

The Hierarchical Classification for The Rituals of Hajj Using Ontology

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ABSTRACT

In our dynamic world, knowledge is linked to data and information that already exists, and knowledge management can be shared and linked. In a broader scope, it can be used to structure ontology. Using ontology helps users understand structure easier and faster. In recent years, there has been a growing interest in developing and building an ontology for many fields.

However, relatively few works related to the religious aspect were conducted, especially regarding the pilgrimage and its rituals. This research paper was proposed given the importance of this field in Islam and the knowledge and exchange of everything related to it. Therefore, the proposed field was represented in ontology by showing the relationships between the categories that make up this field, which was organized hierarchically. When the relationship is already defined, the structure of the ontology can be modeled in the field of knowledge (pilgrimage and its rituals), and an appropriate methodology has been used for this work, which we will explain later.

This paper proposes to perform a hierarchical classification of pilgrimage rituals using an ontology file generated using the Protégé tool for modeling the ontology structure. This ontology structure will help share knowledge about Hajj and its rituals.

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1. INTRODUCTION

By Hajj, we mean the pilgrimage of Muslims to the city of mecca in a specific season every year. Certain rituals are called hajj rites. A once-in-a-lifetime duty for everyone. A healthy adult Muslim [1]. It is the fifth pillar of Islam,

قال النبي الكريم صلى الله عليه وسلم: ((بُني الإسلام على خمس: شهادة أن لا إله إلا الله، وأن محمداً عبده ورسوله، وإقام الصلاة، وإيتاء الزكاة، وحج البيت، وصوم رمضان))

Hajj is an individual duty for every healthy adult Muslim.

قال تعالى في القرآن الكريم: "وَلِلَّهِ عَلَى النَّاسِ حِجُّ الْبَيْتِ مَنِ اسْتَطَاعَ إِلَيْهِ سَبِيلًا وَمَنْ كَفَرَ فَإِنَّ اللَّهَ غَنِيٌّ عَنِ الْعَالَمِينَ"

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Because of the importance of this obligation and its actions in Islam as well as for Muslims, we have made this research paper to know all the details clearly and classify them in a hierarchical manner that is accurate and understandable to the reader instead of reading books, references, and religious sources that take a lot of time and effort. This research paper summarizes everything related to Hajj and its rituals. One of the proposed options for dealing with large amounts of data is ontology. Ontology, in general, is a theory about the nature of things with existence and types [2]. It can also be defined as a set of formal specifications that provide shareable and reusable knowledge representations, meaning that they describe concepts of a particular domain and the relationships between them. Therefore, it is partly a taxonomy, a graphical structure that describes the hierarchical relationship of a group of things [3]. As shared knowledge, domain definitions with interrelated relationships have been incorporated into ontologies [4]. By demystifying language and enabling the reuse of domain knowledge, ontology offers a shared, universal architecture for information between people and machines. It was initially described as a formal, explicit exposition of the terminology used in the area and how they relate to one another. A set of rules that provide further information [5]. Ontology's significance can be summed up as follows: [6]

- The Existential Analysis Makes The Knowledge Structure Clear.
- Vocabulary Cannot Adequately Convey Knowledge Without The Underlying Ontology.
- Ontology Is A Form Of A Theoretical Model With A High Probability Of Application And Can Be Used For Various Uses.
- Interoperability And Reuse.
- Standard Vocabulary (For Humans And Agents).
- A Shared Notion Of Data Organization.

It Has Been Applied In Many Different Domains, Such As Biology, The Semantic Web, And Medicine, To Name A Few. Its Popularity Is Due To Its Capacity To Make Complex Issues Simple. The Current Research Uses Ontology As A Descriptive Aid To Address The Issue Most People Interested In Religion Face, Particularly Regarding Hajj And Its Rites. After Thoroughly Assessing The Literature, We Concluded That The Method Based On Ontology Might Be The Best Choice For Hierarchically Classifying The Acts Of Pilgrimage And Its Rites. This Research Presents A Hierarchical Classification System Based On Ontologies For Hajj Activities And Rituals.

