Nahj Al-Balagha Semantic Search Engine(NSSE)

محرك بحث دلالي لنهج البلاغة

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Abstract

The internet is a global mesh of interconnected web links and became essential for daily jobs. The management of data infrastructure for current web page is ill-suited for the huge developments in information technology and needs to be readily accessible. Semantic web is a framework of advanced current web based on an ontology that allows data to be meaningfully shared and used by humans and machines. Arabic language is one of the official languages of the United Nations which is spoken by more than 1.7 billion Muslims and in addition to Christians in 22 countries of the Arab world. Nahj Al-Balagha is the most important book after Holy Quran because it collects the speeches of Imam Ali Ibn Abi-Talib and consists of 241 sermons, 79 letters, and 489 wisdoms as guides in different topics like politics, science, ethics, history, social philosophy and others. Nahj Al-Balagha is written in the classical Arabic language which was used before 1400 years and for this reason Nahj Al-Balagha not fully understood by most of Muslims because of the different dialects.

This paper presents Nahj Al-Balagha Semantic Search Engine (NSSE) based on ontology and consists of two stages. The first stage is creating the Arabic lexical of the words in Nahj Al-Balagha by extraction the words and groups into set of synonyms and opposites. The second stage is creating ontology based on the first stage. The system was evaluated by using the average precision and recall of the experiments' results.

Keywords:Semantic web,Ontology, Nahj Al-Balagha, Arabic Ontology, Semantic Search Engine

المستخلص

الانترنت هو شبكة من الصفحات والمستندات المرتبطة مع بعضها البعض وقد أصبح اليوم ضرورة أساسية في أداء المهام اليومية .تفتقر البنية التحتية لهذه الشبكة الى بعض أدوات التطور لتتناسب مع الحاجة المتزايدة لها خصوصاً بعد البدء بأستخدام انترنت الاشياء لأن الانترنت الحالي مخصص لفهم الانسان فقط ولا تستطيع الالآت فهمه . الويب الدلالي هو امتداد للويب الحالي و يعتمد على الانطولوجيا التي تعطي توصيفات للبيانات مما يوفر إمكانية مشاركتها بطريقة مفهمومة . تُعَد اللغة العربية إحدى أهم اللغات المعتمدة في الامم المتحدة وهي اللغة الام للبلدان العربية إضافة إلى كونها لغة القران مما يعني إنَّها لغة مستخدمة لدى جميع المسلمين حول العالم . نهج البلاغة هو اهم كتاب بعد القرآن الكريم ويحتوي على كلام أمير المؤمنين علي بن ابي طالب (عليه السلام) ويتألف من 241 خطبة و79 رسالة و 489 حكمة وتمثل دستوراً للأنسانية في مختلف الجوانب مثل السياسية والعلوم والاخلاق والتاريخ والفلسفة الاجتماعية . نهج البلاغة مكتوب باللغة العربية الفصحى التي كانت سائدة تقريباً قبل 1400 سنة وبسبب اختلاف اللهجات فقد أصبحت هذه اللغة صعبة الفهم لدى الكثيرين .

يهدف هذا البحث الى تقديم مقترح لمحرك بحث دلالي لنهج البلاغة يعتمد على الانطولوجيا ويتكون من مرحلتين : المرحلة الاولى إنشاء المعجم اللغوي للكلمات في نهج البلاغة من خلال استخراج الكلمات وتصنيفها حسب مرادفاتها واضدادها .المرحلة الثانية هي إنشاء الانطولوجيا وبناء الويب الدلالي بالاعتماد على المرحلة الاولى . تم تقييم هذا البحث بواسطة قيم الدقة وقيم الارجاع لنتائج البحث .

الكلمات الدلالية : الويب الدلالي ، الانطولوجيا ، نهج البلاغة ، الانطولوجيا العربية ، محرك بحث دلالي.

1. Introduction

Internet is an enormous and complex network of interconnected hyperlinks to allow users to browse web pages and share their data from database warehouses .Unlimited communication, social media , e-learning ,online services , entertainment , easy sharing and others led to exponential growing in internet usage and may reach to 3.6 billion users by 2017 [1]. Current web contains billions of documents and there are many administrative problems and limitations related with links structures' which led to information chaos. Even if the results have been found, Who can we check the accuracy of the results? The main problem in the current web is the query results specially when more than one document talking about the same thing. For example, the results of the word "Ajax" are: Ajax (a group of web development techniques), Ajax (sport club), Ajax (cleaner) and Ajax (dental chair). The current web is web of documents and design for direct human understanding. Those outcomes which mention the "Ajax" by names not by meaning which are ambiguous for machines' understanding. The next generation of internet is the internet of things which impose a challenge how to restruct links in the web to be understandable by human and machine. The poor data interconnection in the current web caused lack of interaction between data and applications without human intervention. To solve these problems, we must restruct the links to the meaningful content of web pages. Tim Berners-Lee mentioned that "The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation"[2]. Semantic web is a mesh of web of data and data of data to be represented in structured manner.

