



**NEAR EAST UNIVERSITY
INSTITUTE OF GRADUATE STUDIES
DEPARTMENT OF COMPUTER ENGINEERING**

**STAFF TRAINING ONTOLOGY FOR HUMANITRIAN
ORGANIZATIONS**

MSc. THESIS

KORDEEN KHAIRI ATALLAH

**Nicosia
JANUARY 2023**

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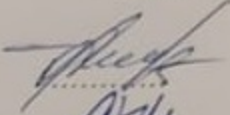

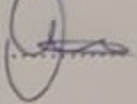
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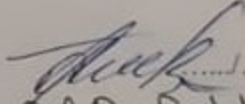
**Nicosia
JANUARY 2023**

Approval

We certify that we have read the thesis submitted by Kordeen Khairi Atallah titled "Staff Training Ontology for Humanitarian Organizations" and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Educational Sciences

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Declaration

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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Signature:

Date:

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I thank the almighty Allah for enabling me to carry this study successfully. A profound gratitude goes to my supervisor Prof Dr Melike Sah Direkoglu for her commitment and support during this study. I will also like to appreciate my big family for their support and backup as well as my mother to give me all the in need push to start this big step on my life and my father that all the time make all steps simple for me and easy to be performed, lastly can't forget my sister, husband and brothers for all support and assistant given to me to be able to reach this step. In the end, thanks for my sons Shah and Yad who are and will remain my smile reason in the life.

To my Family

Abstract

Staff Training Ontology for Humanitarian Organizations

KORDEEN KHAIRI ATALLAH

MSc. Department of Computer Engineering

January 2023, Page 100

Due to high number of wars and conflicts, many people in the conflicted countries are forced to move another location either in the same country and become Internally Displaced Persons (IDPs) or outside the boundary of country and become refugees. This also puts high pressure on the countries for providing basic needs like shelter, food, clean water, health services, education and many more to refugees or IDPs. Therefore, humanitarian organizations should intervene to be able to provide the basic needs for them and protect the human rights. Overall aim and main work of humanitarian organizations to be able provide the service and basic assistance to all in need affected vulnerable people (children, adults and elderly) through aids and services. However, providing these services require high qualified staff to be able reach the vulnerable people and provide in need help. Humanitarian organizations staff also needs continuous training in order to develop their skills and knowledge, as well as, increase the quality of work. Humanitarian organizations have many methodologies to develop the skills of the staff through capacity building trainings. One of the methodologies is website or online learning systems that the international humanitarian organizations are used to train staff according to the aim and goal of the organization. Online training has many advantages such as saving time/budget, location flexibility and management. Although online training is very useful, tracking the training process of humanitarian staff and training materials can be a challenging task. We use Semantic Web technologies as solution to annotate the data in a machine-processable format for detailed querying and reasoning of the knowledge. In this thesis, a staff training ontology is developed for humanitarian organizations for online training of the staff. The proposed ontology allows for the monitoring of staff knowledge and skill levels as well as tracking of the online trainings. Using extensive SPARQL queries, it is possible to find staff members who are appropriate for a given humanitarian activity. Additionally, we use a Semantic Web Rule Language which been stand from (SWRL) rules to deduce information about trainers' and staffs' training activities. Finally, the quality of the created metadata is evaluated using ontology metrics.

Keywords: semantic web, online training, humanitarian organization, staff training, SPARQL, ontology, SWRL.

Özet

İnsani Yardım Kuruluşları için Personel Eğitimi Ontolojisi

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MSc. Bilgisayar Mühendisliği Bölümü

Ocak 2023, Sayfa 100

Çok sayıda savaş ve çatışma nedeniyle, çatışmalı ülkelerdeki birçok insan aynı ülke içinde başka bir yere taşınarak Ülke İçinde Yerinden Edilmiş Kişiler (ÜİYOK) ya da ülke sınırları dışına çıkarak sığınmacı olmak zorunda kalmaktadır. Bu aynı zamanda sığınacılara veya ÜİYOK'lere barınak, gıda, temiz su, sağlık hizmetleri, eğitim ve daha pek çok temel ihtiyaçların sağlanması konusunda ülkeler üzerinde büyük bir baskı oluşturmaktadır. Bu nedenle insani yardım kuruluşları, bu kişilerin temel ihtiyaçlarını karşılayabilmek ve insan haklarını koruyabilmek için müdahale etmelidir. İnsani yardım kuruluşlarının genel amacı ve ana görevi, yardımlar ve hizmetler aracılığıyla ihtiyaç sahibi olan herkese (çocuklar, yetişkinler ve yaşlılar) hizmet ve temel yardım sağlayabilmektir. Ancak bu hizmetlerin sağlanması, hassas durumdaki insanlara ulaşabilmek ve yardıma muhtaç insanlara yardım edebilmek için yüksek nitelikli personel gerektirir. İnsani yardım kuruluşları personelinin de becerilerini ve bilgilerini geliştirmenin yanı sıra iş kalitesini artırmak için sürekli eğitime ihtiyacı vardır. İnsani yardım kuruluşları, kapasite geliştirme eğitimleri yoluyla personelin becerilerini geliştirmek için birçok metodolojiye sahiptir. Metodolojilerden biri, uluslararası insani yardım kuruluşlarının amaç ve hedefine göre personel yetiştirmek için kullandıkları web sitesi veya çevrimiçi öğrenme sistemleridir. Çevrimiçi eğitimin zamandan/bütçeden tasarruf, konum esnekliği ve yönetim gibi birçok avantajı vardır. Çevrimiçi eğitim çok faydalı olsa da, insani yardım personelinin eğitim sürecini ve eğitim materyallerini takip etmek zorlu bir görev olabilir. Bilginin ayrıntılı sorgulanması ve akıl yürütmesi için makine tarafından işlenebilir bir formatta verileri açıklamak için Semantik Web teknolojilerini çözüm olarak kullanılabilir. Bu tezde, insani yardım kuruluşlarında personelin çevrimiçi eğitimi için bir personel eğitimi ontolojisi geliştirilmiştir. Önerilen ontoloji, personelin bilgi ve beceri düzeylerinin izlenmesine ve ayrıca çevrimiçi eğitimlerin izlenmesine olanak tanımaktadır. Kapsamlı SPARQL sorguları kullanılarak belirli bir insani yardım faaliyetine uygun personel bulmak mümkündür. Ek olarak, eğitmenlerin ve personelin eğitim faaliyetleri hakkında bilgi çıkarmak için (SWRL) kurallarından bağımsız bir Semantik Web Kural Dili kullanıyoruz. Son olarak, oluşturulan meta verilerin kalitesi ontoloji metrikleri kullanılarak değerlendirilir.

Anahtar Kelimeler: Anlamsal ağ, çevrimiçi eğitim, insani yardım kuruluşu, personel eğitimi, SPARQL, ontoloji, SWRL.

Table of Contents

Acknowledgments	III
Abstract	V
List of Tables	XI
List of Figures	XII
List of Abbreviations.....	XIV

CHAPTER I

Introduction	1
Thesis Problem	2
The Aim of the Thesis	2
The Importance of the Thesis	3
Limitations of the Study	3
Overview of the Thesis.....	4

CHAPTER II

Semantic Web.....	5
Semantic Web and Various Names	5
Semantic Web.....	5
History of Semantic Web	6
Milestones.....	6
Comparison of Web1.0, Web2.0 and Web3.0.....	8
Web 1.0	8
Web 2.0	8

Web 3.0	9
Components of Semantic Web	10
URI.....	11
XML.....	12
RDF.....	12
RDF	12
OWL.....	12
SPARQL.....	13
Unifying Logic	13
Proof.....	13
Trust.....	14

CHAPTER III

Humanitarian Organization and Online Training	15
Humanitarian Organization	15
Types of NGOs.....	15
Work of Humanitarian Action.....	16
Steps in Establishing NGO	16
Departments of Humanitarian Organization	16
Online Training	19
Simple Comparison of Online Training and Face to Face Training	20
Models of Online Training	24
Capacity building.....	25

CHAPTER IV

Related Work.....	26
-------------------	----

CHAPTER V

Proposed Staff Training Ontology for Humanitarian Organizations	28
Design of the Ontology	28
Ontology Design.....	28
List of components	28
Ontology Construction	31
Classes.....	31
Data Properties	34
Object Properties	36
Individuals.....	38
Skos: Concept.....	39
Usage of Blank Nodes.....	41
Onto Graph.....	42
Ontology Metrics.....	45

CHAPTER VI

Querying The Proposed Ontology Using SPARQL.....	46
SPARQL Example.....	46

CHAPTER VII

Semantic Web Rule Language	54
SWRL Introduction	54
Example 1	55
Example 2	56
Example 3	57

CHAPTER VIII

Evaluation of Ontology	59
------------------------------	----

Functional Requirements	59
Metadata Completeness	59
Schema Metrics	63
Cohesion Metric	67

CHAPTER IX70

Conclusions and Future Work	70
References	71
Appendix	75
Appendix 1	75
Appendix 2	75
Appendix 3	75

List of Tables

Table 1: <i>List of Components in Need</i>	29
Table 2: <i>List of Class Description</i>	32
Table 3: <i>List of Data Properties</i>	35
Table 4: <i>List of Object Properties</i>	37
Table 5: <i>Functional Requirement Table</i>	59
Table 6: <i>Domain and metadata completeness value of Object Properties</i>	60
Table 7: <i>Domain and metadata completeness value Data Properties</i>	60
Table 8: <i>Metadata Completeness of Users Class Individuals</i>	61
Table 9: <i>Summary of the Scheme Metrics Values</i>	67
Table 10: <i>Summary of Cohesion Metrics Values</i>	68

List of Figures

Figure 1: <i>Semantic Web Stack</i>	10
Figure 2: <i>Structure of the URI</i>	11
Figure 3: <i>Department and in Need Training in Humanitarian Organization</i>	18
Figure 4: <i>Models of Online Learning</i>	24
Figure 5: <i>Staff Structure Show the Domain</i>	29
Figure 6: <i>Trainer Structure Shows the Domains</i>	30
Figure 7: <i>The online Training Structure shows the Domains</i>	31
Figure 8: <i>Snapshot of Classes in the Protégé</i>	33
Figure 9: <i>Data Properties in the Protégé</i>	34
Figure 10: <i>Data Properties RDF/XML in the Protégé</i>	35
Figure 11: <i>Object Properties in the Protégé</i>	36
Figure 12: <i>Object Properties RDF/XML in the Protégé</i>	37
Figure 13: <i>The individual in the Protégé</i>	38
Figure 14: <i>Individual RDF/XML Properties in the Protégé</i>	39
Figure 15: <i>Snapshot from Protégée Show Admin Department using Skos</i>	40
Figure 16: <i>Snapshot From Protégée Show HR department Online Training Subject Using Skos</i>	40
Figure 17: <i>Graph of Blank Nodes Usage</i>	41
Figure 18: <i>Onto Graph in the Protégé show the Main Classes</i>	42
Figure 19: <i>Onto Graph line color relation</i>	43
Figure 20: <i>Onto Graph in the Protégé show the online training Subjects</i>	44
Figure 21: <i>Onto Graph in the Protégé show the User class with subclasses</i>	44
Figure 22: <i>Metrics list in the Protégé</i>	45
Figure 23: <i>Simple SPARQL Query Example</i>	46
Figure 24: <i>Snapshot from Protégé to Show the Years of Experience of Trainer</i>	47
Figure 25: <i>Snapshot from Protégé to Show the Number of Trainers</i>	48
Figure 26: <i>Snapshot from Protégé to Online Training Information</i>	49
Figure 27: <i>Snapshot from Protégé to Show Pretest and Posttest of the Staff which has Child Rights Online Training with Condition for Posttest Result</i>	49
Figure 28: <i>Staff Information</i>	50
Figure 29: <i>Snapshot from Protégé to show staff and online training take also the pre and post-test</i>	50

