentioned in the Holy Quran and the approved books of Tajweed science. Finally, the authors demonstrated that information can be retrieved and various queries can be made on their ontology successfully.

Both studies are on Holy Quran Tajweed Provisions using same ontology building tool. The current study is a continuation of what the authors already started in [1], which is handling another branch of Holy Quran Tajweed "the Meem Sakinah provisions".

In [2], authors extracted key-concepts based on a set of linguistic patterns, statistical and domain-specific knowledge to extract a list of key-concepts from the Arabic text of the Qur'an. They evaluate their work against two manually created ontologies. For relation extraction, they apply a mathematical method called Formal Concept Analysis (FCA). They use their ontology to retrieve the synonym relation between the names of Allah in the Arabic Quran text.

Differ in the above research is in creating the ontology automatically, while the authors adopted the manual method. And they focus on retrieving the synonym between the names of Allah in the Quran, while this research keep building on an ontology for the Quran Tajweed.

In [3], the authors reviews a number of methods and techniques used to build systems that can, through the identification of recitation, verify the rules of intonation. In this paper, the authors explain the main stages of speech recognition from preprocessing, feature extraction, classification, and recognition. By using the Mel-frequency cepstral coefficients MFCC and hidden Markov model HMM features. [3].

Both studies are compatible in the public domain “Tajweed systems”. Whereas, the current research seeks to normalize Tajweed terminology through building a general knowledge base that can be used for Tajweed applications.

### 3. BACKGROUND

Before starting building this ontology, a number of important terms must be defined, include:

#### 3.1 Ontology

The formal representation of a set of concepts within the field and the relationships between these concepts.

#### 3.2 Tajweed

In language means optimization; and idiomatically means taking each letter out of its director with giving it its right and its due. The right of the letter is his self-qualities that are necessary for it and which are inextricable from it, and its due means its pathological qualities, such as intoxication, arise from superiority, and like success, it arises from the wickedness. [4]

Its provision: knowing about it is an obligation of sufficiency, and working with it is an obligation imposed on every Muslim reader for the Almighty saying : (...and chant the Quran rhythmically) [5]. And the words of the Messenger of Allah” Mohammed ﷺ: (Read the Qur’an with the melodies of the Arabs, its voices, and beware of the people of immorality and major sins...). The subject of Tajweed is the Quranic word; and it is one of the noblest and best sciences, for his attachment to the most honorable and dignified book.

#### 3.3 Meem Sakinah

Meem Sakinah is the vowel-free Meem (م), and that its stability is fixed in the connecting and stopping. Whether it occurs in a verb, in a name, or in a letter, medium or at the end. Since Meem sakinah is an oral letter that comes out with the occlusion of the lips, all its rulings are oral. [6]

There are three main rules regarding the Meem Saakin: [7]

- Ikhfa Shafawi.
- Idghaam Shafawi.
- Izhaar Shafawi.

##### 3.3.1 Al-Ikhfa Al-Shafawi

The rule will be Ikhfa Shafawi if the letter Baa (ب) appears after the letter Meem Sakinah. it's a light nasal pronounced sound, for two seconds (called two harakah).

وَكَلْبُهُمْ بَنِيَّ	إِنَّ رَبَّهُمْ بِهِمْ
وَمَا هُمْ بِمُؤْمِنِينَ	وَلَسْتُمْ بِعَاذِيهِ
يَعْتَصِمُ بِاللَّهِ	تَرْمِيهِمْ بِحِجَارَةٍ
إِنْ كُنْتُمْ بِعَايَتِهِ	مُؤْمِنِينَ وَأَنْ أَحْكَمَ

Fig 1: Examples of Ikhfa (Al-Shafawi) [8]

##### 3.3.2 Al-Idghaam Al-Shafawi

The rule will be Idghaam Shafawi if the letter Meem (م) appears after the letter Meem Sakinah. It can be said that the

two letters will be combined into one Meem Mushaddah (مّ), and read with Ghunna (nasalization).