2. METHODOLOGY

An ontology is a way to describe the ideas in a domain and how they relate to each other in a way that a computer can understand. As the number of people who used the Internet grew, so did the need to share and reuse networked knowledge. Ontologies, which are made to help with interoperability, sharing, and reusing, make it easier to do these things. They do this by shifting the focus of systems enterprise away from technology and toward a solution that works on both a knowledge and a technology level. This is an essential step that must be taken to get the most out of the electronic information that is out there. A Universal Conference on Emerging Technologies in Engineering was held in 2015. (ICNTE-2015) The Semantic Web is the future of the Web. It gives information clear meanings, which makes it possible for machines to analyze and use Web information automatically. OWL makes it easier for machines to understand by giving meaning to Web content than XML.

Several ways have been given for making and building ontology-based expert systems. One of these methods is METHONTOLOGY, which is thought to be a complete ontology engineering system [7][8]. As shown in Fig. 1, METHONTOLOGY shows the steps that should be taken in the development method and how deep some of these steps should go.

In this research paper, we have built and developed an ontology related to the field of Hajj based on the science of METHONTOLOGY [7]. It was built based on knowledge of this field in full and familiarity with the terms and concepts that make up it and the relationships between the concepts and as explained:

- a) We have reviewed a collection of books and religious sources related to this field. These contents were then agreed upon as basic concepts of the proposed topic, and these contents: Pilgrim and Hajj rituals, contain sub-parts that illustrate the entire field [9].
- b) We have created relationships between each of these concepts mentioned above.

We have tried to cover this field fully because of its importance in Islam and for all Muslims.

2.1 FRAMEWORK

There are four main activities (shown in Fig. 1):

Step 1: Review religious sources and books - review past and present religious sources belonging to different religious references, mainly Shia concerns related to hajj rituals. Various methodologies of ontology were studied and compared, and the appropriate methodology was selected for our work.

Step 2: Data collection and coordination - data and relevant information were collected through the review of religious sources and books, as mentioned earlier, and through the interview of a competent human mufti.

Step 3: Field analysis and modeling - this field is analyzed and modeled using standardized language modeling. The purpose of this modeling is to understand the overview of the proposed work.

Step 4: Ontology Development - in this ontology, we represented a knowledge base related to the Hajj and related works. This was done by identifying the main concepts and relationships between those concepts using a tool called Protégé [10] so that the proposed file is in RDF/XML.