Resource Description Framework (RDF) is an entity–relationship framework based upon entity(Resources)–predicate –value (object) model within the interaction between objects to create a description about resources " to link different applications and Web resources into a new global network" [3]. RDF is a syntax structure written in XML.

Ontology is an intelligent description for taxonomies to resemble data hierarchies in description logics based on the concept of object-oriented programming. The description of data and relationships between data provides knowledge representation for processing information in machines with efficiently interpretation [4]. "An ontology is an explicit specification of a conceptualization" [5] .

Arabic language is the native language for the Arabic people in (22 countries) and is a religious language of all Muslims (more than 1.7 billion Muslims) in about 60 countries. It is a Semitic which consists of 28 alphabet letters and the alignment of writing from right-to-left. Arabic language has some unique characteristics such as:

- Highly inflectional because of the grammar is complex.
- There is a difference between masculine and feminine.
- There is no capitalization in Arabic.
- There are differences among singular, dual and plural.
- Richness of vocabulary.
- Short vowels in Arabic language is very important because the meaning of a word may change depending on them, for example: بِر means (good), بُر means (wheat) and بَر means (land).

Nahj Al-Balagha is the most important book after Holy Quran because it's the collection of speeches of Imam Ali Ibn Abi-Talib and consists of 241 sermons, 79 letters, and 489 wisdom as a guide in different topics from the ancient time of Adam to Imam Al-Mahdi. These topics deal with the most important issues for humans and give constitution in them like politics, science, ethics, social philosophy, history and others. These speeches were collected by Sharif Razi. Nahj Al-Balagha is the wealth of the Arab words in the singular and collected, in metaphors and idioms in elegant form. Nahj Al-Balagha is below of the Creator's words and above of the creatures' words as George Jordac said in the "Masterpieces of Nahj al-Balagha ".

Section 1 of this paper introduces the Semantic Web. Section 2 gives an overview about some related works. Section 3 introduce NSSE in detail whereas section 4 evaluates the proposed system.

2. Related work

World Wide Web is a huge mesh of data links warehouse and this network is growing rapidly. Because it is hard for machines to integrate the information, the retrieval of related data is one of the challenges that face world wide web. The results of research in the current web depends on textual keywords and the search algorithms. This is not an efficient solution because the user may get an inaccurate information or may be ambiguous bout the meaning. For this reason, there are many researches and studies were carried out in order to get a more intelligent structure to reduce chaotic results. Semantic search integrates technologies to evolves to next generation of search engines built on store meaningful information to solve complex queries. C. Mangold created a comparison between ten of semantic search approaches based on architecture , coupling between documents and ontologies , combination between interactive and capabilities of the system to be invisible to the user, capabilities learning system, query recall and precision and structure and technological of ontology [6]. W. Wei, P. M. Barnaghi and others studied the aims of semantic search through number of systems and divided them according to their methodologies and goals into document-oriented search , attribute values and relations of knowledge-oriented search, multimedia information , relation-centered semantic and mining-based search[7]. Majdi Beseiso and Roslan Ismail evaluated the tools that supported Arabic language in a survey of Arabic language support in semantic web. The evaluation based on the layers (RDF , OWL and Query) that tools (protégé , Jena, Sesame and KAON2) supported them and there is a real need for new tools in supporting NLP for Arabic [8]. M. Al-Yahya and others presented a proposal computational model for representing Arabic language lexicons. The model used time vocabulary in the Holy Quran to relate Arabic language vocabulary. The ontology consists of 18 classes and despite the limitations , the model is capable of representing word semantics and gives an approach to facilitate semantic analysis [9].In his paper [10] R. Sujatha introduced a survey of Semantic Search Engine, and showed that semantic search is more timely than traditional search engine. G. Pandey gave a brief overview comparison factors of semantic web with the current web contents, conceptual perception, scope, environment and resource utilization. Semantic web in constantly evolving and this imposes challenges and problems like ontology development, defining a formal semantic, proof and trust, availability of content, scalability, multilingualism, visualization and stability of semantic web languages[11]. A. Azman Ta’a and others tried to facilitate Quran knowledge because Quran knowledge requires special knowledge base and there are many ways to present the Al-Quran knowledge. The thematic approach is one of these approaches which aims to help users to understand the Al-Quran knowledge in a systematic way[12]. A. Malve and P. P. M. Chawan presented a comparative study of keyword and semantic based search engine and concluded that semantic search engines have more accurate results over keyword search through the meaning of the query [13].