Figure 30: Snapshot from Protégé to show the date of online training Published which has been order.....	51
Figure 31: Snapshot from Protégé to Show Date of Published Online Training for the date newest than 2020-02-01	51
Figure 32: Snapshot from Protégé to show the oldest and newest date of online training	52
Figure 33: Snapshot from Protégé to show Evaluation of each staff on the online training take	52
Figure 34: Ismail Mustafa Pre and post-test result	53
Figure 35: SWRL Structure.....	54
Figure 36: Snapshot of Rule Tab in the protégé	54
Figure 37: Snapshot from Protégé of SWRL Example one.....	55
Figure 38: Snapshot from Protégé of SWRL Example Two.....	56
Figure 39: Snapshot from Protégé of SWRL Example Three	57
Figure 40: SWRL Control Tab.....	57
Figure 41: Snapshot from Protégé show the Asserted Axioms tab.....	58

List of Abbreviations

ADIT-LN	Average Depth of Inheritance Tree of Leaf Nodes
AR	Attribute Richness
CR	Class Richness
FSL	Food Security and Livelihood
HR	Human Resource
IDP	Internal Displacement People
IR	Inheritance Richness
IT	Information Technology
NGO	Non-Government Organization
NoL	Number of Leaf
NoR	Number of Root
OWL	Ontology Web Language
RDF	Resource Description Framework
RDFS	Resource Description Framework Schema
RR	Relationship Richness
SKOS	Simple Knowledge Organization System
SPARQL	SPARQL Protocol and RDF Query Language
SWRL	Semantic Web Rule Languages
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
W3C	Ontology Web Language
WASH	Water Sanitation and Hygiene
WWW	The World Wide Web

CHAPTER I

Introduction

The new manner of living and the significant impact of technology have changed many methodologies and domains of life, one of the main affected domains is education and learning (Siambi, 2022). One of the most effective educational approaches is online learning. Many websites offer online instruction and training, including Coursera, Udemy, and others. Accessibility, appropriateness, lower costs (including travel expenses and time savings), and easier management are the main benefits of online training (i.e. content updates, etc.) (Shah, 2012). Owners of organizations, particularly humanitarian organizations in our setting, benefit from all of these advantages.

Each humanitarian organization has goals to develop the skills and abilities of the staff, and they have a specific budget for the training activities, and many organizations prefer online training. Providing training for staff and work interim for capacity building has a high impact on the level and ability of the staff to work direct interim of the humanitarian organization's abilities and work quality as it is main in needed in emergency response. Around the world about 40,000 humanitarians organization we have as estimated number (Barnes,2009). Humanitarian organizations have specific rules, codes of conduct and styles of work and they work as a network. A specific humanitarian organization may have many bases in different countries and these bases should work through the same methodologies or procedures. This can be a difficult task for staff in different locations. Therefore, having online training will aid this problem, providing different pieces of training in various subjects/skills, According to the department and aim of the Non-Government Organization (NGO), each staff takes number of trainings before starting the work in order to understand the work style, aim and goal of the NGO. The set of trainings are chosen according to the position and department of work in the NGO. Also, there is a requirement to achieve a certain training level to carry out the work. Therefore, another challenge is to be able to track the level of staff from online trainings and this can be a challenging task due to high numbers of staff in different locations and different bases in different locations.

After the main problem and challenge have been pointed out, we propose to use Semantic Web technologies as our aim in this thesis to generate and standardize the data for the humanitarian organization's online trainings for three main domains, online trainings, trainers, and staff. We develop a new ontology for humanitarian organizations for online training of NGO staff to be able to cover information in need for staff, online training, and trainers. First, a novel ontology is generated to cover information about humanitarian organization staff capacity building. Then, real data about staff training is populated into the knowledge-based according to the ontology. Using the machine-processable data about training activities, then we can query the training activities of the staff, their progress, and suitability to a certain task in detail. Furthermore, by applying Semantic Web Rule Language which stands from (SWRL) rules, new implicit knowledge is deduced from the existing metadata. On the other hand, the metadata quality of the created knowledge base is evaluated using ontology metrics.

Thesis Problem

The main aim of our thesis is to provide an effective and useful search system for the online training of the humanitarian's organization staff. Having a quality and effective search system mean that the process of searching for information for the different domain of online training, trainer, and staff will be easier and more manageable in the limited time.

The Aim of the Thesis

Our goal in this thesis is to demonstrate how Semantic Web can be used to standardize and generate machine-processable data about online training activities of humanitarian organization staff using a novel ontology. The following advantages come from staff training metadata that can be processed by machines: Data may be automatically processed and analyzed, complicated SPARQL languages can be generated to query data, and SWRL rules can be used to extract new information from the data. For this purpose, a novel staff ontology for humanitarian organizations is created that captures and tracks the training activities, skills, departments, and knowledge of the staff. To achieve this;

- The program structure of humanitarian organizations is identified.

- Online training subject structure is determined.
- A novel ontology is created.
- Real-time data is used to populate the proposed ontology.
- For search and retrieval, complex SPARQL queries are designed.
- To infer and analyze the progress of staff training, complex SWRL rules are executed.

The Importance of the Thesis

In this work, a novel ontology is provided to manage the overall information about three main domains; trainers, staff, and online training subjects. In this way, information about staff training activities can be monitored and tracked, hence contributing to the quality of projects carried out in different departments. To achieve this,

- A novel humanitarian staff training ontology is created using Protégé ontology editor
- For the machine-processable program structure of humanitarian organizations, a SKOS which stands for Simple Knowledge Organization System vocabulary is used to create department taxonomy.
- Key online training subjects are identified and SKOS vocabulary is utilized to create a training subjects taxonomy.
- Real-time data is used to populate the proposed ontology.
- Complex SPARQL queries are designed to query staff skills and knowledge for a particular humanitarian project.
- Using SWRL rules, the progress of staff training is analyzed and inferred automatically.

Limitations of the Study

The challenge we faced during the research work is the limitation of bibliographic works about humanitarian organizations and humanitarian works. On the other hand, this limited work in humanitarian organizations has been the motivation to choose the domain and apply Semantic Web concepts.

Overview of the Thesis

Overall, the thesis is divided into nine main chapters and the next chapters will be structured as follows: the second chapter is overall explanation of the Semantic Web and its components. In the third chapter, an explanation of humanitarian organizations and the importance of staff capacity building in the quality of the work are explained. In the fourth chapter, related works in the areas of online training and ontology-based works are discussed. In the fifth Chapter, ontology design and development are explained, and classes, data properties, and object properties are explained. In the sixth chapter, developed SPARQL queries are shown in detail. In the seventh chapter, semantic web rule languages (SWRL) rules are developed and explained for inference. In the eighth chapter, metadata quality metrics evaluation is demonstrated. Finally, it is conclusions and future works.

CHAPTER II

Semantic Web

In this chapter, we will explain the overall view of the Semantic Web in the context of its name, history, and components.

Semantic Web and Various Names

Semantic Web, Giant Global Graph, linked Data web, web data, and Web3.0 all these names recording the context and at different times have been used and referred to the semantic web technologies, and all of them refer to (W3C) the family of the World Wide Web Consortium which has been designed to link, relate and describe the data on the web and inside the enterprises. The semantic web is the official semiotic technologies name that is most used in many papers and academics.

The main three names that are used are: as first name is Semantic Web, the second name is Linked data, and also Web 3.0 widely used. And as the name Semantic Web is the most officially used let us have a simple description of it.

Semantic Web

Most official names that have been used for the technologies and most commonly used in books, websites, conferences, and academics are over 12 years old, and in 1999 Tim Berners-Lee for the first time used to describe the umbrella of W3Cactivity which is describe the technology standers also describe data on the Web. The vision of the machine-process table of the data. The name of the semantic web consists of 2 words that give the meaning of this technology:

Semantic: this means the data and travel means the ability to transport the data.

Web: means the linking between each data to provide specific information. In a Scientific American article in 2001 Jim Hendler, Tim Berners-Lee, and Ora Wasilla explain and define the semantic web as that draws the future of the use of public and private (personal) data to be able to use it on all the details of the lives, W3C and many other sides work together to define the semantic web vision.

History of Semantic Web

Data was communicated via publications or websites that linked to other documents or webpages located all over the internet using links that were accessible in the early 1990s.

And entire data was processed or shown by networks and desktop computers, although they were unable to comprehend it.

Also the changing of the internet from a "Web of Documents" to a "Web of Data." This is the main goal of Semantic Web technology. The initial web is expanded by the semantic web to explain and connect web material in such a way that is accessible to computers. The following are the main application areas of the Semantic Web:

- **Personalization:** The amount of material on the website keeps expanding. Investigators could filter even tailor material because Designers are unable to keep up with it all.
- **Knowledge Discovery:** New information may be found by connecting information from several web sources. Devices can infer new associations and attach a reason to already-existing connections by semantic websites.
- **Data Reuse:** Data may be reused since Semantic Web enables the linkage of data from many sources. Data that was previously kept in disparate systems can now be exchanged commonly.
- **Automation:** Virtual assistants can take care of this effectively Consumers may prevent undertaking some tasks like making reservations for travel or rearranging meetings.

Milestones

- 1997: Its RDF Model and Syntax initial production edition is created by W3C. These develop into the Resource Description Framework (RDF) W3C Suggestion from 2004: ideas & Conceptual syntax.
- 1998: The W3C has released a working draft of the RDF Schema (RDFS). Because RDF cannot describe semantics, RDFS offers a simple type system

that may be used with RDF models. By February 2014, RDF Schema 1.1 was released as a W3C proposal.

- 2001: Tim Berners-Lee published an article, titled The Semantic Web, which discusses web material that has meaning for technology. The semantic web is described. data forms Ontologies, and agents, are all covered. concept of the semantic web has gained widespread recognition.
- 2004: Web Ontology Language as established by W3C. (OWL). Complicated associations are made feasible by OWL, which is not possible with RDFS. Around 2009, a modification of this (commonly referred to as "OWL 2") was released. OWL 2's second version was released in 2012.
- 2006: Tim Berners-Lee emphasizes that simply publishing details online was insufficient. The information must be connected to other pertinent data. To assess whether successfully individuals exchange information, he suggests what he calls Linked Open Data (LOD) and designs a 5-star system.
- Jan. 2007: Semantic inquiries may be made on DBpedia and use a query language like SPARQL. As of April 2016, there are 9.5 billion RDF triples within DBpedia. through leveraging Wikipedia's structured data and encoding it as RDF triples, DBpedia was constructed.
- 2010: A large number of businesses implement and may use semantic web technology.
- Jun. 2011: Schema.org is a language used by Google, Yandex, Yahoo & Microsoft to provide value for web information. Google officially advises using JSON-LD and Schema.org together.
- Oct. 2011: A few of Apple Inc. include Siri and Virtual assistants from Search Engine Then Alexa, Amazon, and Microsoft Cortina will all be available within the next few years., they will be powered by machine learning approaches.
- Sep 2013: Since May 2012, the Information Graph became declared also with the Hummingbird upgrade, Google Search is now capable of identifying a person's strengths. That goes above only using keywords to perform searches.

- 2021: Semantic Web is 20 this year, and 2001 is recognized as its origin it must advance throughout each branch of the science. Due to the diverse range of techniques, certain application-oriented consolidation with strong device interoperability and very well procedures is required. (Cardoso, 2007).

Comparison of Web1.0, Web2.0 and Web3.0

Web 1.0

It is considered as World Wide Web's early development and a small number of people use it most of them we can call them clients for content it is called web 1. Special websites included static pages and became widespread and maintained that were controlled by ISPs and were free webs.

Web 1.0 was prevalent from around 1991 until 2004 and it can view ads when browsing websites. Ofoto, another online digital photography service from Web 1.0, allowed users to view share, save and print digital images. It works on presenting websites the data we can say that web 1 is a content CDN that stands from the delivery network. Customers can find certain pieces of data from its directories the customer is charged for each page they see.