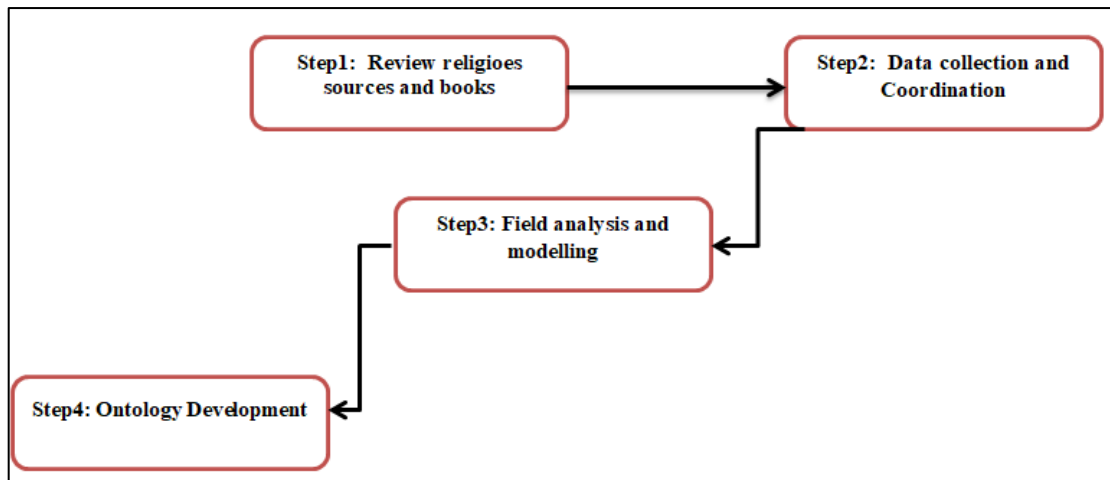


Fig. 1: Framework

2.2 METHONTOLOGY

Here, the methodology of methontology is to build and improve the ontology's applicability through several activities: specifications, the definition of concepts, formalization, implementation, and preservation of the ontology. Here we have described all the essential steps and activities in building the proposed ontology [11], as shown:

2.2.1 Specifications: Here, we have explained why the ontology is built, what inquiries this ontology presents, and who will maintain and use it.

We also discussed here the purpose of this ontology:

- Share domain information.
- Accurate and complete knowledge of the works performed during the Hajj.
- Contribute to the enrichment of Arabic content on the Internet [2].

2.2.2 Definition Of Concepts: In this activity, the informal pictorial concepts of the field are organized and transformed into semi-formal concepts in graphs or symbols. They are understood and interpreted by specialists in this field and ontology developers. This activity or work forms a conceptual model of the field ontology.

- 2.2.3 Formalization:** This activity converts the conceptual model into a formal one, which is not mandatory. Ontology tools are used to build the conceptual model automatically with experts or developers of the ontology language.
- 2.2.4 Implementation:** This activity is responsible for executing the anthology in one of the available anthology editors. We are using protégé 5.5.0 [10] as an editor with the ability to check for lexical and grammatical errors. Protégé is combined with several types of logicians who ensure the completeness, consistency, and non-repetition of the given ontology. Fig. 2 shows a typical tree structure built using the (Onto Graph) plugin included with protégé to illustrate the proposed ontology. Protégé provides capabilities to generate ideas and properties of entities in sensitive interpretation logic [12]. As shown in the figures and tables.