3. The Nahj Al-Balagha Semantic Search Engine System

This system aims to create a knowledge base that can be used in future to provide efficient search to reach accurate information from the Nahj al Balagha. The NSSE is a prototype for the semantic search engine in the Nahj Al-Balagha not only for daily search but, researchers and scientists can rely upon to prepare books and lectures.

The system is a Nahj Al-Balagha Semantic Search Engine(NSSE) which is based on Nahj al Balagha ontology, uses lexicon of Arabic words in Nahj al Balagha for the Arabic language. The core function of this system is to create knowledge based on the relation between words, senses, connotations and their locations. For example, the word heart " القلب" means a member of the human body, the connotation of heart in the Arabic language sometimes referred to member of the human body and other to reasoning and comprehension. This system consists of two main stages shown in figure (1):

3.1 First stage: lexical ontology

Lexical ontology is used for automatically text analysis. It consists of Arabic words in Nahj Al-Balagha, their synonyms and opposites. The lexical ontology architecture consists of: The Words Extraction, the relations building and the ontology building.

3.1.1 The Words' Extraction

The first step in the system is the words extraction which is an infrastructure to start the ontology. The essential function in the words extraction is to cut the words in Nahj Al-Balagha, storing them in Excel spreadsheet (approximately 69389 words) and remove the duplicate words (approximately 1140 duplicated words). The Excel sheet will consist of unique words and relations in tabular form.

3.1.2 The Relations Building

This step is done manually by using Arabic/Arabic dictionaries to find words, synonyms, opposites and relations between them. The relations between words are based on means of semantic relations

1. Means property: If A and B has the same meaning: $A \rightarrow B$

For example: (خير) has the same meaning of (بِر) and means good

2. Anti-property: if A is an (inverse) of B: $A \rightarrow !B$

For example: خير (good) is inverse of شر (bad)

3.1.3 The Lexical Ontology Building

This process reads the words and relations by using an open source java API which is called JExcelApi. The purpose of this step is to extract data from Excel sheet and create ontology. For example

```
<rdf:Description rdf:about="http://www.NSSE.com#قلب">
<a:anti rdf:resource="http://www.NSSE.com#جثمان"/>
<a:anti rdf:resource="http://www.NSSE.com#جسد"/>
<a:anti rdf:resource="http://www.NSSE.com#شكل"/>
<a:anti rdf:resource="http://www.NSSE.com#هيئة"/>
<a:anti rdf:resource="http://www.NSSE.com#طرف"/>
<a:means rdf:resource="http://www.NSSE.com#فؤاد"/>
<a:means rdf:resource="http://www.NSSE.com#مهجة"/>
<a:means rdf:resource="http://www.NSSE.com# كبد"/>
<a:means rdf:resource="http://www.NSSE.com# لب "/>
<a:means rdf:resource="http://www.NSSE.com#عقل "/>
<a:means rdf:resource="http://www.NSSE.com#وجدان "/>
<a:means rdf:resource="http://www.NSSE.com#روح "/>
<a:means rdf:resource="http://www.NSSE.com#عاطفة "/>
</rdf:Description>
```