Web 2.0

Darcy Di Nucci is the creator who created web 2.0, which is a social participatory web that's Website worldwide that emphasizes consumer connectivity, content, and end customers. It works on the layout and functionality of Web sites therefore we can say it does not mean changing any technological requirements. Although transferring this information has advantageous, it will not feel that way once the shifts occur. Web 1.0 has been improved and developed it's named web 2 . it is the producer of consumer material in an internet group and it enables interaction and collaboration between individuals in a social media dialogue.

Five Major Features of Web 2.0:

- By using sorting which is free people can use it to categorize information.
- Ability to exchange data from/ to user and site from digital commenting.
- Provide self-use by creating APIs by using software programs.

- The use of the internet raises issues that are unique to a larger range of users than the typical Number of internet users.
- Dynamic information that reacts to human interaction.

Using Web 2.0: the ability of the user to exchange the overall information in different apps supported by Web 2.0 which helps users to be able frequently to exchange information and more be engaged in the apps.

Web 3.0

When we said Web 3.0 this term describe the growth of web interaction and usage. either which with incorporation of DLT will transforming the Web to database, or that data can assist in the creation of Smart Contracts tailored to the needs of the individual. After a lengthy period of focus on focus, it enables the upgrading of the backend of the site. The phrase "Online 3.0" is used to denote the number of web usage and interface evolutions. In this, services provide many perspectives of the same site or the ideal data, the data is not owned but rather shared but is still present.

Google will never be able to establish "the world's information" in a decent manner with its current engine schema, but the Semantic Web (3.0) promises to do so. From the standpoint of this is especially true from the standpoint of machine conceptualization as opposed to human comprehend biological language, such as OWL, rather than only the machining phase we will be able by the semantic web to develop a new ontology that will be used from computer to draw new conclusion and data analyse. Define Web 3.0 according to the below main features:

- **Semantic Web:** The Semantic Web is a component of the Web's future growth. The semantic web enhances online technology by allowing users to produce, share, and link material through search and analysis based on the capacity to understand the meaning of words rather than just phrases or figures. By blending this capacity with natural language processing, Web 3.0 allows computers to discern material like people do to deliver quicker and more pertinent results. To meet user needs, they develop more knowledge.
- **3D graphics:** according to the metadata web 3.0 have a high ability interim of use 3 D design that is widely used in different website to show for example

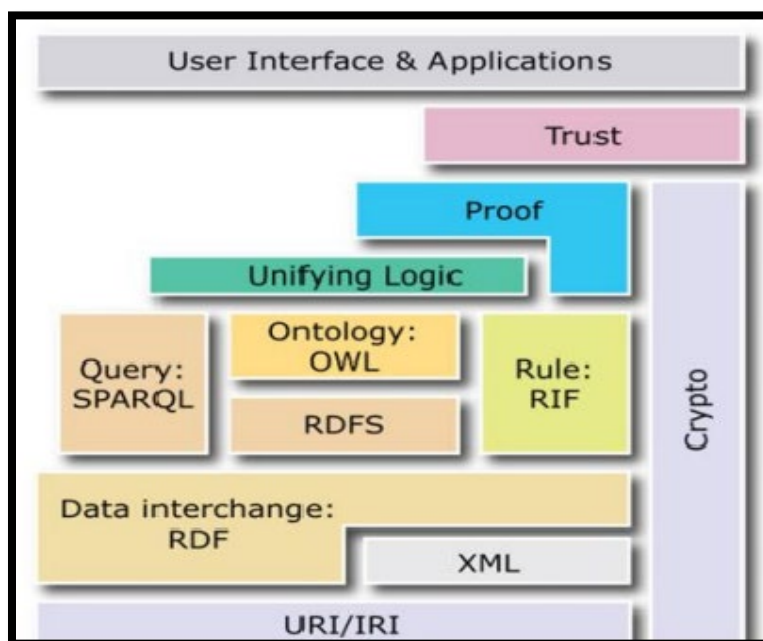
game, the guide for location, electronic commerce also location geographic set, and many others, has a high connecting the user with the application.

- Ubiquity: Content is available through a variety of applications, every device is online, and the services are available anywhere.
- DLT and Smart Contracts: Through the integration of smart contracts, which do not require a middleman to act as a guarantor to make that contract occur on certain grounds because it is based on data from that DLT, will be able to great high-security data which will be too hard for anyone to-ack database from that will provide more value regarding this property, This technology enables a trustless society. It's a potent instrument that has the potential to improve everything and provide everyone on the internet with additional options.

Components of Semantic Web

The design of the Semantic Web Stack is to work as the ladder of languages that each layer works interim of the capabilities and exploits of the layer below to be able to

Figure 1: *Semantic Web Stack*



Source: (Berners, 2001)

work as hierarchy languages which show the technology and the stander of semantic web illustration of the hierarchy of languages, the stack has been designing by Tim Berners-Lee.

There are three main parts(Layers) in the semantic web stack:

- Hypertext Web technologies: In this layer provide the basis for the semantic web without any change as it contains this type of technology known for the hypertext.
- Standardized Semantic Web technologies: it is the middle layer that contains and builds the semantic web application as all in-need W3C standers technologies consist of.
- Unrealized Semantic Web technologies: this layer, contains some technologies that yet have not been standardized to implement the semantic web and it is the top layer of the semantic web stack (Gerber, 2008).

Each layer in the semantic Web stack consists of many parts which will explain one by one.

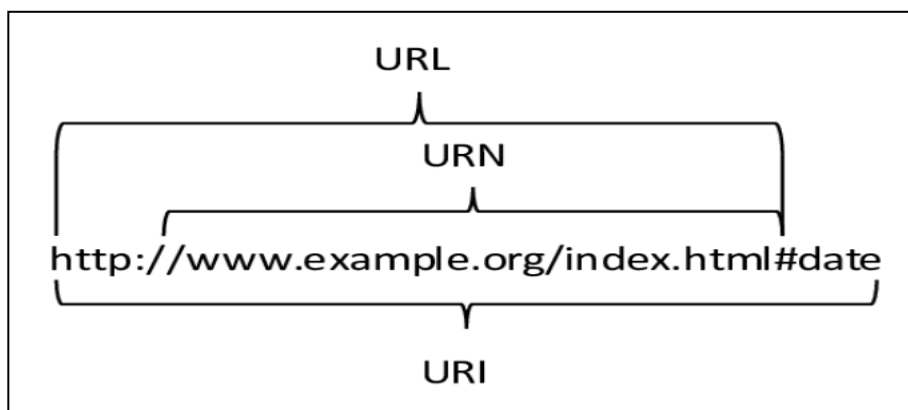
URI

It stands for Uniform Resource Identifier which works as an identifier of the Web, as everything on the web has a specific URI that should start with HTTP:// or FTP, and its structure of it is a string that consists of 2 parts URN and URL :

URN: stands for Uniform Resource Name that shows the name of the item.

URL: stand from the Uniform Resource locater and show the address or location of it.

Figure 2:Structure of the URI



Source :(Hynynen et al., 2019)

XML

It stands for Extensible Markup Language which is work as a way to transfer data and consider a simple way as it is considered readable for humans and also for machines and that makes it powerful in usage.

RDF

It stands for Resource Description Framework, which is simple and work in term to model data on the RDF file to be able for computer program work on this web data, according to that RDF considers as the most fundamental block. by using RDF in the semantic web we will be able to find the resource of the data via the use of syntax format.

RDF

The main goal was to make it possible to give customer types with features semantic context by expanding the RDF dictionary was the main goal of the concept. (RDFS) specification initial draft was released as a W3C Technical Document in April 1998 to enable the specification of very well connections among categories and characteristics Four essential keywords were added to the RDF and it became a standard protocol in 2004 the description of the RDF Semantics presented thus far, combined with the new RDFS definition therefore when a new RDF occurred when a Significant change can see in later versions such as for aspects about limitations with a data structure would be eliminated in favour of a definition that was more explicitly in line with the Open World Assumption and for instant Thus, the description of the RDF Semantics [29] presented thus far, combined with the new RDFS definition.

OWL

The resultant Web Ontology Language (OWL) received W3C proposal status in 2004. The OWL 2 W3C Recommendation furthered this in 2008 Richer entailment systems are made possible by RDFS with more expressive semantics

In comparison to RDFS, OWL is a far more complex consensus. It can boast a rich history and enter leading to a standard. OWL may be serialized as RDF triples much like RDF/XML. In reality, OWL provides a richness of additional vocabulary founded in clear semantics while reusing that underlying RDFS work as mentioned in the preceding section (with equivalent semantics). We do not have to accurately reproduce the complexities of the OWL standard and its history here.

SPARQL

The core of the SPARQL standard is a querying language created as well as a protocol that enables delivery and searches of results. In 2008, the initial SPARQL definition was upgraded to a W3C proposal. The initial SPARQL list's expansion, SPARQL 1.1, also obtained a W3C suggestion in 2013 on the original SPARQL standard their properties are concentrated SPARQL supports RDF, which is orthogonal to the OWL and RDFS standards described before. SPARQL uses keywords of Structured Query Language (SQL) used, but in the case of SPARQL is designed for interacting with RDF data. When learning SPARQL syntax and knowledge, RDF Turtle syntax is very beneficial because Turtle syntax and SPARQL's RDF-specific syntax are strongly related.

Unifying Logic

Ontological standards and logic elements that make up the Semantic Web stack's basis were found to be smaller on the stack which is called RDF-compatible query dialects. The Unifying Logic layer's intended purpose is to act as an accessibility layer that lays the unifying language to engage queries and rules over information stored in RDF and related ontologies/schemata and the groundwork for integrating various lower-level technologies into a who let the integration of regulations and vocabularies it's called the integration of ontological explanations and querying

Proof

An example of proof is which accomplishes the goal or arrives at a solution. Over decentralized sources of structured information using the Semantic Web agents will be capable of performing a wide range of automated tasks, which implement a

variety of logic and try to verify shapes to obtain some main objective, the computer program must include some type of proof that the client can use to verify the process or data was used to combine data from different externally .

Trust

First of all, to work the barrier of trust does not need an a priori. Concerning the fundamental Solid evidence layer, customers on the Semantic Web could access control mechanism to decide how each cable company or other Web investigators are made accessible to whatever data, as well as decide what resources should be trusted in a proof, customers may use the Trust layer to decide what resources should be trusted in a proof.

CHAPTER III

Humanitarian Organization and Online Training

In this chapter we will have overall view about the humanitarian organization work, aims and goals. In addition, an introduction about online trainings and the capacity building of the staff will be explained.

Humanitarian Organization

The phrase "(NGO)"non-governmental organization" The word "non-governmental agency" does not have a commonly accepted legal concept the governments refer to it as parties that do not have the structure of government. A NGO is any group that is independent in its humanitarian work, meaning that these people can join the humanitarian work when their organization obtains full or partial funding through states. Thus, it has an independent status without government support or salary. Such names are used exclusively to refer to people who work in the humanitarian field for broader social goals far from political goals or party interests.

It has been started by international non-governmental groups since at least 1839. According to available estimates, there were 1,083 NGOs at that time in existence in 1914. At the time of the World Disarmament Conference slavery and women's suffrage peaked which was the most struggling thing for the NGO role. But, it wasn't until the Un International Agency was founded in 1945 that the term "non-governmental organization" became widely used.

Some of the most important developments in international development over the past 20 years have been the expansion Agency for Economic Development and Cooperation non-governmental organizations (NGOs) 2006 international organizations within unity According to reports, there were 6,000 worldwide NGOs in 1990 and over 50,000 by 2006. (O. Uzuegbunam, 2001)

Types of NGOs

- Orientation and degree of cooperation can be used to determine the sort of NGO.
- Participatory, service, and orientations.

- Empowering are among the categories of the GOs, by orientation of Charitable all of them are types of NGO.
- NGOs according to a degree of cooperation.
- National NGOs, international NGOs, citywide organizations, community-based organizations, etc.