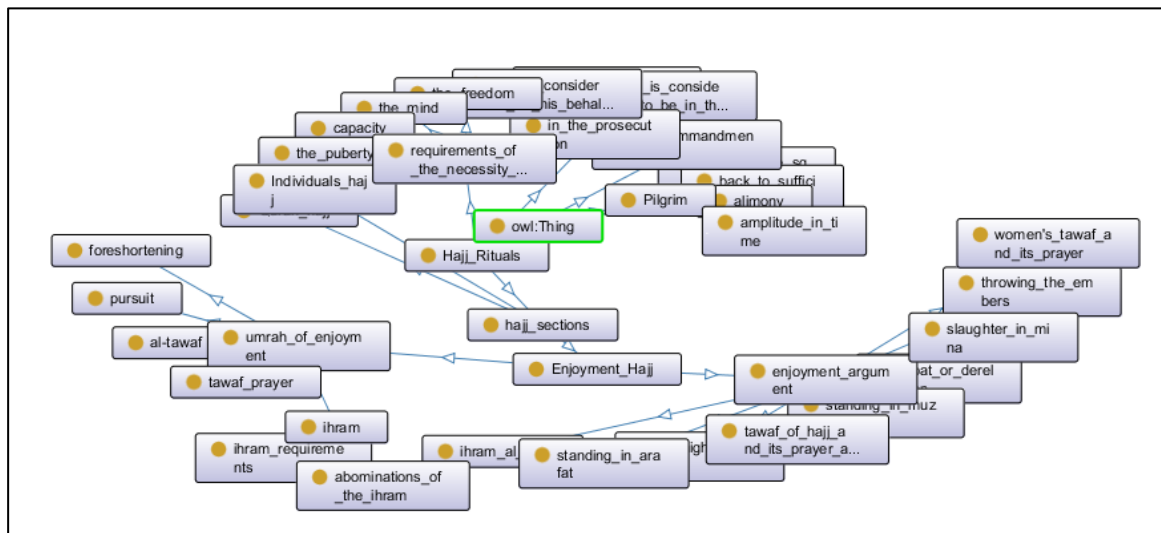


Fig. 2: Owl Graph Of Ontology

- 2.2.5 Maintenance:** In this activity, the ontology is updated, and modifications are made if necessary.
- 2.2.6 Evaluation:** It is not a stand-alone stage; instead, it is the stage that all the other stages overlap. Early in the development process, the evaluation stage gets more in-depth, but as the process continues, it gets less. Initially, it's essential to ensure that the developed ontology is valid. This is done by interviewing experts in the field to validate the information gathered and the visualization table and tree. Professionals have checked the proposed ontology, which is now in its final stages, to ensure it meets their needs.
- 2.2.7 Documentation:** This stage runs at the same time as all the other stages because the result of each stage is a document that the next stage needs to be able to use. Also, papers published in journals or at conferences are seen as a form of documentation.

3. FINDINGS

The ontology of Hajj consists of several ontologies at different levels, and the main ones are Pilgrim and Hajj Rituals. In addition to sub-levels complementary to the construction of the proposed ontology below, we will address all these levels in detail and as shown in the figures and tables:

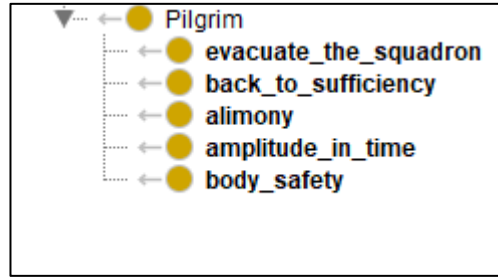


Fig. 3: Concept Classification Tree - Pilgrim

Table 1 - Description of terms - Pilgrim

Name In Arabic	Name In English	Description	Superclass
الحاج	pilgrim	he is required to perform the Hajj of Islam if he can perform it because of the conditions that the performer of the Hajj must fulfill, and he must be a sane adult capable [9].	thing
الرجوع الى الكفاية	back to sufficiency	It is that he can actually or by force subsistence himself and his family after returning if he goes out to the Hajj and spends what he has in his expenses so that he does not need to be suffocated and does not fall into distress and embarrassment because of [9].	الحاج
السعة في الوقت	amplitude in time	Here it is intended to have ample time to travel to the holy places and perform the Hajj [9].	الحاج
النفقة	alimony	it means all the costs of going back and forth in the hajj pilgrimage, or going only to those who do not want to return to their country, the wages of housing, and the food, medicines, etc. [9]	الحاج
تخليّة السرب	evacuate the squadron	it is intended here that the road should be open and safe so that there is no obstacle with which it is not possible to reach the places of performance of the ritual, nor is it dangerous to the soul, money, or supply [9].	الحاج
سلامة البدن	body safety	We mean here to be able to make the pilgrimage himself, as the patient or the pyramid - that is, the elderly - who cannot perform the pilgrimage to the end of his life does not have to make the pilgrimage himself [9].	الحاج

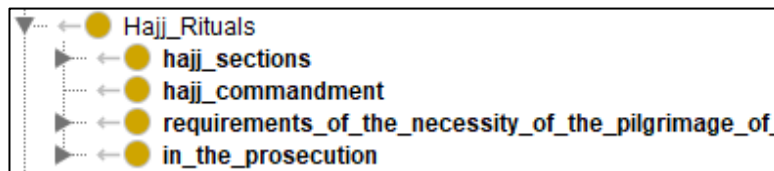


Fig. 4: Concept Classification Tree - The Rituals Of Hajj

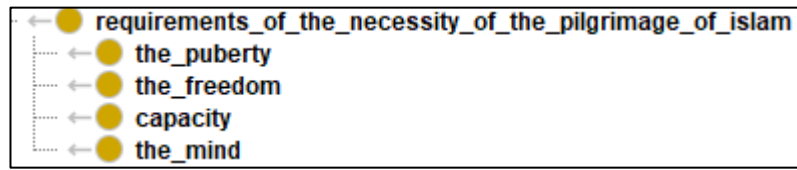


Fig. 5: Concept Classification Tree - Requirements Of The Necessity Of The Pilgrimage Of Islam

