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Ontology-Supported Approach for Judging Hadith Isnad

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Abstract

Isnad is the chain of narrators attesting to the historical authenticity of a particular hadith. It helps differentiate between the accepted and rejected hadiths. In this paper we develop an ontology-based approach to support the process of judging *isnad*. The approach applies the rules followed by hadith *isnad* scholars and depends on the hadith domain specific ontology built specially to represent narrators' knowledge. We implement a prototype of the approach which is used to automatically generate a suggested judgment of hadith *isnad*. The accuracy of the approach in judging has reached 80% and is evaluated through hadith examples and comparisons with hadith scholars' judgments.

***Keywords*:** Ontology Engineering, Domain-Based Ontology, Hadith Ontology, Hadith Isnad.

1. Introduction

Hadith is oral traditions related to the words and deeds of Prophet Muhammad (peace and blessings of Allah be upon him). Hadith consists of two parts: the actual narration, known as *matn*; and the chain of narrators through whom the narration has been transmitted, traditionally known as *isnad* or *sanad*. Isnad consists of a chronological list of the narrators, each mentioning the one from whom he heard the hadith all the way to the prime narrator of the *matn* followed by the *matn* itself (Azmi & Bin Badia, 2010a, 2010b). Hadith scholars agreed that hadith *isnad* is required in the narration of prophetic Sunnah and it is a condition to trust hadiths. In order to know whether hadith is authentic or not, hadith scholars follow clear steps in judging hadith *isnad* that are considered as traditional methods. Existing tools used to help in the process of judging hadith *isnad* like electronic hadith encyclopedias and some application are mostly manual and only deals with some steps of the process of *isnad* like returning the chain of narrators mentioned in the *isnad*. Moreover they are based on traditional searching and matching.

Ontologies are a semantic web building block that can be used in many applications, like information retrieval systems and decision-support systems (Boyce & Pahl, 2007; Kalfoglou, 2004). Ontologies can also be helpful in the process of judging hadith *isnad*. An ontology is a formal explicit description of concepts in a domain (classes), properties of each concept describing various features and attributes of the concept (slots or properties), and restrictions on slots (facets) (Wache, et al., 2001). An ontology together with a set of individual instances of classes constitute a knowledge base (Al-Safadi, Al-Badrani, & Al-Junide, 2011; Boyce & Pahl, 2007).

In this paper, we develop and ontology-based approach for supporting the process of judging the *isnad* of hadith. The core of the approach is the hadith domain-dependent ontology developed based on the knowledge of the well-established science of hadith. It is designed by the assistance of a hadith *isnad* expert to identify concepts, relationships, and definitions of the hadith domain and following a well-established development methodology that is due to Noy & McGuinnes (2001) resulting in a set of narrators' equivalent classes, properties, relationships and instances.

The approach takes a hadith as input and separates its *matn* from its *isnad*. It then builds the tree of narrators contained in the *isnad* and uses the ontology to identify each narrator and ensures the continuity of the *isnad*, i.e., connection of the narrators' chain. Then it uses an algorithm that applies the judgment rules followed by hadith specialists to judge the authenticity of each narrator and his *Rotba* (rank), then gives a decision weather a hadith is authentic or not. A prototype of the approach is implemented as the Isnad Judgment System (IJS). It enables a user to choose a hadith, view its narrators and their authenticity, and gets a final judgment and a trace showing how the system arrives to this judgment decision. The accuracy of the approach respectively IJS is evaluated through two means: A set of already judged hadiths by the well-known scholar Al-Albani and a set of un-judged hadiths that are judged by IJS and by a hadith specialist at the same time. The results show a high degree of judgment accuracy.

The paper is organized as follows: Section 2 presents some related works, Section 3 presents the ontology development process and evaluation, Section 4 presents the *isnad* judgment approach, Section 5 presents the implementation of the approach, Section 6 presents the evaluation of the accuracy of the implemented approach, and Section 7 concludes the paper.