فِي قُلُوبِهِمْ مَرَضٌ	إِنْ كُنْتُمْ مُؤْمِنِينَ
وَلَقَدْ جَاءَكُمْ مُوسَىٰ	جَزَاءُ هُمْ مَغْفِرَةٌ
فَإِذَا أَفَضْتُمْ مِنْ عَرَفَاتٍ	وَأَنْتُمْ مُسْلِمُونَ
وَلَهُمْ مَا يَشْتَهُونَ	أَطْعَمَهُمْ مِنْ جُوعٍ
وَأَمَّنَهُمْ مِنْ خَوْفٍ	يَنْصُرُكُمْ مِنْ دُونِ
مِنْكُمْ مَنْ يَرِيدُ الدُّنْيَا	وَاللَّهُ يَعِدُكُمْ مَغْفِرَةً

Fig 2: Examples of Al-Idghaam Al-Mithlayn [8]

##### 3.3.3 Al-Izhaar Al-Shafawi

When any of the remaining 26 letters of the Arabic language appears after the Meem Sakinah (م), there will be Izhaar Shafawi, with no Ghunna.

سَنَدِّخِلُهُمْ جَنَّاتٍ - وَظَنَنْتُمْ ظَنَّ السَّوْءِ
رَمَزًا - فَهَمَّ غَافِلُونَ - أَمْ أَنْتُمْ صَامِتُونَ
سَوَاءٌ عَلَيْهِمْ ءَأَنْذَرْتَهُمْ أَمْ لَمْ تُنذِرْهُمْ -
لَعَلَّهُمْ يَتَّقُونَ - وَإِذْ قَتَلْتُمْ نَفْسًا -
فِي قُلُوبِهِمْ زَيْغٌ - أَلَمْ أَقُلْ لَكُمْ -

Fig 3: Examples of Izhaar (As-Shafawi) [8]

## 4. PRACTICAL STUDY

To build any ontology there are several steps to be followed as shown in fig (4). [9]

### 4.1 Determine ontology domain

In this paper the domain will be Quran Tajweed Provisions, and authors will focus on “Meem Sakinah Provisions”.

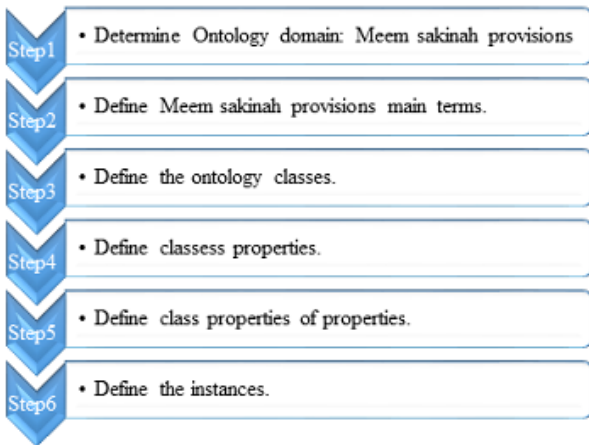


Fig 4: General steps for building ontology

## 4.2 Define Meem sakinah provisions main terms

In Meem sakinah provisions, the common terms include: Ikhfa Shafawi, Idghaam Al-Mithlayn, Izhaar Shafawi, Idghaam Shafawi, Makhaarij, Ghunna, nose, pronounce, character, letters, lips, Shafatain, light lips touch, lips closing, clear, Arabic letters, Baa, Meem, and harakah.

## 4.3 Define the ontology classes

The main class Thing shown in fig (5) consist of two classes:

- **Makhaarij** (letters outlets) with its subclasses:
  - **Lips (Shafatain)**
  - **Nose.**
- **Meem sakinah rules**, with its subclasses:
  - **Ikhfa Shafawi.**
  - **Izhaar Shafawi.**
  - **Idghaam Shafawi (Idghaam Al-Mithlayn).**

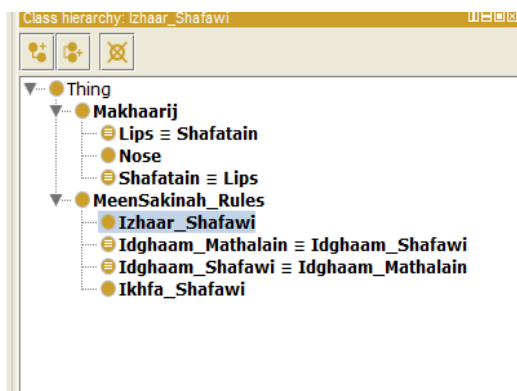


Fig 5: Class hierarchy

## 4.4 Define class properties

All these classes have properties that linked between its individuals which called object properties. As shown in fig (6), the object property pronounce include several sub properties according to the Meem Sakinah rule subclasses, as follows:

- Clear is a property for all letters belong to class **Izhaar Shafawi** (all Arabic letters except Meem and Baa).
- Light\_lips\_touch is a property for the letter Baa which belong to class **Ikhfa Shafawi**.
- Lips\_closing (ghunna) is a property for the letter Meem Mushdadah which belong to class **Idghaam Shafawi**.