Work of Humanitarian Action

The work may be hazardous, and both the communities who receive relief and the aid workers themselves must deal with resource shortages, unfortunate decisions, and physical and psychological suffering. In order to achieve humanitarian goals without supporting a global economic system that makes life therefore uncertain for many, humanitarian groups struggle to establish an ethical foundation under neoliberal globalization. Even though that humanitarian work is context-specific, it nonetheless serves as a consistent and widespread expression of compassion.

Steps in Establishing NGO

Finding the areas of special societal needs, such as those pertaining to nutrition, shelter, schooling, personal rights, healthcare, AIDS/HIV, maternal mortality, polio, and alleviating poverty, is the first stage in the foundation of an NGO.

Finding like-minded individuals is the second stage, there needs to be a common goal. The third stage is hiring a certified legal professional to provide help during the Registration procedure. Depending on the prospective NGO's activity, certain NGOs may be able to register with the regional or federal government. Identifying internal or external partners with well-defined goals and a strategy for action is a crucial next step.

Departments of Humanitarian Organization

NGO department have main 2 parts (Program and Admin). Program department directly work with beneficiaries and provide service or assistant to in need people. Admin department work to provide in need resources for humans and materials to the program departments to be able provide in need services. Thus, the

admin programs work more interim to arrange the things inside the NGO such as Human Resources, Purchases, financial and security. Program Department contains many sub-departments, these sub department of the program can be changed from one NGO to another, means may be NGO work only interim of education and will have many projects regarding education therefore will not have health or FSL department .

- **WASH**

Water sanitation and hygiene promotion (WASH) is about all the projects which work direct to provide services include water regarding safe water, disposable black water , provide sanitation and hygiene promotion, to minimize the infection of dieses which water borne diseases that effected from the water contamination and appear in the emergency response according to not proper use of the sanitation like Cholera, Diarrhea and E.coli ...ect

- **Education**

This department includes projects is about all the projects which work direct to provide services for education either formal education which mean the program that given by schools or non-formal education which is life skills education.

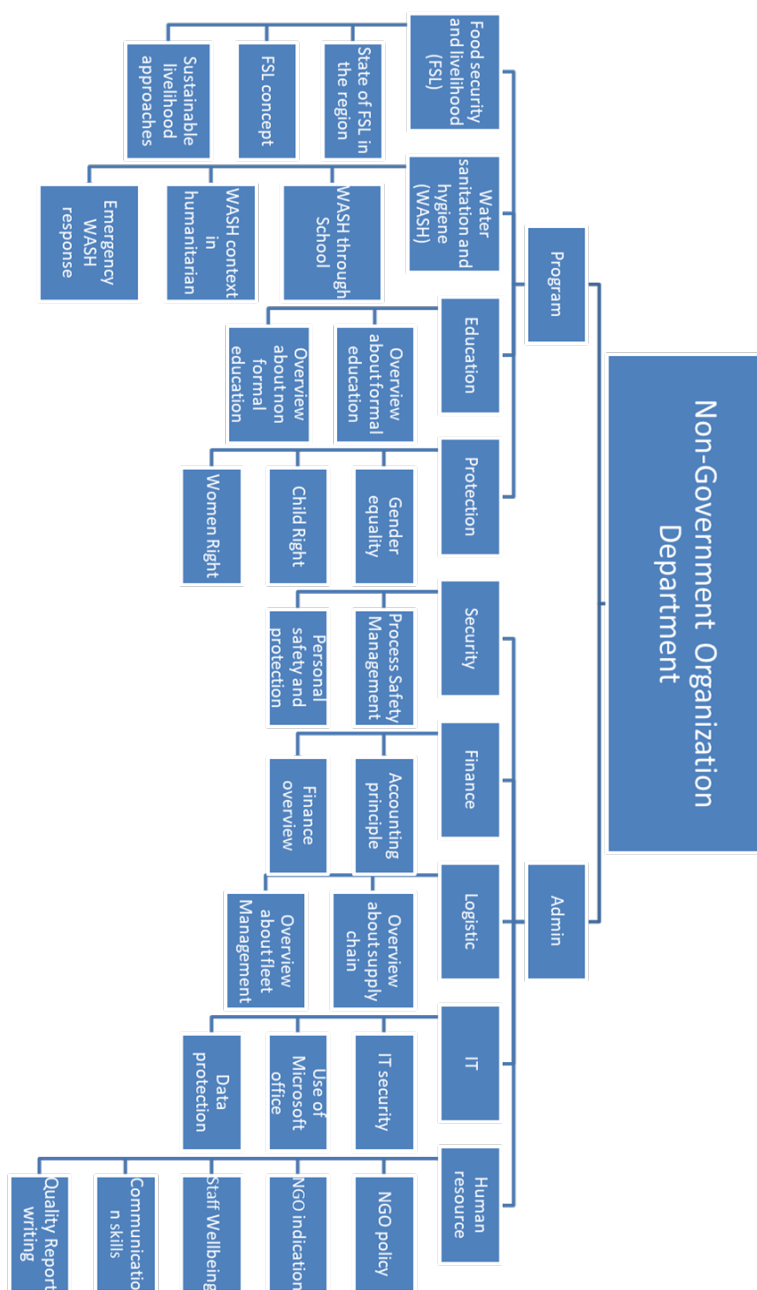
- **FSL**

Food security and livelihoods (FSL) is a department which includes the projects that provides foods and help in need to have sustainable means of living to be able to provide them basic needs.

- **Protection**

This department work as context of the humanitarian organization and as link between all departments in the humanitarian organization and regarding to needs referral the case to the department or another NGO which provide the service in the in need location. (Niland, 2015).

Figure 3: Department and in Need Training in Humanitarian Organization



Source: (Author,2022)

In figure 3 will show diagram that show the main department and sub-department of the Humanitarian organization and regarding each department some Training Subject have been dedicated. According to the structure, departments and online trainings subjects are designed. This diagram may be different from one NGO to another.

Online Training

Digital training is instruction offered via the use of the Net, with many different names, this learning is frequently called e-learning. Or what is called digital learning will review only one type of “virtual classroom”, which refers to all types of learning that takes place remotely and outside the regular classroom. A long history of online courses exists.

(CMS) a course management system which system that’s used by all universities. CMS gives teachers the flexibility to deliver and create their courses in a framework that works on communication and learning using a variety of resources. The university was opened in the UK (1998) due to Robin Mason, the majority of online teaching falls somewhere between "partially online" and "completely online learning courses.

A course that is partially online: A course is said to be "partially online" if it combines some online learning components such as textbooks and pencil and any material or any existing resource which is a non-print or print form This may involve using an email list for some asynchronous conversation or a learning management system. The completely online course also if, a course is "completely online" means that the majority of the learning and instruction is done online.

In order to participate and learn from any area and any time online learning is the best choice also due to the population growth and even in the time of disease and spreading of diseases a traditional classroom is not the best choice therefore the best one is to learn online specially the flexibility the learner have can participate everyday any time and people that prefer online learning which are those people that work or lives in a far area or that aren’t able to find a institution or people that suffer from disease that online education because it fit their busy lifestyle and because learner doesn’t need a lot of facility and time the only thing is needed which is computer and internet that makes their life easier and more comfortable.

Anywhere, to receive and participate and learn how it’s possible anywhere which makes it possible for everybody, therefore a great way to earn education which is online education that’s not restricted by place, or time seven days a week, whenever you want, and there are many other benefits such as points below:

- Convenience: 24 hit will support hectic schedules, it is available without delay and can access from any computer requires no parking or parking.
- To Increasing the depth of comprehension and learning of course material, increased the meaningful of the dialogues, and a focus on written form and technical skills are all indicators of learning outcomes, according to studies.
- Enhanced student-to-student and student-to-teacher conversation, a classroom experience that is better focused on the needs of the students, less listening and more active learning, and a stronger feeling of community and unity are all examples of involvement.
- Innovative teaching practices include student-centered methods, more dynamic and varied learning processes, consideration of diverse learning needs, including innovations that may be applied to traditional classroom settings too.
- Enhanced Management: More opportunity to carefully review homework assignments, also have the capacity to control marking digitally and record and verify online marketplaces.
- Save money by accepting extra learners, which will boost learning and decrease duplicates.
- Conserve Physical Assets: Reduce strain on the faculty's parking traffic jam and constrained facilities.
- Outreach: enter new destinations for learners, and connect with present ones to boost admissions Provide learners with alternatives.

Simple Comparison of Online Training and Face to Face Training

- Difference #1: Online courses are predominantly asynchronous .E-Learning, is often online, allowing teacher and students to choose their own times for engagement and participation, in contrast to their simultaneous equivalents in school .Asynchronous programs are advantageous for learners to participate in a wide range of activities and study program sessions and content numerous times also will be more advantageous for non-regular learners in order to complete their education who need a formable timetable such as people who work or have a lot of responsibilities like parents. Participate in a wide range of activities might.
- Difference #2: In addition to identity, ego, and project planning, ambition, effective software learners ought to be .Attending class regularly is essential to achieving

success therefore Participation must be effective, as face-to-face participation in a specific activity in the electronic classroom, and they also have the opportunity to complete homework, and enjoy their time in discussions, but there must also be respect for time, and there must be a desire and skill in time management because it does not There is a controlling teacher in front of you who manages the time for you according to your need, all of this for a future task or take the next exam .

-Difference #3: in order to understand new material, and task explanations, observe how creative ideas are implemented, and perceive and receive evaluations of your performance, several more approaches of teaching and course materials in eLearning which contain a variety of communication skills that require a broad range of interpersonal skills, including consuming audio content video The intellectual content and the amount of interaction with the participating groups are among the modern methods of communication. In online learning, having a variety of communication abilities is essential. The advantage of always having a diverse course content is that it enables students to read daily or view and review educational materials at the times specified by them. (quite as many times as possible), thereby better propping up graduation rates. This is in contrast to its face-to-face equivalent, acquiring knowledge activities that have the most discussion and lecture.

- Difference #4: Students rely a great deal on a lecturer's participation, evaluation, and evaluation task explanation, learners may anticipate receiving data and criticism on overall achievements and progress for stimulation, task explanation, and feedback in asynchronous online courses that don't include live in-person classes because in traditional classes People relied more heavily on their instructors A number of thing methods for adding regular and insightful input utilizing textual and media techniques.
- Difference #5: there will be communication that's conducted as a visual asynchronous discussion it will be between The whole trainee as well as the educator which is in virtual education, the great majority of contact between students and instructors as well as between students is non-verbal asynchronous correspondence, mostly in the form of, immediate chats, email, audio, and video conversations, feedback and web forums. Since students may reread, view, and research again, a benefit of an online course is that you can frequently convey new concepts with adequate data in addition to precise, unlike a face-to-face or directly course, it's

possible they only heard it once at a face-to-face lesson which also includes more people interactions and discussions.

- Difference #6: Netiquette as well as digital literacy are essential. Both students and teachers had to be proficient in online learning including netiquette. To instruct an online program, you mustn't necessarily be an expert in computer coding program languages. However, educators must be at ease using common computer tools and education management systems, like Google applications, email, and publishing software, as well as guiding learners through simple technological issues. Netiquette is essential for ensuring that you can effectively connect with others and make connections even when you are not in direct contact with them. In order to be included in the world of online Netiquette is essential for ensuring that you can effectively connect with others and make connections even when you are not in direct contact with them you don't need to save or memorize computer you only ought to have a good outlook and be willing to learn new skills and a good outlook and connect with each
- Difference #7: Dialogues may provide learners extra time to reflect, conduct experiments, and even plan out their debate postings and answers. These venues may be used to sophisticated classroom activities, foster rich, but each one, has personal specific benefits and drawbacks. Online system, is communications may provide, more opportunities to individual reflect, conduct research, and perhaps, even If can edit their discussion posts and there answers as those who frequently last extended stretches (often moments). Additionally, in the internet environment, debates could be more balanced, fair and truthful as students are treated equally in the introverted and extroverted.
- Difference #8: Online classes are more specialized and personalized. Participation in ELearning in education or perhaps really have more connections among students .when compared to a face-to-face environment online, It may look, more specialized and individualized because there aren't synchronized meetings, places, and times E-Learning substitute classrooms instead are created including all participants for teacher-led lectures and in-class tasks. Overall, students with and teachers are more engaged and individual on personal level, which supports each learner's performance across the program.