2. Related Work

There exist various electronic encyclopedias that are helpful in hadith judgment like Shamela library (http://www.shamela.ws), Encyclopedia of Narrators of Hadith (http://www.ahlalhdeeth.com), Encyclopedia of Harf: the Nine Books (http://www.harf.com), Aldourar Alsunnia (http://www.dorar.net/enc/Hadith). From our review, we noticed that they are all similar in their outputs (related to judgment of hadith process). In judging a hadith, they all depend on the efforts of the user who needs to search for a narrator. They usually provide narrators' chain and biographies such as name, surname, death date, layer, rank, teachers, and students. Encyclopedia of Harf additionally draws a tree of the hadith *isnad*. Aldourar Alsunnia prioritizes the author's judgment such as Imam Bukhari, Imam Muslim, and Al-Albani. Although hadith electronic encyclopedias have useful features, they lack the automation of judgment of hadith *isnad* resulting in time-consumption and much of the effort lies on the researcher of the hadith.

Prayer domain ontology is developed in (Saad, Salim, Zainal, & Muda, 2011). It represents an attempt to understand the characteristics of an ontology development as a concept of Islamic knowledge. They use information from multiple sources provided by domain experts. It involves Qur'an, authentic hadith and books that focus on the Shafie's school of thought. The ontology developed from information gathered by domain experts and assigned to the ontology in the form of a set of concepts, relationships, and definitions.

To enrich the Arabic content in the semantic web, a model is proposed in (Al-Safadi, Al-Badrani, & Al-Junide, 2011) for representing Arabic knowledge in the computer technology domain through ontologies. The model starts by elicitation of users' informational needs. The

ontology is designed based on the Web Service Modeling Ontology framework (Roman, et al., 2005) for modeling semantic web services. They model the ontology first and then use this ontology as a domain model to form the basis of the generation of the semantic search engine.

e-Narrator (Azmi & Bin Badia, 2010) is an approach that parses a plain hadith text and automatically generates the full narration tree. It involves parsing and annotating the hadith text and recognizing the narrators' names. It uses shallow parsing along with a domain specific grammar to parse the hadith content. e-Narrator depends on iTree (Azmi & Bin Badia, 2010) that automatically generates the narrators' chain of a given hadith and graphically displays it. Experiments on sample hadiths show that e-Narrator has acceptable success rate. But it has a limitation in that it is based on Sahih Muslim book only. The effect of this limitation is that it can't draw the *isnad* tree for all hadiths in the six books. Additional limitation that we are trying to overcome in our research is that it only generates a narration tree which cannot be used for making judgment on the *isnad*.

In Baraka & Dalloul (2014), we use e-Narrator's HadithRDF ontology designed by Azmi & Bin Badia (2010) as a basis for building the Hadith Isnad Ontology used in this research. To overcome the forth mentioned limitations of e-Narrator's ontology, we have enriched it with more properties, relations and attributes related specifically to the narrators. Hadith Isnad Ontology combines the ontology features with Hadith judgment rules (the clear steps Hadith scholars follow in the judgment of the Hadith Isnad) to identify the narrators and support the Isnad judgment. We have evaluated the ontology through Hadith examples and DL-Queries. Next, we give an overview of building the ontology as it is considered the basic building block in the development of the proposed ontology-based Isnad judgment approach.

3. Hadith Isnad Ontology

Although the development of Hadith Isnad Ontology is presented in (Baraka & Dalloul, 2014), we present it here in a condensed way as to serve clarity of presentation in this research and at the same time avoid repetition. The ontology is developed based on the knowledge of the well-established science of hadith and by the assistance of a domain, hadith *isnad*, specialist to identify concepts, relationships, and definitions of the hadith domain. The development methodology we adopted is widely known (Noy & McGuinness, 2001; Boyce & Pahl, 2007) and consists of determining the domain and scope of the ontology, enumerate the important terms in the ontology, define the classes and the class hierarchy, define the properties of classes (slots), and define the facets of the slots and finally creating instances (individuals) in the ontology to establish some sort of a knowledge base. We have added an additional step related to the evaluation of the ontology.

The ontology provides a comprehensive information related to a hadith narrator such his name, descent (*Nasab*), category (*Tabaqa*), rank (*Rotba*), teachers, students, muddle (*Ikhtelat*) if any, ignorance (*Irsal*) if any. To enumerate the basic terms in the ontology, we use the basic terms used in HadithRDF ontology (Azmi & Bin Badia, 2010) as a basis of the terms. We add more properties for these terms as stated in the science of judging hadith *isnad* and through analyzing the structure of hadiths in the six hadith books (called Kutub Al-Sittah). The main terms are Book, Hadith, Person, Author, and Narrator. Each of these terms has its comprehensive set of properties (see (Baraka & Dalloul, 2014) for the complete set).