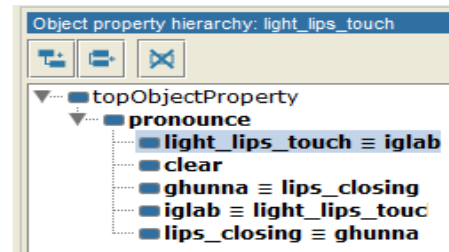


Fig 6: Object properties hierarchy

As in fig (7), there are data properties which linked class individuals with data types, including:

- *harakah*: Integer data type with value 2 (2 counts, the duration of pronouncing Meem Mushdadah letter, which named ghunna).
- *character*: Literal data type, defining how the letter will be written.
- *letters*: String data type, defining the letters belong to each class.

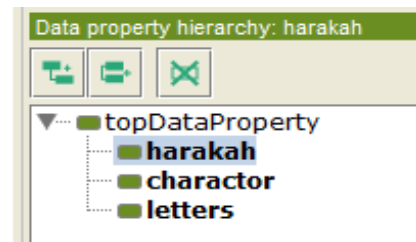


Fig 7: Data properties hierarchy

## 4.5 Define class properties of properties

At this stage, some constraints of class properties are defined, such as domain range constraint, cardinality constraint, and data type constraint, fig (8, 9 and 10) consequently.

For example, when the letter belongs to class Idghaam\_Shafawi is pronounced -letter Meem- the reader should close his lips (fig 8) for exactly two counts “two harakah”, fig 10).

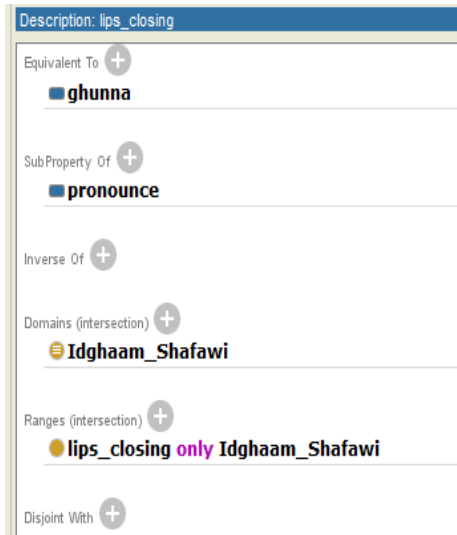


Fig 8: lips\_closing constraint

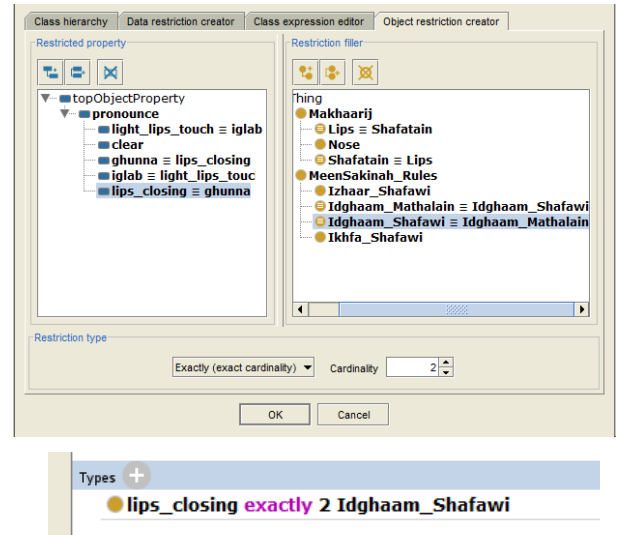


Fig 10: Cardinality constraint

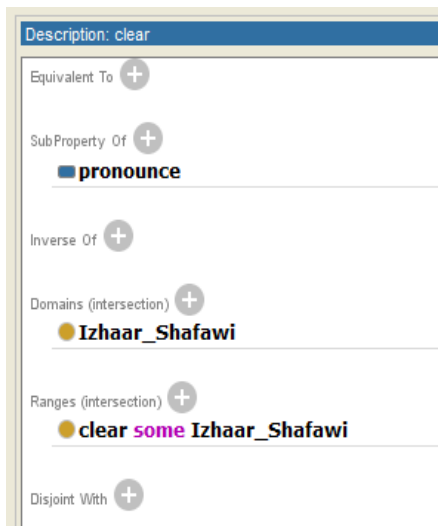


Fig 9: clear constraint

#### 4.6 Define the instances

As shown in fig (11), ontology populate with instances of all ontology classes.