- Difference #9: Bring varied people, cultures, neighborhoods, and regions with each other as a variety. The type of Online class, which are enroll the learners from many throughout the country, have the some potential to extend to education chances by locations that offer fresh experiences and viewpoints beyond their personal immediate surroundings such as putting along towns, varied individuals, and nationalities.
- Difference #10: learning activities in multi-dimensional It is extremely simple to incorporate learning activities all across the program and a variety of number information when every aspect of learning and participation in such a session operates online, education possibilities, incorporating multiple innovative, also h programs that could depend on conventional teaching lecture hall instructional resources material supply, which is conventional in-persons on program.
- Difference #11: Everybody participates frequently and actively .All must actively participate frequently to succeed in the digital world. to support academic achievement Educators now create educator attendance plans Instead of creating teaching materials, as students' progress through the program. In order to finish the course's learning activities and connect with other colleagues, participants can schedule a personal time Instead of turning up for class. In learning how you interact using these can be different don't difficult or take extra time, and are not difficult.
- Difference No#12: There are no lecturers on the platform .There is a national curriculum, a show (the class session itself) and a practice run (where you prepare and deliver your lecture) theatrical performances can be Face-to-face class meetings, and if you hadn't been present to see it you would have completely lost the chance. But Instructors are not on stage during online Classrooms to succeed in achieving their true educational goal. Whenever necessary, to understand the material, it is possible to repeat the course because it is recorded and repeat it several times if required, write and re-write educational materials for students or watch educational films and re-watch and re-read a number of times
- Difference #13: The purpose of educators is to support students' abilities to have a sense of new material, integrate, produce evaluate however teaching online appears different than regular classrooms. The principal's job is to instruct across both situations. However, the pupil has access to all knowledge in the world. Online instruction shifts the focus from merely imparting material to education's attempts to

adapt, make sense of fresh information, and form opinions therefore it only needs to search for solutions by Google or open a new tab.

Models of Online Training

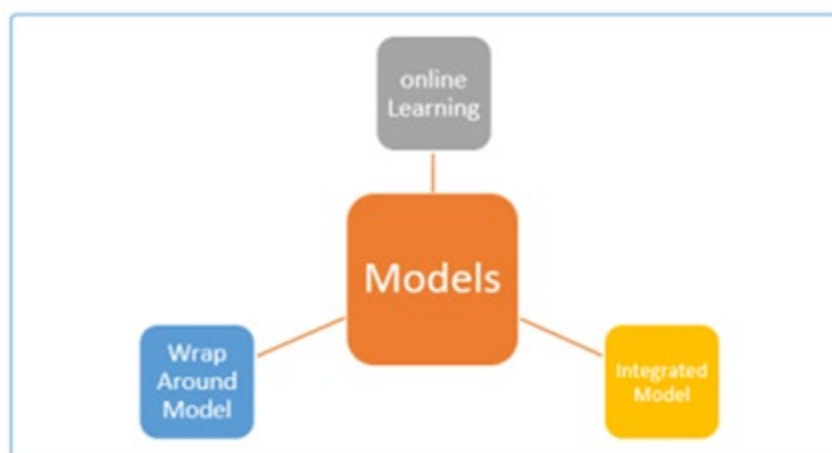
- Wrap around Model

This type of online learning concentrate on study materials, which might include digital study aids, exercises, and forums "wrapped" around already-published materials like books or CD-ROMs. This model which shows that the content is already available offline or online can be a resource-based learning method since it aims to employ pre-existing, once designed, it can be taught or supervised by anybody other than.

- Integrated Model

In this model is the most model which is full closest to the online learning course with total and all in need will be done online regarding activities, test and assessments. this type of training provided by learning management system which total include the style of the training and all in need activities regarding the subject of the training to be done online Such . this type of activities or model can be largely determined by individual as it is useful for people to participate on it and effect in term minimize the cost and distance which is effect direct on the in need time. (Bielaczyc & Collins,1999)

Figure 4: *Models of Online Learning*



Source: (Bielaczyc & Collins,1999)

Capacity building

Staff productivity is significantly impacted by capacity building, particularly when it comes to MTN connectivity limitations. The research took into account the component of capacity building that is concerned with the growth of a person or a group of members. The term capacity building can be used in different ways, with different results. It is widely recognized, as training, education, and support for human development are all part of the concept of capacity building. To develop resources in a civilized manner, this name will be updated to include governmental and non-governmental institutions activities from a wider and more holistic perspective. The learning process, capabilities, and behaviors in persons or groups which are pertinent in the design, development, administration, and maintenance of institutional and operational infrastructures and processes that are locally meaningful were defined by Groot and (Molen ,2000).

When growing the capacity of human rights organizations, administrators need to maintain to provide their employees with better knowledge, experience, and skills Hiring plans to place a strong emphasis on finding and retaining the finest and most brilliant individuals possible and employing. In fact, staff needs chances for on-the-job growth. Learning programs support these staffing practices by offering capacity advancement, particularly in areas that cannot be transferred to another organization if an employee should quit. A small amount of evidence supports the idea that the focus of the programs affects the success of employee productivity and capacity building. Typically, capacity development initiatives have prioritized technical training in areas like strategic planning and financial management with the hope that they will increase organizational performance. (Burabyo & Mulyungi, 2018)

CHAPTER IV

Related Work

In this thesis show the application of the semantic web technology interim of the E-Learning model. The ability to increase quality and more effective service that the current E-learning service provide to the participate .Therefore using the semantic web technology which is provide type of service that have the main aim interim of the service information from web and that make the semantic web more readable and useful for the human and computer program. (Shah, 2012).

The authors in (Shamoug et al., 2014) show the main four problems that they face in humanitarian organization , regarding the phase of the emergency cries response of the first days of people displacement .

(Palmér, 2012) summarizes works from 2001 to 2008 in the author in these 7 years have published about 6 thesis papers with subjects (E-Learning in the Semantic Age, Semantic Web Meta-data for e-Learning - Some Architectural Guidelines, The SCAM framework - helping semantic web applications to store and access metadata, a Conceptual Interface to the Semantic Web, Annotation profiles: Configuring forms to edit RDF and A Mash up-friendly Resource and Metadata Management Framework, Proceedings of the First International Workshop on Mashup Personal Learning Environments (MUPPLE08)) .

Therefore an article have been published in 2012, which show the different of time with semantic web technology and how much effective in the people. And it provide guidance to be able for development of semantic web technologies application main motivation point to this work is the vision of semantic web benefit . For improvement, online studying can work on various nationalities and locations can be a benefit use of the ontologies Semantic Web based on work and design. Which show semantic web technology develops regarding online learning

For the university of Duhok polytechnic, the design of online learning or ontology was explained in (Subhi, 2019). In order to help the learners in their educational progress and help them have more knowledge, ontology is used in an online learning. Also in university of Duhok ontology have been developed to that show student can reach the lectures ,assignments and in need education materials and show effective of use semantic web in education platform .(Abdulazeez , 2020)

In this thesis semantic web have been developed and SPARQL queried data in need to monitoring and evaluation the work inside the humanitarian organization which is direct work interim tasks and monitoring the project activities as target reached ,report submission , date of submission and other in need information . (Wafa,2022)

In crisis moment working and having SWRL rule and ontologies is used on materials and performance ,SWRL rules and Ontologies specially in the situation such as crisis it helps makes a very good and right decision for example using java based application also It helps enable ontology-based calculations as (Dagienè, 2015;Polakowski, 2008). Applied SWRL for emergency humanitarian crisis management ontologies , will apply Performer and different unique information which is included in emergency response .

The semantic web has the ability to provide specific and well-distributed knowledge for different categories and trends. At exactly the required times, this is what the authors started in (Alsultanny, 2006). In the learning system, they incorporated semantic web resource selections and allocations in an automatic mode. In this way, In order ontology easy access to educational materials and tools will design basic descriptive the information.

The research conducted on e-learning in applications is different, especially in classrooms and distance learning. Based on a clear and relatively different Web, (F. M. Ghaleb & S. Daoud, 2006) believe that science students need to access unlimited resources at a greater speed, time and an appropriate place. Authors presented a model of e-learning based on the semantic web, using various tools, and focused on the courses used in their country.

In this work, show how they will be able to by using the semantic web to develop adaptive quiz, which is E-learning tool that used the knowledge of the DBpedia. author explain in this work that prewise no work have been done based on game/quiz-based e-learning using Semantic Web, and that was the key of this thesis. (Ali & Sah, 2017)

CHAPTER V

Proposed Staff Training Ontology for Humanitarian Organizations

In this section, the proposed ontology is explained. In particular, classes, Object Properties, Data Properties, and individuals are discussed in detail.

Design of the Ontology

The main four steps to developing ontology are:

1- Ontology Requirements

- Scope of ontology: In this step, it is important to identify the scope of the ontology also the applications of it.
- List of questions: The list of components and list of the questions that the ontology will answer. It is preferable to be asked to a group of people who work in humanitarian organization.

2- Designing Ontology

- Here we will think about the word which can be useful during design of our ontology and in need to cover our requirements. The word can be verb and object and will try to connect between word to each other and understand the relationship between it.
- Group the list of terms we have and defined the similar domain to show the design of the classes.
- Show the properties in need to the link which consists of building the relationship between the two classes or class and individual.

3- Ontology Construction

- We build our ontology module by using Protégé ontology editor. (Ludovic, 2007)

4- Ontology Evaluation

- We will evaluate our ontology design which effect direct in the quality and correctness also show the competency of our ontology. (Raad & Cruz, 2015)

Ontology Design

List of components

In Table 1, the terms shown will be used during the design of the ontology.

Table 1: *List of Components in Need*

Online training	Staff	Trainer
Level	Name	User
Subject Of training	Email	Language
Department	Duration of training	Years of experience
Evaluation of training	Date of published	

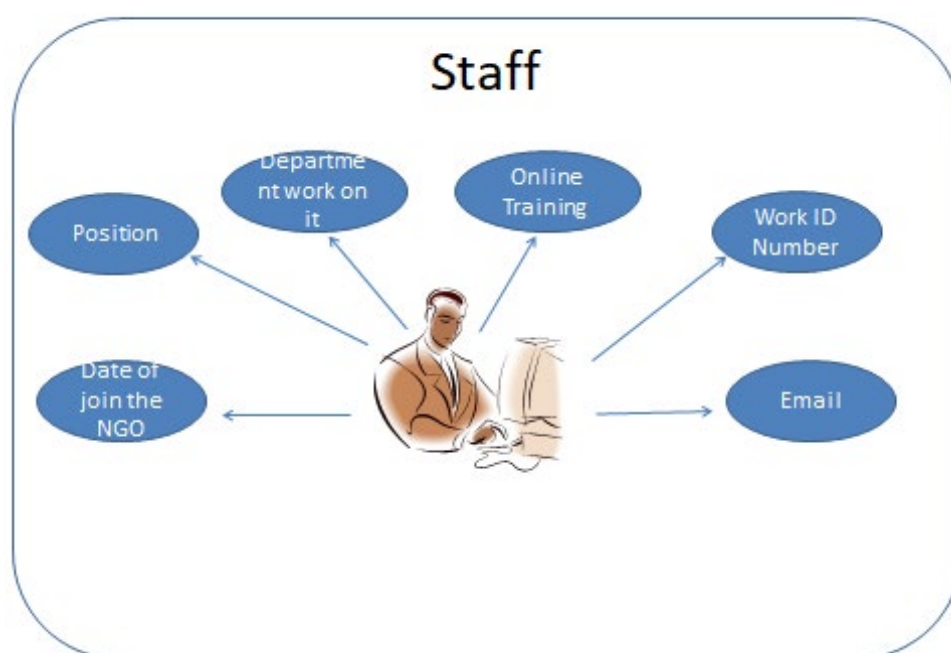
Source: Author's own

Classify the terms and main domains

Regarding the in need 3 mains field has been found:

- Trainer
- Staff
- Online Training

In Figure 5,6 and 7 the main domain of main parts in our projects have been showed as the properties, to be able show in need information according to that will help us during develop of our ontology .