Table 2: Description Of Terms - Requirements Of The Necessity Of The Pilgrimage Of Islam

Name In Arabic	Name In English	Description	Superclass
شُرَايَطُ وُجُوبِ حِجَّةِ الْإِسْلَامِ	requirements of the necessity of the pilgrimage of Islam	means the requirements due to each person entrusted with the performance of the Hajj [9][13].	مَنَاسِكُ الْحَجِّ
العقل	the mind	one of the conditions must be met by the assigned pilgrim, i.e., the pilgrimage must not be made on the madman and the like [9][13].	شُرَايَطُ وُجُوبِ حِجَّةِ الْإِسْلَامِ
الحرية	the freedom	one of the conditions to be met by the pilgrim in charge [9][13].	شُرَايَطُ وُجُوبِ حِجَّةِ الْإِسْلَامِ
البلوغ	the puberty	one of the conditions to be met by the assigned pilgrim, i.e., it is not permissible to make a pilgrimage for a non-adult [9][13].	شُرَايَطُ وُجُوبِ حِجَّةِ الْإِسْلَامِ
الاستطاعة	capability	One of the conditions to be met by the assigned pilgrim is the financial and physically able to perform the Hajj [9][13].	شُرَايَطُ وُجُوبِ حِجَّةِ الْإِسْلَامِ

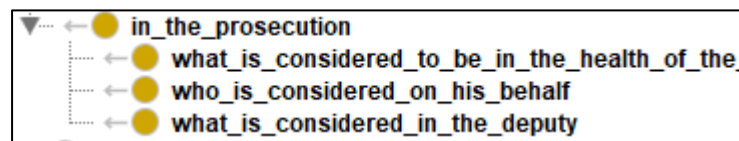


Fig. 6: Concept Classification Tree - In the prosecution

Table 3: Description of terms - In the prosecution

Name In Arabic	Name In English	Description	Superclass
فِي النِّيَابَةِ	in the prosecution	, this means that someone else performs the Hajj instead of the pilgrim himself [9].	مَنَاسِكُ الْحَجِّ
مَا يُعْتَبَرُ فِي النَائِبِ	what is considered in the deputy	means the things that must be available in the deputy person, such as reason, puberty, and faith [9].	فِي النِّيَابَةِ

ما يعتبر في صحة النيابة	what is considered to be in the health of the prosecution	means the prosecution, i.e., appointing his representative, and it is not required that his name be mentioned [9].	في النيابة
ما يعتبر في المناوب عنه	who is considered on his behalf	means the person who acts on behalf of the pilgrim in performing the rites of Hajj if the pilgrim is young or insane or unable to complete the rituals [9].	في النيابة

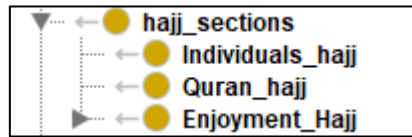


Fig. 7: Concept Classification Tree - Hajj Sections

Table 4: Description of terms - Hajj Sections

Name In Arabic	Name In English	Description	Superclass
حج الافراد	individuals Hajj	it means the pilgrimage due to those who lived in mecca or the distance between him and mecca was less than sixteen leagues[9][13].	اقسام الحج
حج التمتع	enjoyment hajj	it means the pilgrimage due to those who lived outside mecca or the distance between them and mecca was more than sixteen leagues [9][13].	اقسام الحج
حج القران	Quran hajj	it means the pilgrimage due to those who lived in mecca or the distance between him and mecca less than sixteen leagues. [9][13].	اقسام الحج