- *letter\_meem* is an instance for class **Idgham Shafawi**, with more details for *letter\_meem* shown in fig (12).
- *letter\_baa* is an instance for class **Ikhfa Shafawi**,
- *all\_arabic\_letters\_except\_Meem\_and\_Baa* is an instance for class **Izhaar Shafawi**.

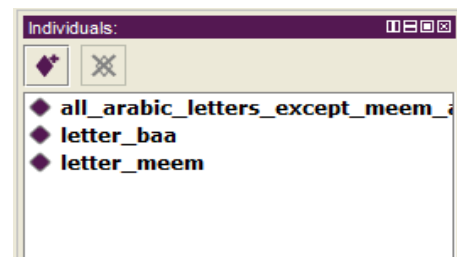


Fig 11: Classes instances

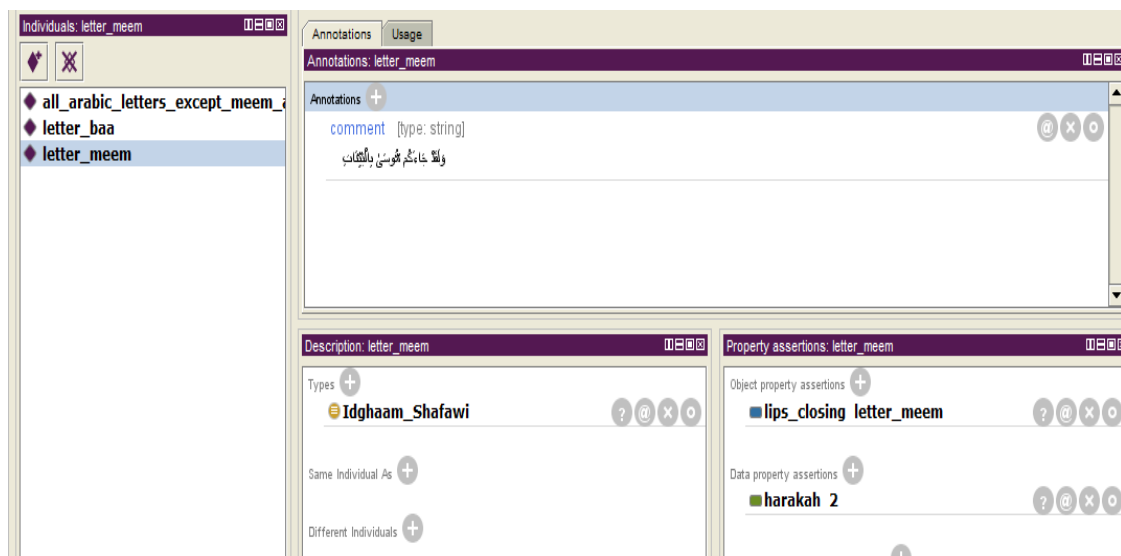


Fig 12: letter\_meem instance with more details

## 5. RESULT AND DISCUSSION

After completing the ontology construction, and ensure that all its classes are consistent with each other via the *Reasoner*, now it is possible to inquire about its components (classes, subclasses, properties, etc.) using SPARQL or DLquery. The inquire can be done either for all ontology components, as

shown in fig (13), or for a specific component using *where* condition part.

**SELECT** ?subject ?object

**WHERE** { ?subject rdfs:subClassOf ?object }

Above SPQRQL Query will retains back all ontology subjects and objects.

SPARQL query:

```
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 ?subject ?object
WHERE { ?subject rdfs:subClassOf ?object }
```

subject	object
Lips	Makhaarij
Nose	Makhaarij
Idghaam_Shafawi	MeenSakinah_Rules
Idghaam_Mathalain	MeenSakinah_Rules
Ikhfa_Shafawi	MeenSakinah_Rules
Shafatain	Makhaarij
Izhaar_Shafawi	MeenSakinah_Rules

Fig 13: Full ontology query result using SPQRQL

Fig 14 and 15 show a query done using DLquery, which show details of class **Izhaar Shafawi** and **Idgham Shafawi**

consequently. These details can be controlled through the right side check points.