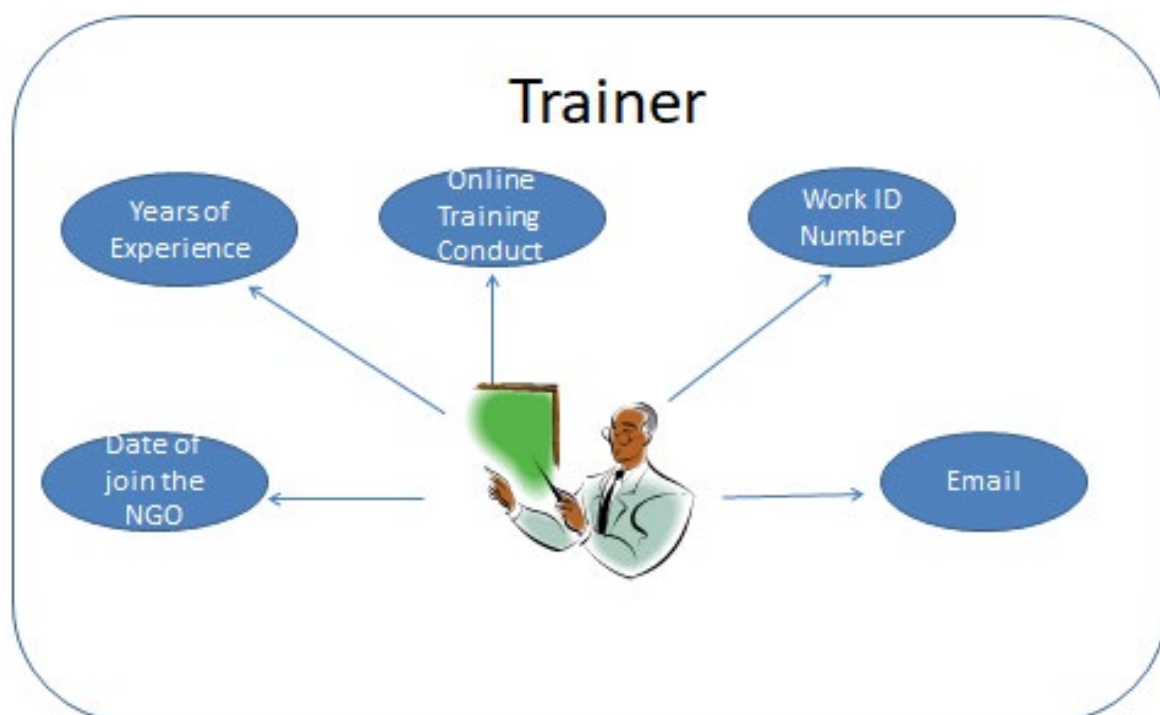
Figure 5: *Staff Structure Show the Domain*

Source: Author's own

Staff: Here mention the staff as the employees which work in a humanitarian organization that we need to have the main information on, also the training that they should take. Figure 5 shows the staff domain:

Trainer: This is the person which gives the specific online training in order to increase knowledge of a staff in a specific domain. In figure 6 will find the picture which shows the domain in need of a trainer.

Figure 6: *Trainer Structure Shows the Domains*



Source: Author's own

Online Training: Here mention the online training which consists of many subjects and staff should take it according to the department of work. Figure 7 shows the online training structure.

Figure 7: The online Training Structure shows the Domains



Source: Author's Own

After we have a structure of the domain fields in our ontology and we know the domains of work regarding each we will start to develop the classes, data properties, and object properties.

Ontology Construction

We use Protégé ontology editor to construct our ontology using the following concepts:

- Classes
- Object properties
- Data properties.
- Individual
- Skos: Concept Vocabulary
- Usage of blank node

Classes

To be able to develop the class table 2 describe the class that needs to develop by protégé:

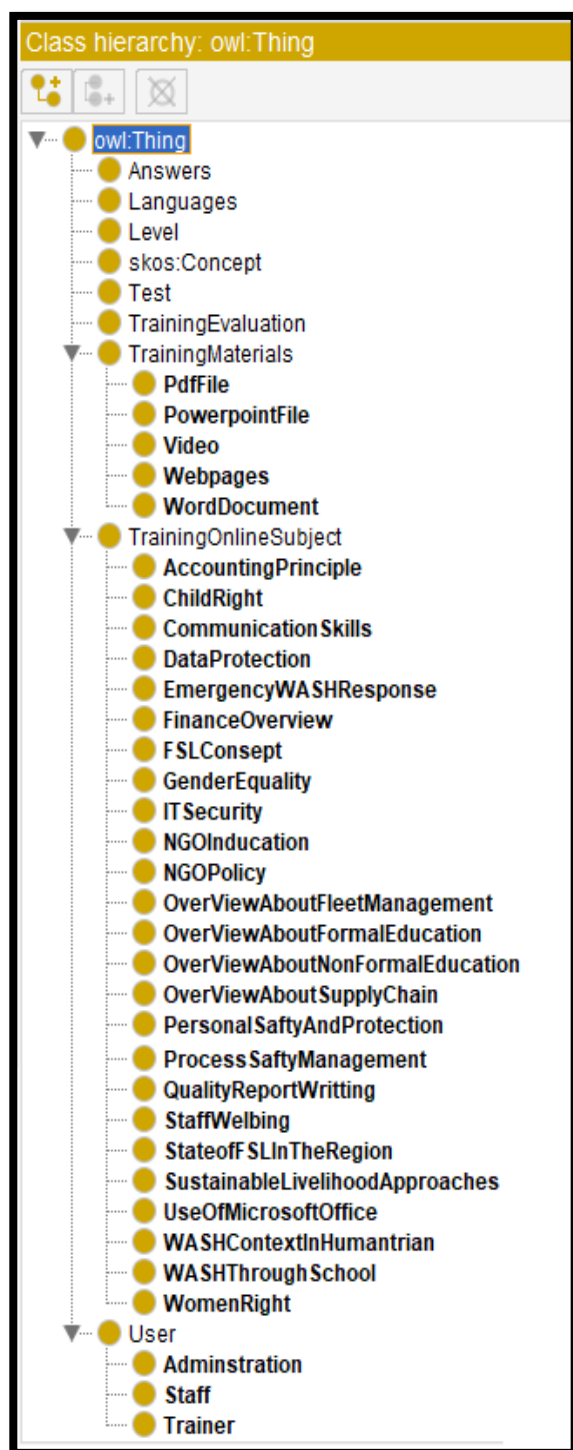
Table 2: *List of Class Description*

Classes	Description
Answers	Show the auto answers interim of yes and know
Languages	Show the languages of the Training interim what are the languages of the online training
Level	Show the level of the online training interim it is (Basic, Intermediate, and advanced).
Skos: Concept	Simple knowledge organization system regarding this class will be able to link the Individual of department
Test	Show the pre and post-test which is the type of evaluation of the knowledge and information of the staff which will conduct the online training
Training Evaluation	Show the evaluation or the score that the staff gives to the online training after finalizing it.
Training Materials	Describe the Materials included in the online training regarding PDF, Video and... etc.
Training Online Subject	According to the department, we had some examples of online training have been taken which is shown in this class
User	Describe users which are staff that will take the training, Trainer who is responsible for training teachers, and administration who is responsible for training publish.

Source: Author's own

To be able to develop a class that is the main used and in need of information about it, Figure 8 is the shot from protégé which show our class and subclass:

Figure 8 Snapshot of Classes in the Protégé

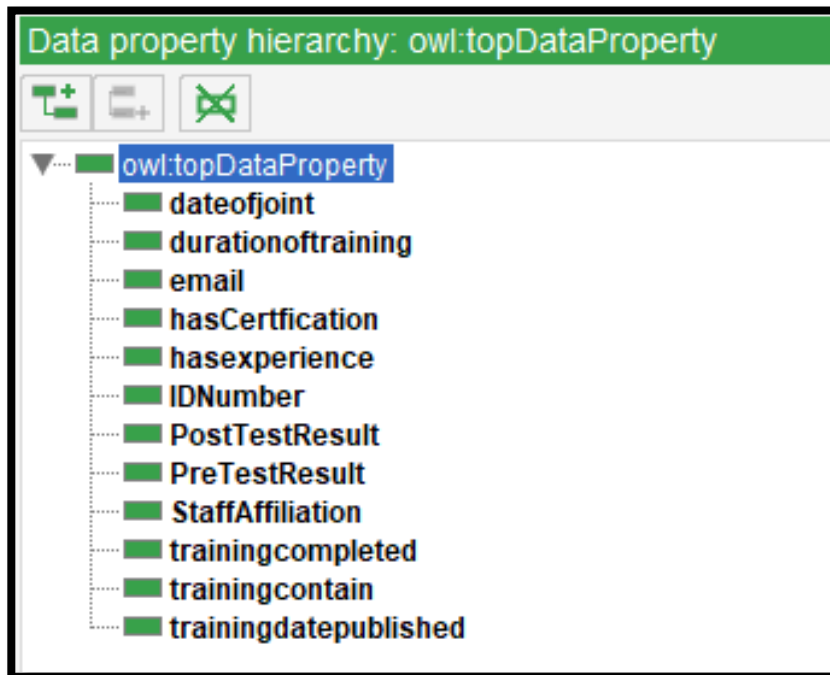


Source: Author's owner

Data Properties

Type of properties which link between classes and value which this value can be: Date, string and integer ...ect . In figure 9 the shot from protégé show the Data Properties

Figure 9: *Data Properties in the Protégé*



Source: Author's own

In the figure 10 we show the Data properties which have the domain online training subject and the range will be a string as it will show "The duration of the NGO policy is 90 Minutes ".Therefore to be able to say this sentence we will need the data property "duration of training"

Figure 10: *Data Properties RDF/XML in the Protégé*

```

<!-- http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#durationoftraining -->
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#durationoftraining">
  <rdfs:domain rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#TrainingOnlineSubject"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>

```

Source: Author's own

The table 3 shows the description, domains, and range of all data properties:

Table 3: *List of Data Properties*

Data Properties	Domains	Ranges	Description
Dateofjoint	xsd:dateTime	User	Show the date that the user joins the organization or the first date of the work.
Duration of training	xsd: string	TrainingOnline Subject	Express the time or duration that the online training takes.
Email	xsd: Name	User	Express the email of the users.
has certification	xsd: Name	TrainingOnline Subject	Show if the participant which is the staff after complete training takes the certification or not.
Has experience	xsd: int	User	Show the year of experience of the staff
Number	xsd: string	User	Show the user ID number.
PostTestResult	xsd:integer	TrainingOnline Subject	Type of the test done after conducting the training to show the level of change and knowledge before and after training.
PreTestResult	xsd:integer	TrainingOnline Subject	Type of the test done before conducting the training to show the level of change and knowledge before and after training.
StaffAffiliation	xsd: string	Staff	Show the Department of work of the staff in the organization.
Training completed	xsd: Name	training online Subject	Express if each staff completes or does not train.