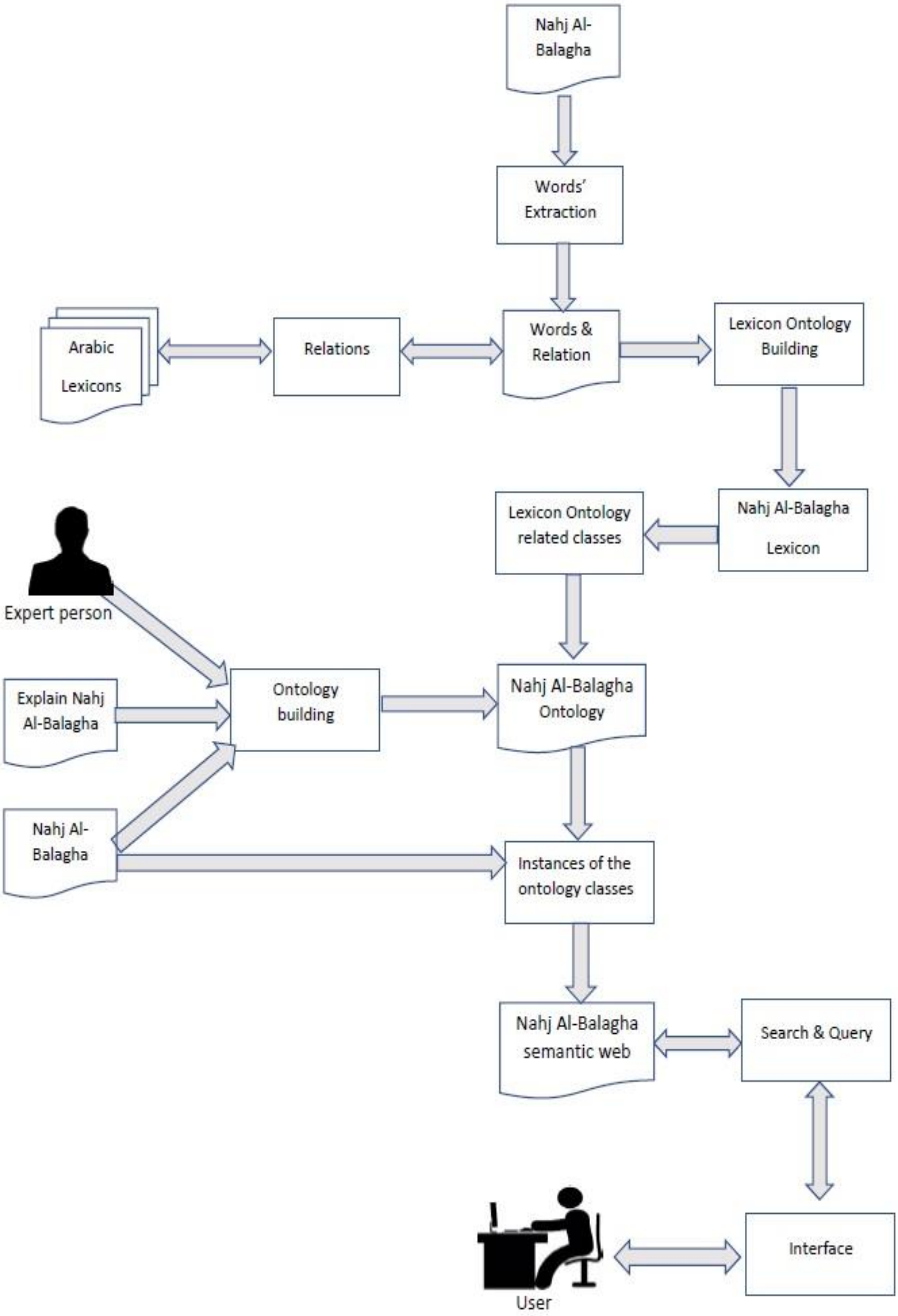
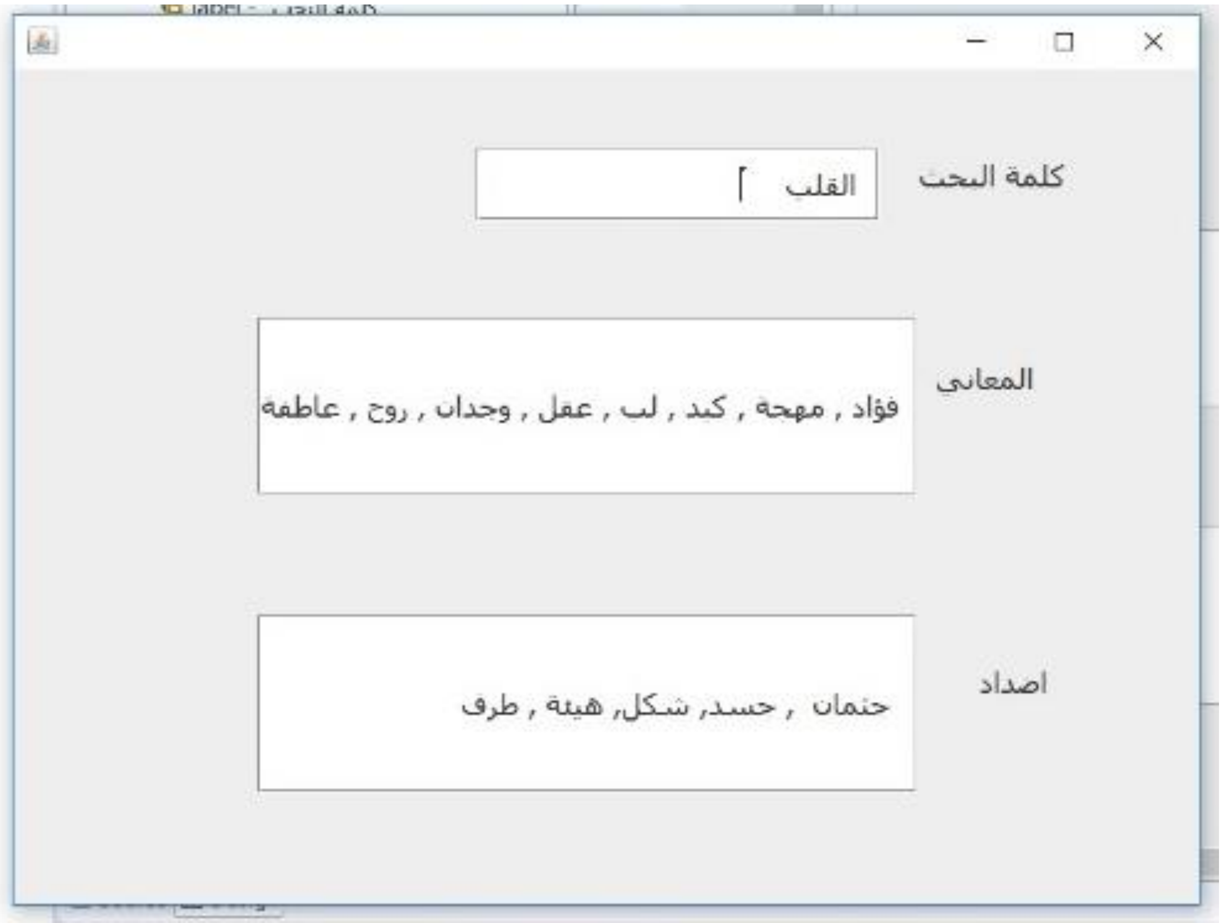