Fig. 8: Concept Classification Tree - Enjoyment Hajj

Table 5: Description of terms - Enjoyment Hajj

Name In Arabic	Name In English	Description	Superclass
حجة التمتع	enjoyment argument	means the second part of the Hajj of enjoyment.	حج التمتع
احرام الحج	ihram al_ hajj	the first duty of the duties of the argument of enjoyment.	حجة التمتع
الوقوف بعرفات	standing in Arafat	The second duty of the argument of enjoyment and means (by Arafat) is a mountain located four leagues from mecca.	حجة التمتع
الوقوف في المزدلفة	standing in muzdalifah	, the third duty of the enjoyment argument is located in Muzdalifah between Arafat and mecca.	حجة التمتع
الذبح او النحر في منى	slaughter in mina	, the fourth duty of the argument of enjoyment occurs on the day of Eid al-Adha	حجة التمتع
الحلق او التقصير	throat or dereliction	, the fifth duty of the enjoyment argument is to shave some of the hair off the head in Mina.	حجة التمتع
طواف الحج وصلاته والسعي	tawaf of Hajj and its prayer and pursuit	, the sixth duty of the argument of enjoyment occurs after returning to mecca and praying and seeking between Safa and Marwa.	حجة التمتع
طواف النساء وصلاته	women's tawaf and its prayer	, the seventh duty of the argument of enjoyment.	حجة التمتع
المبيت في منى	overnight in mina	the eighth duty of the argument of enjoyment.	حجة التمتع
رمي الجمار	throwing the embers	The ninth duty of argument is to enjoyment, i.e., to throw the three embers (first, middle, and Aqaba embers) when the pilgrim is overnight in mina.	حجة التمتع

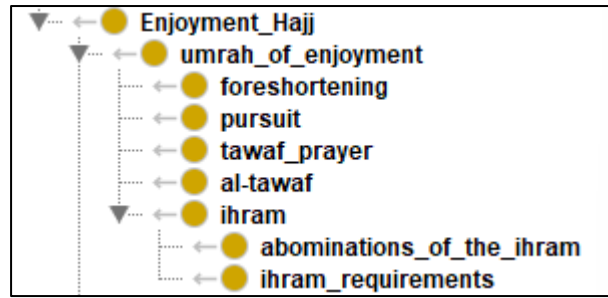


Fig. 9: Concept Classification Tree - Umrah of enjoyment

Table 6: Description of terms - Umrah of enjoyment

Name In Arabic	Name In English	Description	Superclass
عمرة التمتع	umrah of enjoyment	means the first part of the Hajj of enjoyment.	حج التمتع
الاحرام	ihram	the first duty of umrah is to enjoyment.	عمرة التمتع
مكروهات الاحرام	abominations of the ihram	mean the things that the pilgrim should not do during the ihram.	الاحرام
مستحبات الاحرام	ihram requirements	mean the things that the pilgrim must do during the ihram.	الاحرام
الطواف	al-tawaf	the second duty of umrah duties of enjoyment is al-tawaf around the Kaaba.	عمرة التمتع
صلاة الطواف	tawaf prayer	The third duty of umrah duties to enjoyment.	عمرة التمتع
السعي	pursuit	the fourth duty of umrah duties of enjoyment is the pursuit between Safa and Marwa [9].	عمرة التمتع
التقصير	foreshortening	The fifth duty of umrah, the duties of enjoyment, is to cut some hair off the head, beard, or mustache [9].	عمرة التمتع