Classes are terms that describe objects having independent existence or terms that describe these objects. Classes include Hadith, Person, Narrator, Author, and Book. They become

anchors in the class hierarchy since they will be organized into a hierarchical taxonomy. A top-down approach is used to build the class hierarchy: we define top-level classes such as Book, Chapter, Hadith, and Person then define subclasses that could expand from them.

The set of class properties are defined and attached to it as slots. For Example: *Person* has two types: *Narrator* and *Author*. Every instance of *Narrator* has properties such as *HeardFrom*, *hasFather*, *TransferTo*, *NarratorOf*. We have defined 37 object properties that are sufficient to create associations and relationships between class instances. Additionally, we have defined 33 data properties such as *Id*, *Name*, *Konia*, *Luqab*, *Nasab*, *BirthYear*, *DeathYear*, L*i*veIn, *Rotba*, *Tabaqa*, and *hasTadlees*. Data properties help us describe instances and usually are typed data. For example, *Id* takes an integer value while *Name* takes a string value.

Slots have different facets that describe allowed values, their types, the number of values (cardinality), and other features of values the slot can take. In our case, most of the slot types are strings and integers encoded using either ASCII or UTF-8 (Arabic). For example, the type of *Name* property is string and the type of *Tabaqa* property is integer.

Adding class instances (individuals) allows for all the properties of the classes to be recorded. The added instances represent a number of hadith examples that are representative of all the information we want to include in the ontology and use them later in the isnad process. These individuals include Books, Hadiths, and Narrators respectively their properties and relationships.

An ontology can be evaluated against many criteria such as domain coverage, specific use cases, scenarios, applications, consistency and completeness (Brank, Grobelnik, & Mladenic, 2005; Obrst, Ceusters, Mani, Ray, & Smith, 2007; Porzel & Malaka, 2004). We have evaluated the quality of the created hadith *isnad* ontology in representing all terms, properties, and relations through hadith examples and ontology querying. The evaluation of the quality of the ontology through a hadith example is done to show if the ontology indeed represents terms, properties and relations of the hadith. Additionally, we have evaluated the quality of the ontology through querying narrators for their information and properties using DL-Query (Sirin & Parsia, 2007) via the standard Protégé plugin (Knublauch, Fergerson, Noy, & Musen, 2004) where the ontology is represented in OWL (Horridge, et al., 2006). Next the ontology will be incorporated as the core component in the *isnad* judgment approach.

4. The Isnad Judgment Approach

In this section, we present the approach that portrays the use of the hadith *isnad* ontology in the *isnad* judgment process. Figure 1 illustrates the steps of *isnad* judgment approach. It consists of 4 steps: separating *isnad* from *matn* using the e-Narrator web service, identifying the narrators using the *isnad* judgment ontology, checking the continuity of *Isnad* using the reasoner, and applying the judgment rules. The judgment rules which are followed by hadith scholars are realized using the hadith *isnad* judgment algorithm. Next we explain each step.