Figure 1: NSSE architecture.

The expert person can use the ontology above but GUI helps user to use the lexical as shown in figure (2).



كلمة البحث

القلب

المعاني

فؤاد , مهجة , كبد , لب , عقل , وجدان , روح , عاطفة

اضداد

جثمان , جسد, شكل, هيئة , طرف

Figure 2: Lexical GUI.

3.2 Second Stage: NSSE building

This stage uses the lexical ontology for the Arabic language in the first stage and based on Nahj Al-Balagha ontology.

3.2.1 The Ontology Building Process

Ontology building describes classes and the relation between them. The knowledge management system and ontology building are manually done by using protégé depending on examination of the sources of Nahj Al-Balagha such Nahj Al-Balagha, and explained Nahj Al-Balagha.

The outcomes from this system is the Nahj El-Balagha ontology which consists of Imam Ali's concepts in 20 hierarchal classes form as a prototype ontology and it can be extended to contain all Imam Ali's speech. The main classes of the ontology are Religion concepts (اصول الدين) ,Ethics (الأخلاق) , Promotion of Virtue and Prevention of Vice (الامر بالمعروف والنهي عن المنكر) , Belief (الاسلام والايمان واليقين) , family (الاسرة) , History (التاريخ) , Piety (التقوى) ,Repentance (التوبة) , Economy (الاقتصاد) , Jihad and war (الجهاز والحرب) , governor (الحاكم) , Pray (الدعاء) , Worship (العبادات) , Reason and science (العقل والعلم) , Quran and Sunnah (القران والسنة) , judiciary (القضاء والافتاء) , Hypocrisy (النفاق) , asceticism (الزهد) , Counsel and advice (الموعظة والنصيحة) as shown in figure (3) .

This system includes super classes and subclasses, equivalent classes (because the system is a set of relations and shared properties between classes), composite classes and disjoint classes (to prevent repetition in the individuals).