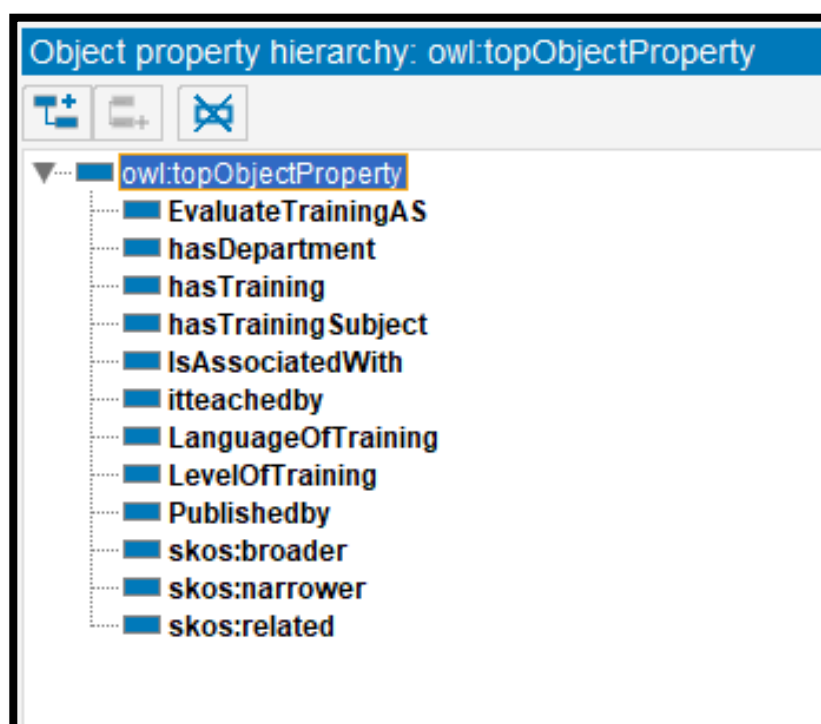
Training contains	xsd: Name	training online Subject	Show the contents of the training example PDF, video ...etc.
Trainingdatepublished	xsd:dateTime	training online Subject	Show the date of training published.

Source: Author's own

Object Properties

To be able link between two classes which need to show the main used and in need for information about it, In figure 11 the shot from protégé shows the Object Property.

Figure 11: *Object Properties in the Protégé*



Source: Author's own

In the figure 12 we show the Object property which has the domain Languages and ranges online training subjects as it will show " NGO Policy online Training Languages is English ". Therefore to be able to say this sentence we will need the object property "Languages Of Training "to link between online training subjects and language classes.

Figure 12: *Object Properties RDF/XML in the Protégé*

```

<!-- http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#LanguageOfTraining -->
<owl:ObjectProperty rdf:about="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#LanguageOfTraining">
  <rdfs:domain rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#Languages"/>
  <rdfs:range rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#TrainingOnlineSubject"/>
</owl:ObjectProperty>

```

Source: Author's own

Table 4 shows the description, domains, and range of all Object properties:

Table 4: *List of Object Properties*

Object Property	Domains	Ranges	Description
hasDepartment	Staff	Staff skos: Concept	Show the department of the NGO
hasTraining	Staff	TrainingOnlineSubject	Express each staff which online training take.
hasTrainingSubject	TrainingOnlineSubject	Skos: Concept	Show the online training of each department.
IsAssociatedWith	Skos: Concept	TrainingOnlineSubject	Show the online training of each staff belong to which online training subject
Itteachedby	Trainer	TrainingOnlineSubject	Express the trainers that conduct the training.
Published by	Administration	TrainingOnlineSubject	Show the person or staff who works on the online training that has been published.
Skos:broader	skos:Concept	skos: Concept	Show the sub-department belong to which department
skos:narrower	skos:Concept	skos:Concept	Object property that is used to show the item consists of which sub-department
EvaluateTrainingAssess	Training Evaluation	TrainingOnlineSubject	Express the reaction or evaluation of the staff on the online training.

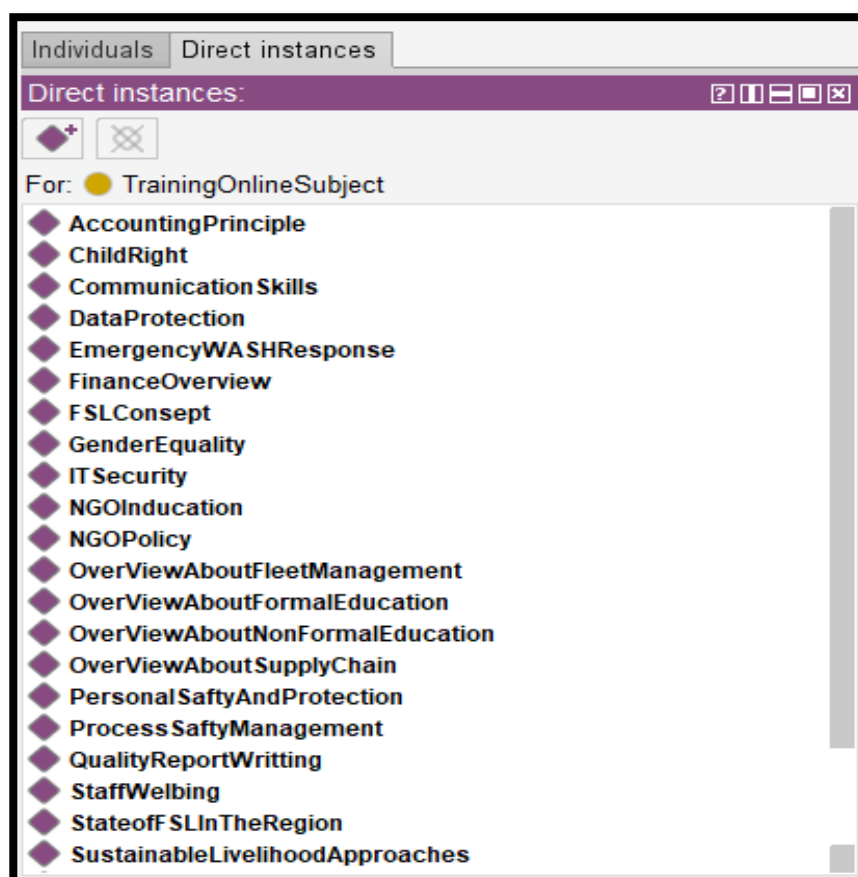
LanguageOfTraining	Languages	TrainingOnlineSubject	Show the languages of online training.
LevelOfTraining	Level	TrainingOnlineSubject	Show the level of the online training

Source: Author's own

Individuals

Figure 13 shows the individuals or class instances that we populated according to the ontology. In total 288 instances are created to demonstrate the proposed ontology.

Figure 13: *The individual in the Protégé*



Source: Author's own

In Figure 14, we demonstrate the individual for Online Training Subject "Communication Skills", shows all the data and object properties work in it is domain to be able to express this information which is (online training Subject have the level of Basic languages of the training is English also the trainer Jamal Hasan conduct it with the duration of 120 Minutes that have been published on 2019/3/3).

Figure 14: *Individual RDF/XML Properties in the Protégé*

```
<!-- http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#CommunicationSkills -->
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#CommunicationSkills">
  <rdf:type rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#TrainingOnlineSubject"/>
  <LanguageOfTraining rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#English"/>
  <LevelOfTraining rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#Basic"/>
  <hasTrainingSubject rdf:resource="http://www.w3.org/2004/02/skos/core#CommunicationSkills"/>
  <itteachedby rdf:resource="http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#JamalHassan"/>
  <durationoftraining rdf:datatype="http://www.w3.org/2001/XMLSchema#string">120 Minutes</durationoftraining>
  <trainingdatepublished rdf:datatype="http://www.w3.org/2001/XMLSchema#dateTime">2019-03-03T12:00:00</trainingdatepublished>
</owl:NamedIndividual>
```

Source: Author's own

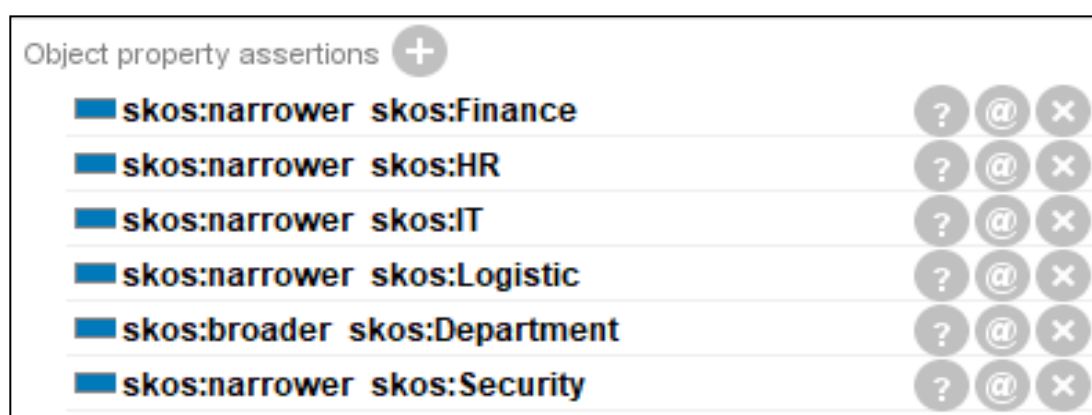
Skos: Concept

Figure 2 shows the departments of the humanitarian organization and each department has specific online training subjects belonging to it. To be able to implement this diagram regarding ontology we used Skos: Concept class for annotating online training subjects and departments. Skos is known as a simple Knowledge organization system which is a data model and stands from W3C(Miles & Pérez-Agüera, 2007). And work as a bridge that links several different fields of technology knowledge. Using Skos, a simple taxonomy can be created and skos: Concept is the main class to represent different concepts. Regarding that URI of the Skos: Concept is: <http://www.w3.org/2004/02/skos/core#>

Skos Vocabulary has been used to be able to show the diagram of the online training subject regarding the humanitarian organization department we will use the two relationships as object properties skos: broader and skos: narrower to create a simple taxonomy of online training subjects and departments. Since we use instances of skos: Concepts, we can link training materials to subjects using object properties. In addition, simple reasoning can be used using skos: narrower and skos: broader relationships.

In the figure 15 is the snapshot from the protégé that show the development of the object properties and use of the skos: narrower and skos: broader. skos: Admin property links staff to the different departments as shown that consist of sub-concepts (skos: HR,skos: Finance,skos: Security,skos: IT, and skos: Logistic) and that can be done by using the object properties skos: narrower. In addition, by object property skos: broader be able to show that skos: Admin is part of Skos: department.

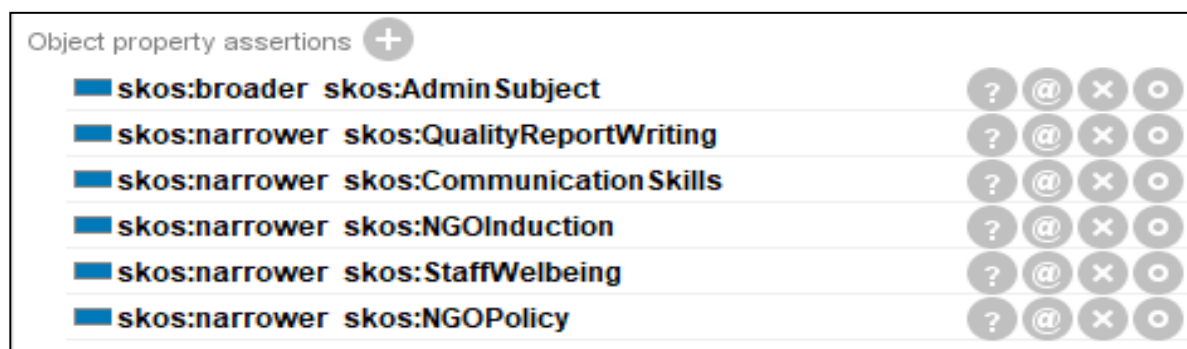
Figure 15: *Snapshot from Protégée Show Admin Department using Skos*



Source: Author's own

Figure 16 is a snapshot from protégé that show the skos: Admin by using the skos: broader that shows it belongs to the Admin department and consist of the five online training subject which have been linked by the object properties relationship skos: narrower.