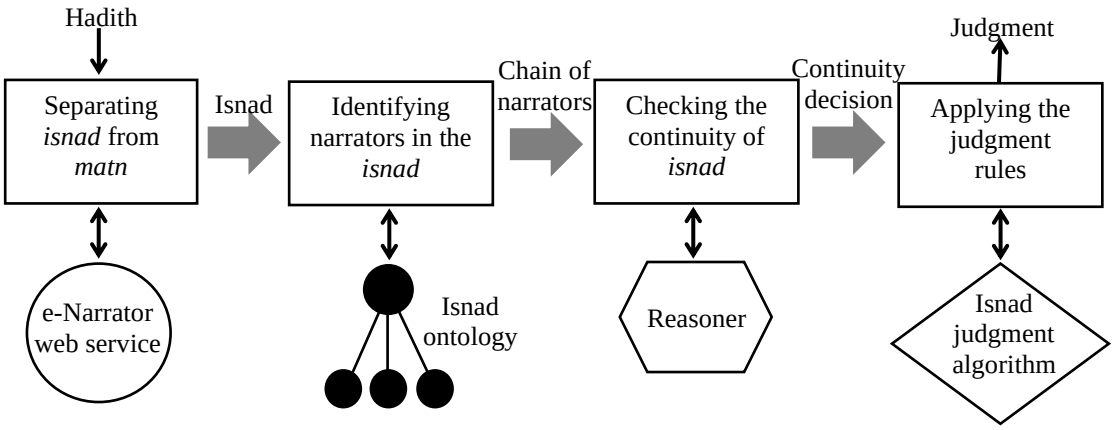

Figure 1. The Steps of the Isnad Judgment Approach

4.1. Separating Isnad from Matn

In separating the narrators' chain from the words of hadith, we use e-Narrator (Azmi & Bin Badia, 2010) tool (see Section 2) which takes a hadith as input and returns the narrators' chain which is the basis of the *isnad* judgment. To use e-Narrator effectively, we made web service enabled such that our system sends it a hadith as a SOAP message request based on its WSDL and it returns the narrators' chain as a SOAP message response.

4.2. Identifying the Narrator Using the Hadith Isnad Ontology

Identifying each narrator in the returned chain of narrators poses a challenge and takes time from specialists due two issues (Azmi & Bin Badia, 2010; Azmi & Bin Badia, 2010):

- The various and different naming manners: the names of narrators are listed in the *isnad* of hadiths using various many manners such as First Name alone, First Name followed by Father's Name, First Name followed by Father's Name followed by Grandfather's Name, First Name followed by Father's Name followed by Family Name, Son Of followed by Father's Name, Ibn (Son of) followed by Father's Nickname, etc.
- Similarity of names: if the narrator has heard hadiths from two or more narrators whose names are similar. For example, if the narrators of a hadith contain the name Sufyan "سُفْيَانُ" we can't tell if the intended narrator is Sufyan Ibn Oiaina "سفيان بن عيينه" or Sufyan Al Thawry "سفيان الثوري".

To resolve these two issues, we set some rules to identify the narrator using the ontology:

1. Insert all cases of the narrator manners in the *Name*, *Luqab*, Konia, and *DenotedBy* properties. This resolves the complexity of narrators' name.
2. The ontology querying is executed on *Name*, *Konia*, *Luqab*, *Nasab*, *DenotedBy* properties.
3. Identify all narrators of hadith using ontology querying for hadith *Narrator*.
4. Identify the first narrator in the chain using ontology querying of book *Author*.
5. Identify the second narrator using the ontology querying for the *Teacher* of the first narrator and so forth. Then query for the *TransferTo* property of the first narrator.
6. Identify the narrator who has family relations (*FatherOf*) using ontology querying.

4.3. Checking the Continuity of Isnad

Continuity of *isnad* means that each narrator in the *isnad* chain had heard the hadith from his teacher and the teacher had transferred the hadith to his students. It checks if the narrator had heard the particular hadith from his teacher or not. This case is satisfied when the hadith scholar explicitly states that the narrator did not hear this hadith from his teacher. We check the continuity of *isnad* by means of the ontology reasoner. It checks whether each narrator heard from his teacher. The ontology object properties: *HeardFrom*, *notHeardFrom*, and *TransferTo* are used for this purpose.

4.4. Applying the Judgment Rules

We apply the set of rules followed by hadith scholars to judge the *isnad* through the hadith *isnad* judgment algorithm. The algorithm basically checks a narrator's degree of authenticity using the *Rotba* property of the ontology. Also it checks a narrator's Condition of Trouble such as Tadlees, Ikthelat, Irsal, Bedaa, and Wahem using *hasIkthelat*, *ikhtelatHadiths*, *hasIrsal*, *hasBedaa*, *bedaaHadiths*, *hasWahem*, and *wahemHadiths* properties of the ontology.

Hadith Isnad Judgment Algorithm

The algorithm takes as input a narrator's *Rotba* property value from 1 to 12 and returns a judgment as follows:

1. If *Rotba* property value is 1, then this narrator is Sahabi and *isnad* takes the judgment Sahih.
2. If *Rotba* property value is 2 or 3, then the judgment will be based on the following steps:
   - 2.1. Check *Tadlees* property, this property has values 1 to 5.
     - 2.1.1. If *Tadlees* property value is 1 or 2, then *isnad* will get judgment Sahih.
     - 2.1.2. If *Tadlees* property value is 3, then check the narrator's *HeardFrom* property:
       - a. If *HeardFrom* property value is yes, then *isnad* takes the judgment Sahih.
       - b. If *HeardFrom* property value is no, then *isnad* takes the judgment Weak.
     - 2.1.3. If *Tadlees* property value is 4 or 5, then *isnad* takes the judgment Weak.
   - 2.2. Check *hasIkthelat* property:
     - 2.2.1. If *hasIkthelat* property value is no, then *isnad* takes the judgment Sahih.
     - 2.2.2. If *hasIkthelat* property value is yes, then check the narrator's *ikhtelatHadiths* property (i.e., check the intellectual condition of the narrator when he narrated this hadith)
       - a. If the hadith is narrated before Ikthelat then *isnad* takes the judgment Sahih.
       - b. If hadith is narrated after Ikthelat then *isnad* takes the judgment Weak.
       - c. If the narrated hadith is not distinguished (before or after) then *isnad* takes the judgment Weak.
   - 2.3. Check *hasIrsal* property:
     - 2.3.1. If *hasIrsal* property value is no, then *isnad* takes the judgment Sahih.
     - 2.3.2. If *hasIrsal* property value is yes, then check that the narrator's *HeardFrom* property:
       - a. If *HeardFrom* property value is yes, then *isnad* takes the judgment Sahih.
       - b. If *HeardFrom* property value is no, then *isnad* takes the judgment Weak.
   - 2.4. Check *hasBedaa* property:
     - 2.4.1. If *hasBedaa* property value is no, then *isnad* takes the judgment Sahih.
     - 2.4.2. If *hasBedaa* property value is yes, then check the hadith's Bedaa property:
       - a. If the hadith's Bedaa is no, then *isnad* takes the judgment Sahih.

b. If the hadith's Bedaa is yes, then *isnad* takes the judgment Weak.

2.5. Check *hasWahem* property:

2.5.1. If *hasWahem* property value is no, then *isnad* takes the judgment Sahih.

2.5.2. If *hasWahem* property value is yes, then check if the hadith supports the narrator's Wahem:

a. If the hadith supports Wahem is no, then *isnad* takes the judgment Sahih.

b. If the hadith supports Wahem is yes, then *isnad* takes the judgment Weak.

3. If Rotba property value is 4, then the judgment will be taken from the following steps:

3.1. Check *Tadlees* property, this property has values 1 to 5.

3.1.1. If *Tadlees* property value is 1 or 2, then *isnad* takes the judgment Hasan.

3.1.2. If Tadlees property value is 3, then check that the narrator has *HeardFrom* the teacher narrator:

a. If *HeardFrom* = yes then *isnad* takes the judgment Hasan.

b. If *HeardFrom* = no, then *isnad* takes the judgment Weak.

3.1.3. If Tadlees property value is 4-5, then the narrator takes the judge Weak.

3.2. Check *hasIkthelat* property:

3.2.1. If *hasIkthelat* property value is = no, then *isnad* takes the judgment Hasan.

3.2.2. If *hasIkthelat* property value is yes, then check the cases of narrated this hadith *ikhtelatHadiths*:

a. If the hadith narrated before Ikthelat then *isnad* takes the judgment Hasan.

b. If the hadith is narrated is not distinguished then *isnad* takes the judgment Weak.

c. If the hadith narrated after Ikthelat then *isnad* takes the judgment Hasan.

3.3. Check *hasIrsal* property:

3.3.1. If *hasIrsal* property value is = no, then *isnad* takes the judgment Hasan.

3.3.2. If *hasIrsal* property value is yes, then check that the narrator's *HeardFrom* property:

a. If *HeardFrom* is yes, then *isnad* takes the judgment Hasan.

b. If *HeardFrom* is no, then *isnad* takes the judgment Weak.

3.4. Check *hasBedaa* property:

3.4.1. If *hasBedaa* property value is no, then *isnad* takes the judgment Hasan.

3.4.2. If *hasBedaa* property value is yes, then check the hadith's Bedaa property:

c. If the hadith's Bedaa is no, then *isnad* takes the judgment Sahih.

d. If the hadith's Bedaa is yes, then *isnad* takes the judgment Weak.

3.5. Check *hasWahem* property:

3.5.1. If *hasWahem* property value is no, then *isnad* takes the judgment Sahih.

3.5.2. If *hasWahem* property value is yes, then check if the hadith supports the narrator's Wahem:

c. If the hadith supports Wahem is no, then *isnad* takes the judgment Sahih.

d. If the hadith supports Wahem is yes, then *isnad* takes the judgment Weak.

