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

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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 are 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 Idgham 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]. The words of the Messenger of Allah” Mohammedﷺ: (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 (ɔ), 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 Sākinah: [7]

- Ikhfa Shafawi.
- Idghaaam Shafawi.
- Izhaar Shafawi.

3.3.1 Al-Ikhfa Al-Shafawi
The rule will be Ikhfa Shafawi if the letter Baa (٣) appears after the letter Meem Sakinah. It’s a light nasal pronounced sound, for two seconds (called two harakah).

3.3.2 Al-Idghaaam Al-Shafawi
The rule will be Idghaaam Shafawi if the letter Meem (ɔ) appears after the letter Meem Sakinah. It can be said that the two letters will be combined into one Meem Mushaddah (ٝ), and read with Ghunna (nasalization).

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

3.3.3 Al-Izhaar Al-Shafawi
When any of the remaining 26 letters of the Arabic language appears after the Meem Sākinah (ɔ), there will be Izhaar Shafawi, with no Ghunna.

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

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”.

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4.2 Define Meem sakinah provisions main terms

In Meem sakinah provisions, the common terms include: Ikhfa Shafawi, Idghaam Al-Mithlayn, Izaar 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.
  - Izaar Shafawi.
  - Idghaam Shafawi (Idghaam Al-Mithlayn).

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 Izaar 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.

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).
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.
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.

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.

Fig 14: Izhaar 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.

7. REFERENCES