The screenshot shows the DLquery interface. On the left, a class hierarchy for 'Izhaar\_Shafawi' is displayed, showing its relationship to 'MeenSakinah\_Rules', 'Idghaam\_Mathalain', 'Idghaam\_Shafawi', 'Ikhfa\_Shafawi', and 'Thing'. On the right, the 'DL query' section shows the query 'Izhaar\_Shafawi' and the results. The results are categorized into: Equivalent classes (1) - Izhaar\_Shafawi; Ancestor classes (2) - MeenSakinah\_Rules, Thing; Super classes (1) - MeenSakinah\_Rules; Sub classes (0); Descendant classes (0); and Instances (1) - all\_arabic\_letters\_except\_meem\_and\_baa. A sidebar on the right contains checkboxes for Super classes, Ancestor classes, Equivalent classes, Subclasses, Descendant classes, and Individuals, all of which are checked. At the bottom right, 'Reasoner active' and 'Show Inferences' are also checked.

Fig 14: Izhaar Shafawi query using DLquery

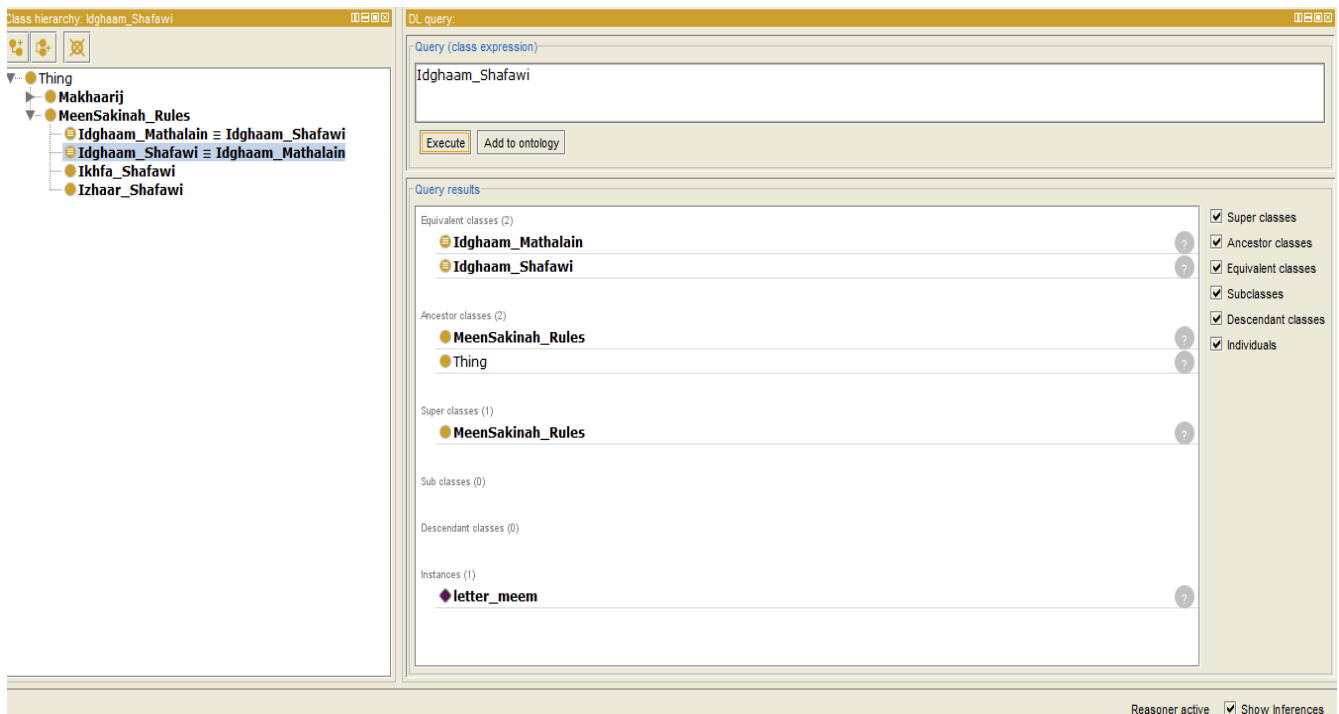


Fig 15: Idgham Shafawi query using DLquery

## 6. CONCLUSION

Via using Protégé framework with OWL language, an ontology for Meem Sakinah provisions is constructed. Firstly, the main terms are listed, then using the concepts of classes and subclasses in programming, these concepts and the relations between them are identified. On the other hand, and according to Meem Sakinah rules, some constraints are put on some properties. Finally, instances are attached for each class, while the *Reasoner* is used to check class consistency. Eventually, SPARQL and DL Query are used to inquire about Meem Sakinah ontology components.

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