4. If *Rotba* property value is 5 to 12, then *isnad* takes the judgment Weak.

5. Finally we get the lowest judgment from the previous judgment

5.1. If the lowest judgment is Sahih then the final judgment of *isnad* is Sahih.

5.2. If the lowest judgment is Hasan then the final judgment of *isnad* is Hasan.

5.3. If the lowest judgment is Weak then the final judgment of *isnad* is Weak.

5. Implementation of the Isnad Judgment Approach

We implement a prototype for the ontology-based *isnad* judgment approach, called Isnad Judgment System (IJS), which automatically generates suggested judgments of hadith *isnad*. It is based on the rules hadith scholars follow to produce a suggested judgment. The above hadith *isnad* judgment algorithm is implemented as part of IJS. The prototype is divided into the following six components:

1. User Web Interface: allows users to search hadiths and shows results of hadith *isnad*.
2. Hadith Database: to store the hadith books.
3. e-Narrator web service: to extract all narrators' chains from hadith.
4. Ontology: to represent narrators' knowledge needed in the process of *isnad* judgment.
5. Judgment Rules: to use the rules based on the hadith *isnad* judgment algorithm.
6. Judgment System: to judge hadith *isnad* using the judgment algorithm.

The IJS architecture in Figure 2 shows these components and the interactions among them.

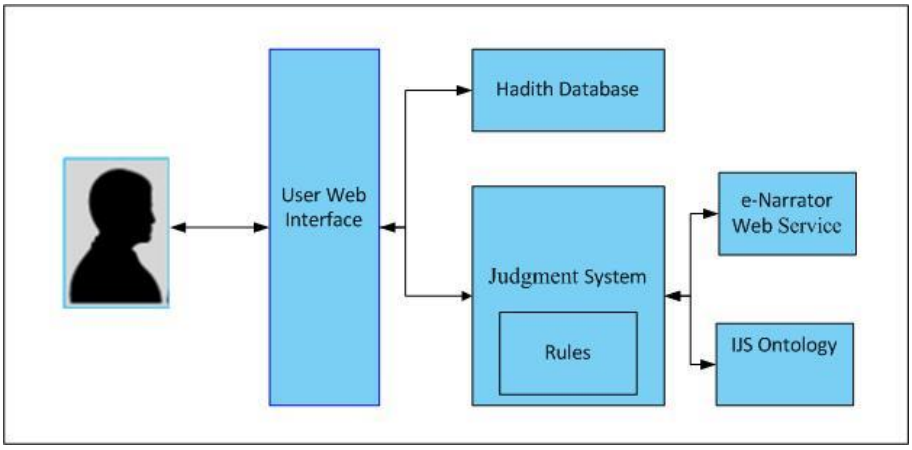

Figure 2. Architecture of the Isnad Judgment System

The system starts working once the user chooses a hadith to judge from the user web interface. This request is directed to the e-Narrator web service that analyzes the hadith to split the *isnad* from *matn* and extracts the narrators to produce the narrators' chain. The narrators' chain is processed by the judgment system using the IJS ontology to get the hadith narrators. The system uses properties such as *FirstName*, *DenotedBy*, *Nasab*, *Konia*, *Luqab*, and *NazeelOf* to achieve that. Once all the chain's narrators are determined correctly, the judging process starts. The judgment process is based on the hadith *isnad* judgment algorithm which implements the rules. It generates the final *isnad* judgment of the hadith. The judgment will result in one of three *isnad* cases: Sahih, Hasan, or Weak. Figure 3 shows the output interface of IJS. It contains the hadith text, narrator chain properties, and the judgment of *isnad*.

6. IJS Evaluation

To evaluate the accuracy of the *isnad* judgment approach we have asked a specialist in *isnad* judgment to select a representative set of hadiths containing the various cases of Sahih, Hassan, and weak. The set also contains narrators' stands with Ikhtelat, Irsal, Tadlees, Wahem and Bedaa. Moreover, Isnads contain narrator chains with family relations. The set is selected from the famous hadith book Sunan Ibn Majah. The evaluation of the accuracy is performed using two approaches; according to Al-Albani scholar and according to hadith specialist.