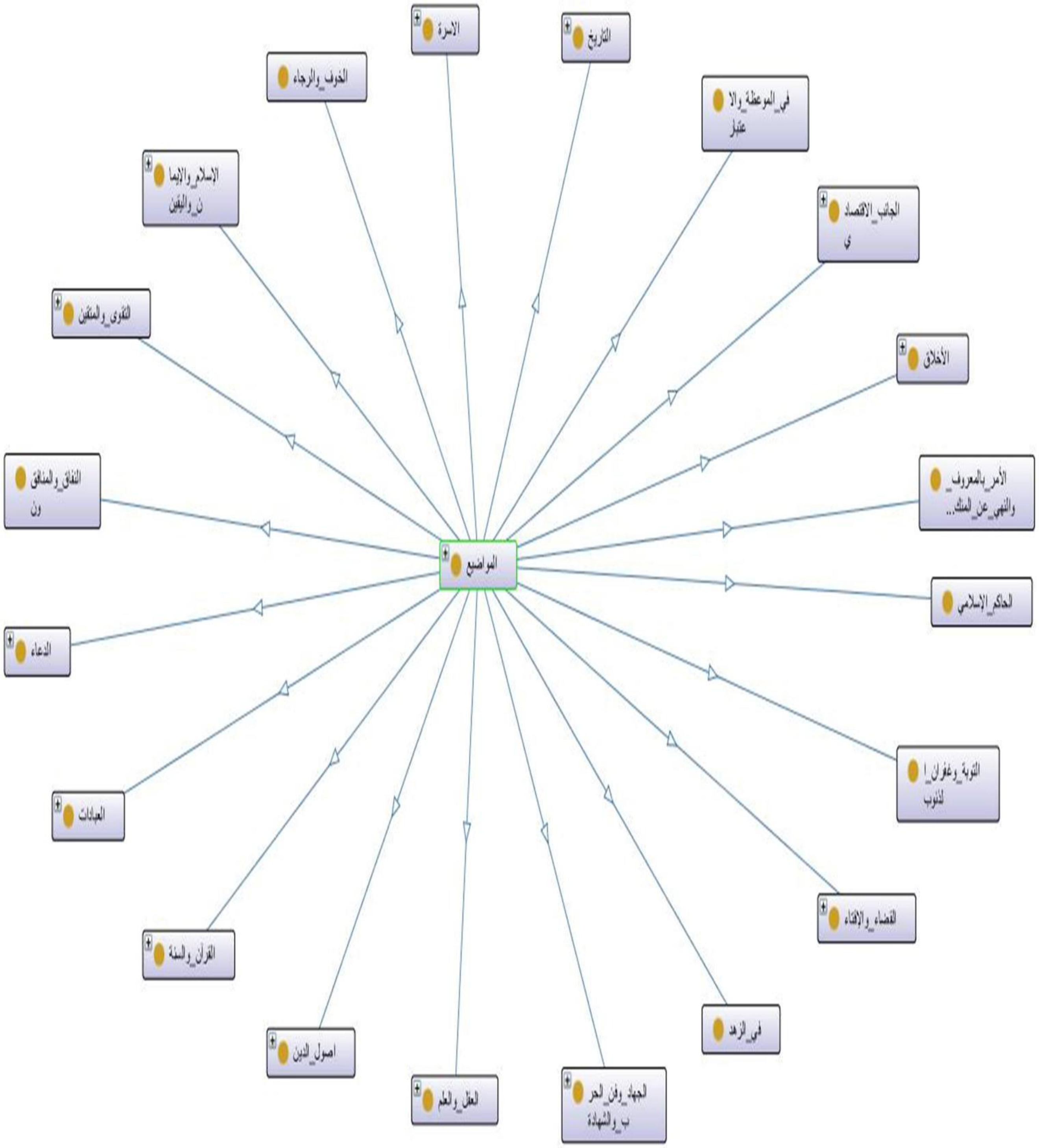


Figure 3: Nahj Al-Balagha Ontology Main classes

3.2.2 Instances of the Ontology Classes

The outcomes of this step are a RDF which contains subject(entity), predicate and object (value). The subject is a Nahj Al-Balagha ontology individuals, the predicate is the relation called IS_IN (يوجد في) and the object is the text's number (sermons, letters and wisdoms), for example:

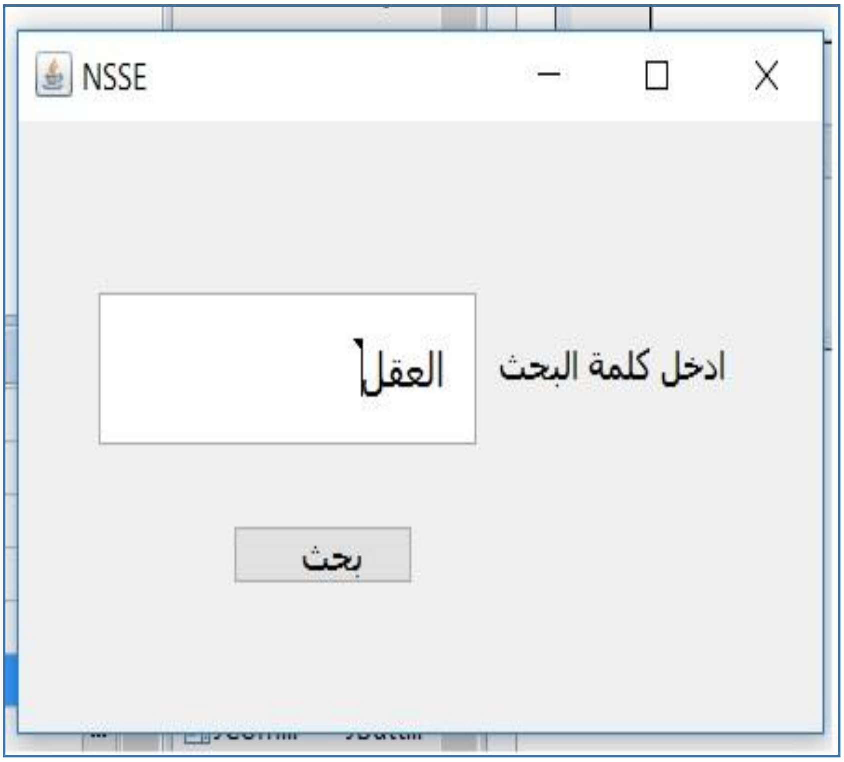
<الميراث rdf:about="http://www.NSSE.com/# أموال_المسلمين_فقسمها_بين_الورثة_في_الفرائض ><يوجد_في
rdf:datatype="http://www.w3.org/2001/XMLSchema#string"> 270_حكمة < /يوجد_في> </الميراث>

3.2.3 Search & Query

This step sims to receive the query requested by user and returns the results of the search operations by using an open source java API which is called Apache Jena.

3.2.4 Graphical User Interface (GUI)

GUI is used to create interaction between users and the system with better accessibility and ease of use. The main interface of GUI is shown in figure (4)

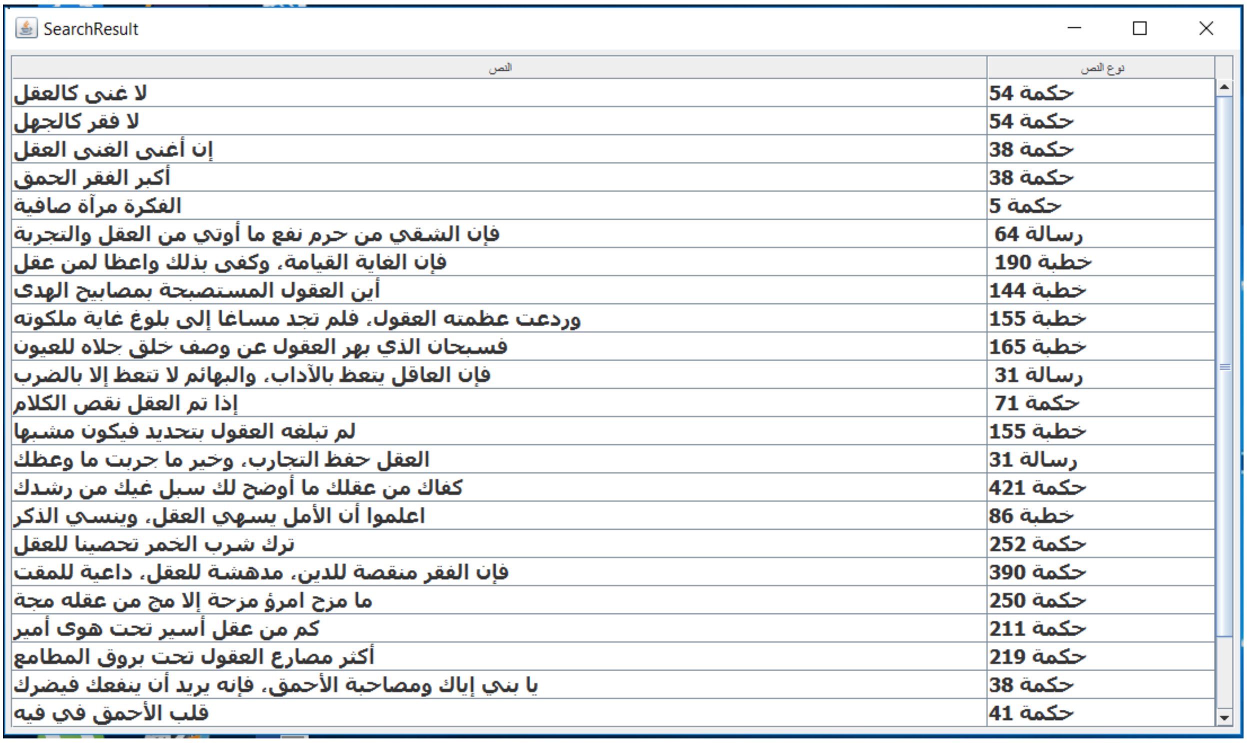


ادخل كلمة البحث العقل

Figure 4: GUI Main Page.