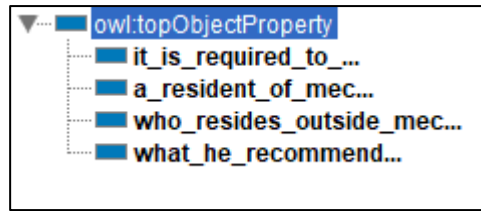
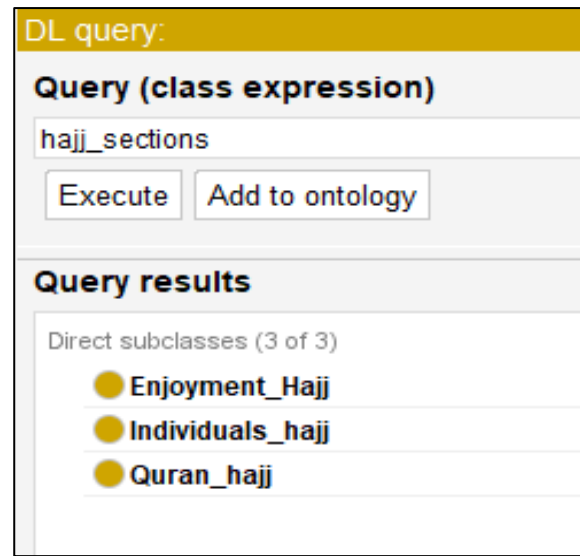
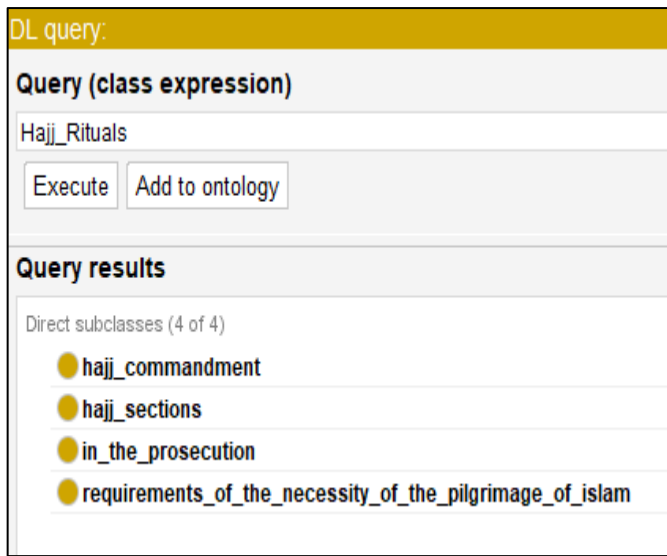


Fig. 10: Object Properties Of Ontology

Table 7: Description of Object Properties Of Ontology

Name In Arabic	Name In English	Description	Domains	Ranges
ما اصى به	what he recommended	link pilgrim class with the hajj commandment subclass.	الحاج	الوصية بالحج
من سكن خارج مكة المكرمة	who resides outside mecca	Link pilgrim class with the enjoyment hajj subclass.	الحاج	حج التمتع
من سكن مكة المكرمة	a resident of mecca	link pilgrim class with the individual's hajj or Quran hajj subclass.	الحاج	حج الافراد, حج القران
يشترط ان يكون	it is required to be	link pilgrim class with requirements of the necessity of the pilgrimage of Islam.	الحاج	شرائط وجوب حجة الاسلام