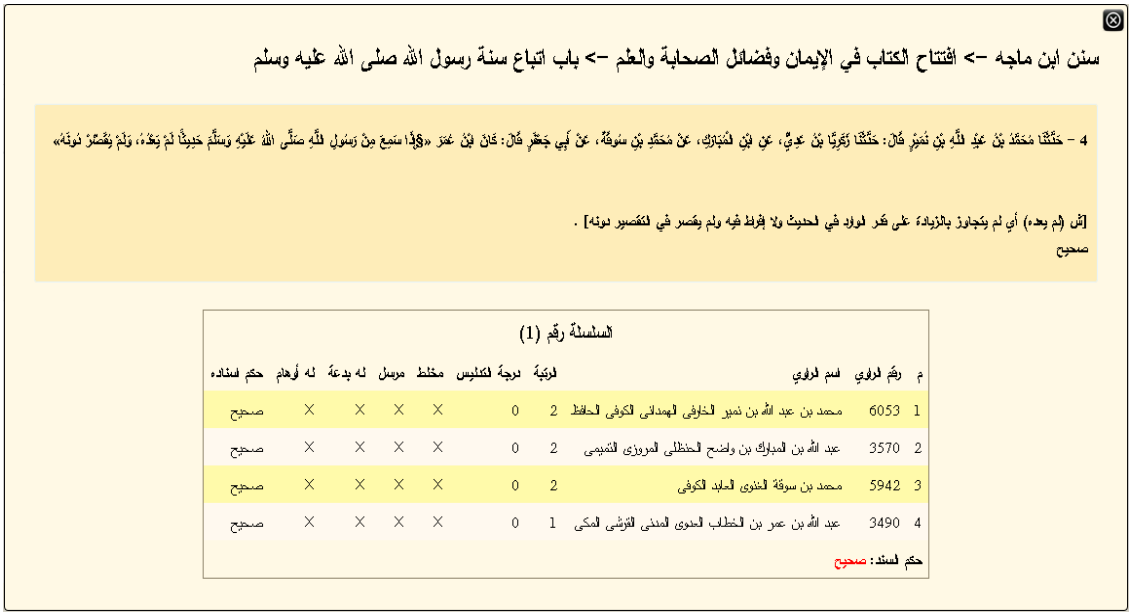

Figure 3. Hadith Judgemnt Results Interface

6.1. Accuracy Evaluation According to Al-Albani Scholar

Sheikh Nasser Eddin Al-Albani is one of the few recognized scholars of hadith and Sunnah. He is knowledgeable in *isnad* and its trusted narrators. His *isnad* judgments are always on top of hadith scholars' judgments. He had performed judgments on the *isnad* and *matn* of hadiths in Sunan Ibn Majah book.

Table 1 shows the results obtained after judging the set of hadiths (their numbers are written as they appear in Sunan Ibn Majah book) that had been judged by Al-Albani.

Table 1. Accuracy Compared to Al-Albani

Hadith No.	Al-Albani Judgment	IJS Judgment
4, 6, 23	Sahih	Sahih
5, 48, 92	Hasan	Weak
21	Weak	No Judgment
30, 762	Sahih	Weak
54, 141	Weak	Weak
57	Sahih	Hasan
85	Hasan	Hasan
94	Sahih	No Judgment
439	Hasan	No Judgment
595	Weak	Hasan

The results shown in Table 1 indicate that 6 hadiths have identical judgments to Al-Albani, 3 hadiths as "No Judgment", 7 hadiths have different judgments from Al-Albani. But since the judgment of Al-Albani is always more rigorous (strict) than that of our approach, then 6 of these 7 hadith judgments (except hadith no. 595) can be considered correct since they have judgments that are more rigorous than that of Al-Albani. Notice that the judgment of Al-

Albani is based on isnad and matn while the IJS system judgment is based on the isnad only. Therefore, 12 of the 16 hadiths have correct judgments giving accuracy of 75%.

These judgment results are also depicted in Figure 4 where "Higher than" indicates that IJS judgment is more rigorous than that of Al-Albani and "Less than" indicates that IJS judgment is less rigorous than that of Al-Albani. The "System Error" ("No Judgment" in Table 1) result is due to the limitation of e-Narrator web service that returns the chain of narrators, it was designed to work with narrators based on Sahih Muslim book and can't deal with all narrator cases in the other six books of hadith (see Section 7).