3. The experimental results

This paper took Nahj Al-Balagha as a case study and applied the concepts on it. The experiment is executed on 241 sermons, 79 letters, and 489 wisdoms. The NSSE GUI of the experiment is shown in figure (5).



النص	نوع النص
لا غنى كالعقل	حكمة 54
لا فقر كالجهل	حكمة 54
إن أغنى الغنى العقل	حكمة 38
أكبر الفقر الحمق	حكمة 38
الفكرة مرآة صافية	حكمة 5
فإن الشقي من حرم نفع ما أوتي من العقل والتجربة	رسالة 64
فإن الغاية القيامة، وكفى بذلك واعظا لمن عقل	خطبة 190
أين العقول المستصبحة بمصابيح الهدى	خطبة 144
وردعت عظمته العقول، فلم تجد مساغا إلى بلوغ غاية ملكوته	خطبة 155
فسبحان الذي بهر العقول عن وصف خلق جلاه للعيون	خطبة 165
فإن العاقل يتعظ بالآداب، والبهائم لا تتعظ إلا بالضرب	رسالة 31
إذا تم العقل نقص الكلام	حكمة 71
لم تبلغه العقول بتحديد فيكون مشبها	خطبة 155
العقل حفظ التجارب، وخير ما جربت ما وعظك	رسالة 31
كفاك من عقلك ما أوضح لك سبل غيك من رشدك	حكمة 421
اعلموا أن الأمل يسهي العقل، وينسي الذكر	خطبة 86
ترك شرب الخمر تحصينا للعقل	حكمة 252
فإن الفقر منقصة للدين، مدهشة للعقل، داعية للمقت	حكمة 390
ما مزح امرؤ مزحة إلا مج من عقله مجة	حكمة 250
كم من عقل أسير تحت هوى أمير	حكمة 211
أكثر مصارع العقول تحت بروق المطامع	حكمة 219
يا بني إياك ومصاحبة الأحمق، فإنه يريد أن ينفعك فيضرك	حكمة 38
قلب الأحمق في فيه	حكمة 41

Figure 5: Page of Results’

The average recall and precision of the proposed system are 93% and 88.5% respectively for 10 executed queries shown in the Table (1)

Table 1: Precision and recall.

Object	Word Search	Recall	Precision
الايمان	الاسلام	0.8	0.7
القران	شفاء	0.85	0.75
القران	كتاب	1	1
العدل الالهي	قسط	1	0.8
الامام	يعسوب	0.9	0.8
الصلاة	الصلاة	0.95	0.9
التقوى	ذي لب	1	1
يوم القيامة	الدار الاخرى	1	1
صفات القائد	سعة الصدر	1	1
صفات الانسان	زينة الدنيا	0.8	0.9

5. Criticism and Comparison

This system depends on the first part (lexical ontology) which consists of words, synonyms and opposites. When the lexical ontology contains a variety of words and their relationships, the system will be better and stronger. Arabic wordnet (AWN) is the largest Arabic lexicon which consists of words and synonyms. AWN has a weakness such

1. There are errors in some meanings
   Example: the results of the search " غاب " "absent" are " ادغال", "احراش" and "غابة" which are refer to "jungle".
2. Associated characters with words were ignored in AWN
   Example: there are no results when search about "كعيناه " " Like his eyes"
3. There are limited capacity in words
   Example: No results found about "زبرج" which means " ornament"

The above weakness points were noted and find the solutions in the proposed system.

6. Conclusions and Recommendations for future work

This paper proposed Nahj Al-Balagha Semantic Search Engine(NSSE) which is built on Imam Ali's speeches. NSSE consists of two stages: the first stage groups Nahj Al-Balaghas' words, their synonyms and opposites. The second stage creates the ontology based on the first stage. The evolution of the system was done by using precision and recall as a performance metrics. The end results of this paper were the semantic web which is an efficient way to provide variety of related results based on the meanings not syntax because of the detailed information of words and this will reduce the cycle time for search.

The future work will attempt to improve the results query by using planning to receive more specific results and give suggestions about equivalent query which have the same meanings.

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