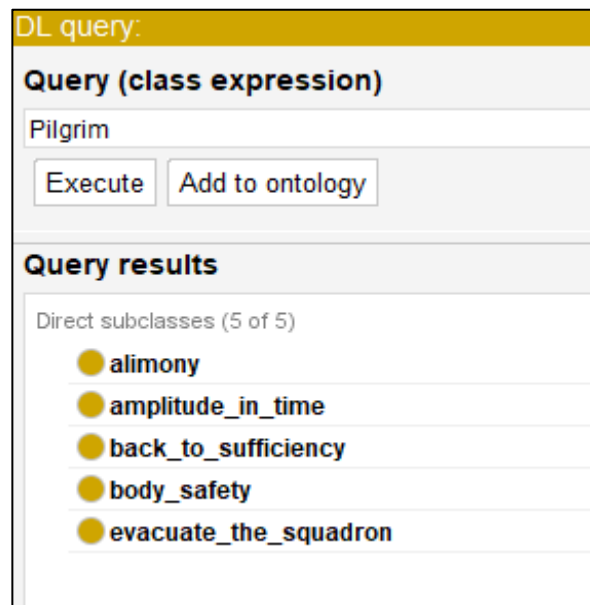
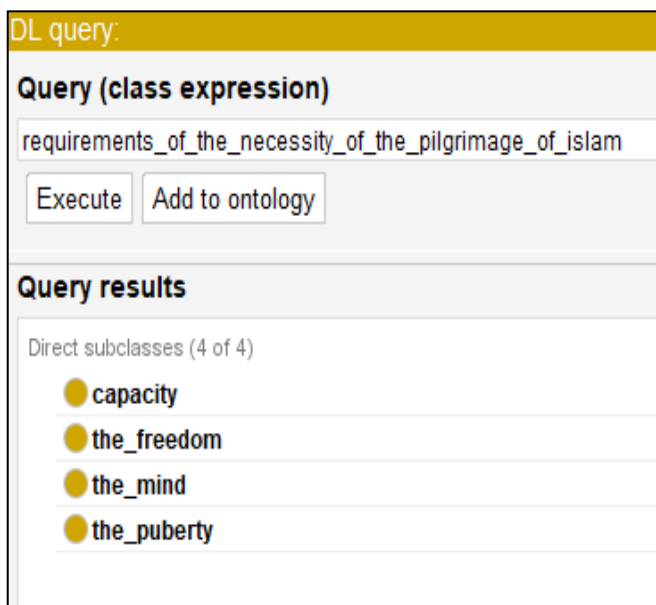


(a)

Fig. 11: Display DL Query in the Protégé

(b)

- The Answer to the following question: What are the rituals of Hajj in Islam?
- The Answer to the following question: What are the sections of Hajj in Islam?



(c)

Fig. 12: Display DL Query in the Protégé

(d)

c. **The Answer to the following question: What are the requirements for Hajj in Islam?**

d. **The Answer to the following question: What conditions must the pilgrim meet?**

4. DISCUSSION

The two steps of expert system evaluation are technical assessment and user evaluation. As stated in the preceding sections, technical evaluation should go through verification and validation. During the verification stage, all knowledge obtained should be guaranteed to be accurate, and the designed system should be guaranteed to perform correctly. Various strategies were used to assess the validity of an expert system. One of these techniques is to employ the DL Query, as shown in Fig. 11 and Fig. 12, with case study validation being the most prevalent. To ensure that the system's validation is correct, Each test case provides input parameters containing general information related to the rituals of Hajj and pilgrimage, such as conditions, duties, prohibitions, and the many branching techniques in this sector. The prototype from the described methodology is usable, and the proposed ontology-based approach is clear enough to serve as a domain expert in the religion sector. Based on the study results and the ontology methodology, the approach used can be necessary for presenting the Hajj works from beginning to end in an accurate, clear, and understandable way for people interested in this field.

5. CONCLUSION AND FUTURE WORK

In this research study, a formal existential definition of a religious topic was used to come up with a way to classify the rituals and actions of Hajj in a way that is easy to understand and follows a hierarchy. The proposed ontology includes all basic ideas about the pilgrim and pilgrimage rituals. The two main parts of the proposed ontology are the built knowledge base and the method used to build it. After building and developing the proposed ontology based on the hierarchical classifications we made based on the fatwa books, we concluded that the process of understanding and knowing everything about the Hajj rituals, including duties, conditions, taboos, and many others, is clear and understandable here, better and faster than the extensive reading of books and religious sources that takes a lot of time and effort. Because of this, we've reached the research goals we set for this study, and the recommended method is correct and gives the right level of accuracy. In the future, we'd like the knowledge base we're building to be complete, more expansive, and familiar with Islamic law. Lastly, we want to make mobile apps for the proposed system.

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