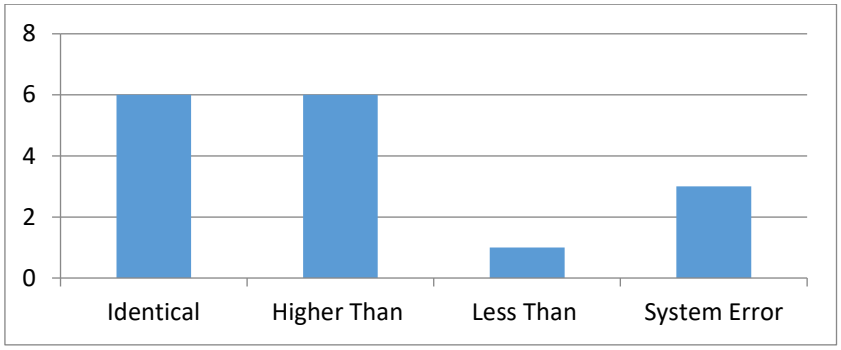

Figure 4. Results of IJS Compared to Al Albani

6.2. Accuracy According to Hadith Specialist

The judgment of Al-Albani scholar is more rigorous than ours because it is based on isnad and matn while the IJS is based on the isnad only. We asked a hadith isnad specialist to manually judge the same set of hadiths based on the isnad only. Table 2 shows the results of judging the set of hadiths (their numbers are written as they appear in Sunan Ibn Majah book) by the hadith isnad specialist and by IJS.

Table 2. Accuracy According to Isnad Judgment by Hadith Specialist

Hadith No.	Specialist Judgment	IJS Judgment
4,6,23	Sahih	Sahih
57,85,595	Hasan	Hasan
5,30,48,54,92,141,762	Weak	Weak
21	Weak	No Judgment
94	Sahih	No Judgment
439	Hasan	No Judgment

The results shown in Table 2 indicate that 13 hadiths have identical judgments in both the hadith isnad specialist and by IJS, 3 hadiths have "No Judgment". Therefore 13 of the 16 hadiths have correct judgments giving accuracy of 81%. The "No Judgment" result (in Table 2) is due to the limitation of e-Narrator web service, which returns the chain of narrators, since it was designed to work with narrators based on Sahih Muslim book. It can't deal with all narrator cases in the other six books of hadith.

7. Conclusion and Future Work

We have developed an automatic hadith *isnad* judgment approach. The approach is based on hadith *isnad* ontology developed specially for this purpose. The approach combines the ontology with hadith *isnad* judgment rules and hence returns decision weather a given hadith is authentic or not and why it returns this decision. Hadith *isnad* ontology uses ontology

features with hadith judgment rules (the clear steps hadith scholars follow in the judgment of the hadith *isnad*) to identify the narrators needed in the process of the *isnad* judgment. The ontology is evaluated in terms of its ability to represent all terms, properties and relations of a given hadith and to ensure that it answers questions that are needed in the process of *isnad*, i.e., identifying narrators and returning their needed information.

The core of the approach is the hadith *isnad* judgment algorithm which represents the set of rules followed by hadith scholars to judge the *isnad* of a given hadith. The algorithm basically checks a narrator's degree of authenticity using the ontology. The approach is implemented as a prototype called the Isnad Judgment System. The main components of the prototype are User Web Interface, Hadith Database, Judgment System including the algorithm, e-Narrator web service, and the IJS Ontology. It takes a hadith including its *isnad* as input and generates the final *isnad* judgment of the hadith. The judgment will result in one of three *isnad* levels: Sahih, Hasan, or Weak. Two approaches are used to evaluate the accuracy of the approach respectively IJS. The first is according to Imam Al-Albani approach in judging *isnad* who judges the *isnad* and *matn* of a given hadith. It showed that the accuracy is up to 75%. The second is according to a hadith specialist who, similar to our approach, judges *isnad* only. It showed that the accuracy is up to 81%.

The obtained results are encouraging but still need further improvements. Since only a prototype of the proposed approach is implemented, a complete implementation is needed that covers the six books of hadith. The approach need to cover *matn* in addition to *isnad* so that it can be comprehensive and trustworthy. A limitation of e-Narrator web service, resulted in the limited accuracy, is that it is designed to work with narrators based on Sahih Muslim book and can't deal with all narrator cases in the other six books of hadith, therefore there is a need for a more generic tool that can deal with all narrator cases. Since we are dealing with a very sensitive field related to Muslim believes, it is recommended that the system be used as a support and helping tool in the process of judgment rather than standalone and depending absolutely in its judgments.

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