Figure 16: *Snapshot From Protégée Show HR department Online Training Subject Using Skos*

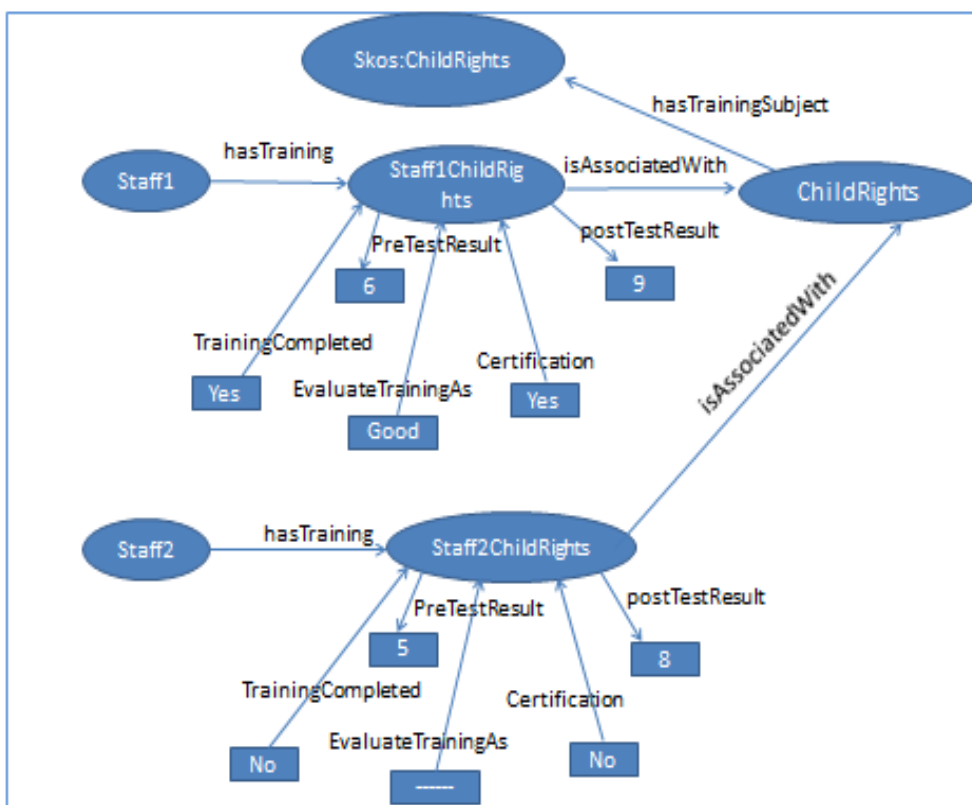


Source: Author's own

Usage of Blank Nodes

In our ontology design, we have about 22 online training and different staff members. Each staff may have multiple online trainings regarding the department they worked in the organization. We need the knowledge of the staff on different subjects, also each staff (individual) should take a number of the online training between 8- 10 online training subjects. To be able to query the information of the multiple staff member with different training subjects, blank nodes have been used which provide space and distance as shown in the figure 17.

Figure 17: *Graph of Blank Nodes Usage*



Source: Author's owner

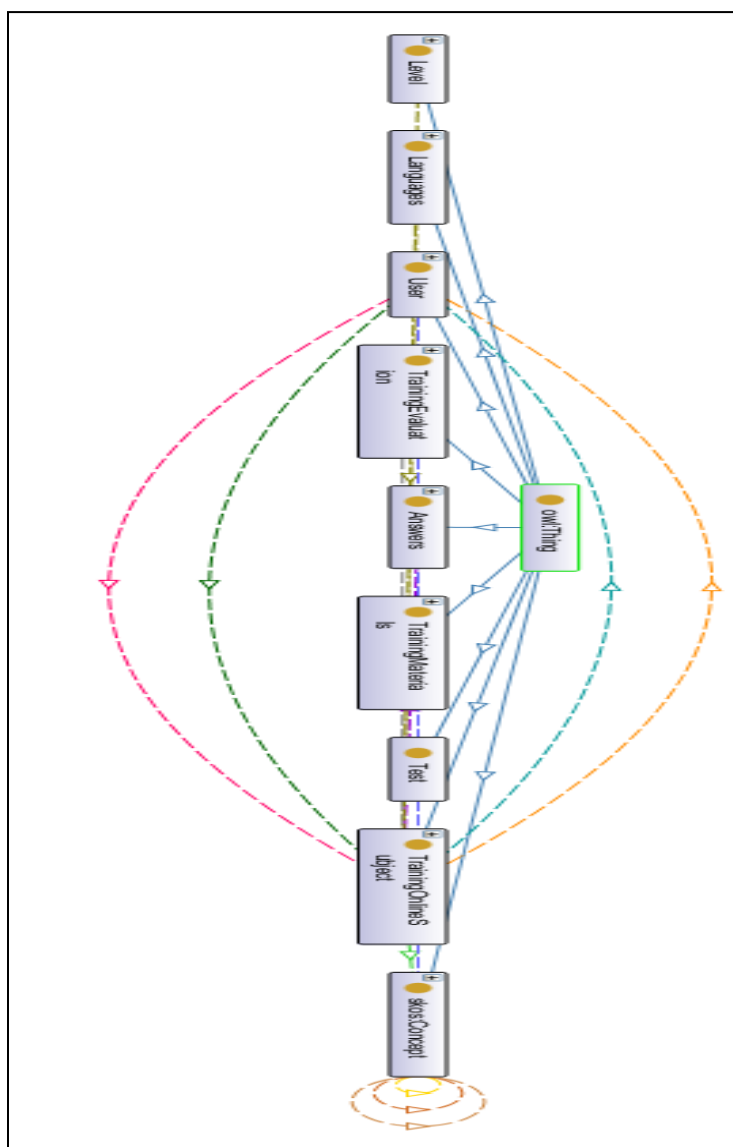
In the department of protection, we had an online training with the name child right in our ontology it is Skos: ChildRights instance of the Skos: Concept concept. Each staff has a blank node that links the staff and online training with all the properties in need to be done for one staff and one online training this blank node will collect all required properties for a staff. In addition, there is a direct link to the online training sub-class of training child rights using object properties associated with them by

using the object property `hasTrainingSubject` will link with `Skos: ChildRights` which is the border of the `Skos: Protection`.

Onto Graph

In figure 18, the classes that we have in the protégé have been shown as a directed graph using the graph editor.

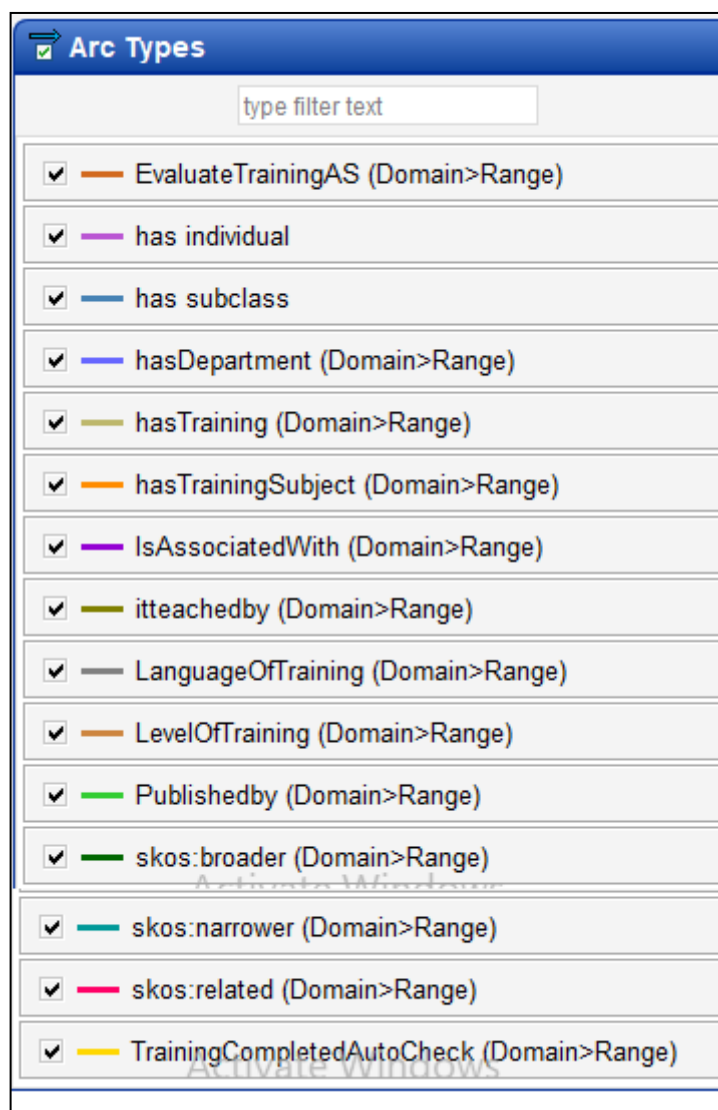
Figure 18: *Onto Graph in the Protégé show the Main Classes*



Source: Author's own

To be able to understand the line shown in the onto graph the figure 19 shows the relationship between classes according to the colours, as objects properties skos: border and skos: narrower which show as the circle around skos: Concept which means the domain and range of object properties is skos: Concept.

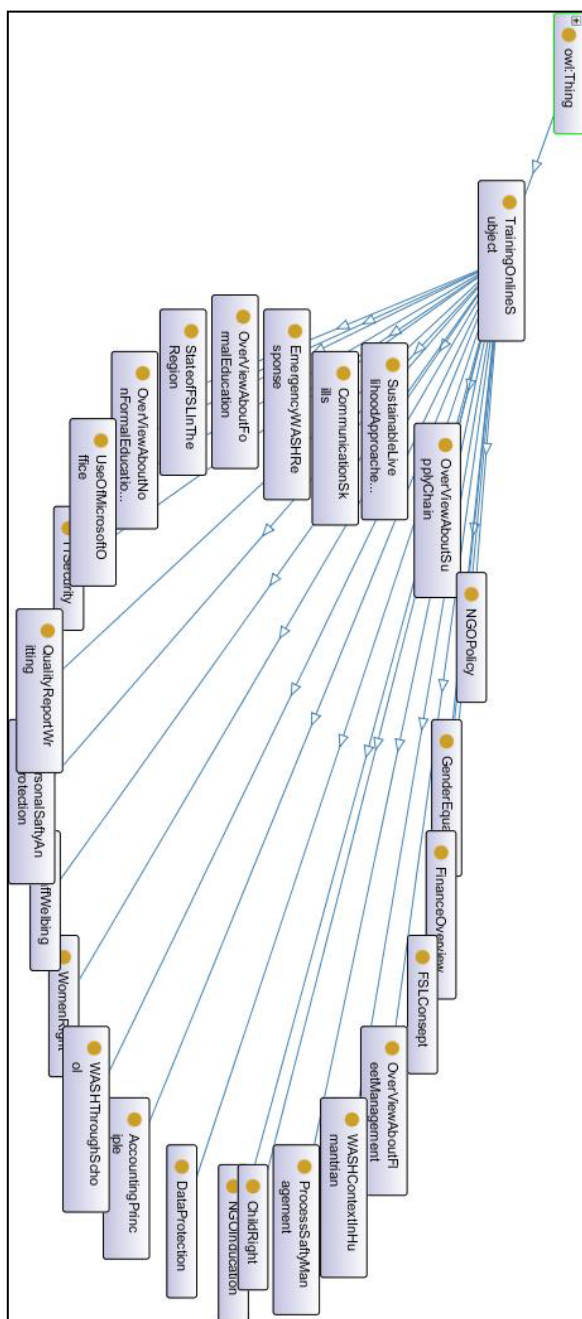
Figure 19: *Onto Graph line color relation*



Source: Author's own

In the figure below the subclasses of the training online subject will be shown which we take about 25 training online subjects as an example these subclasses work as an example as the Subject name of online training

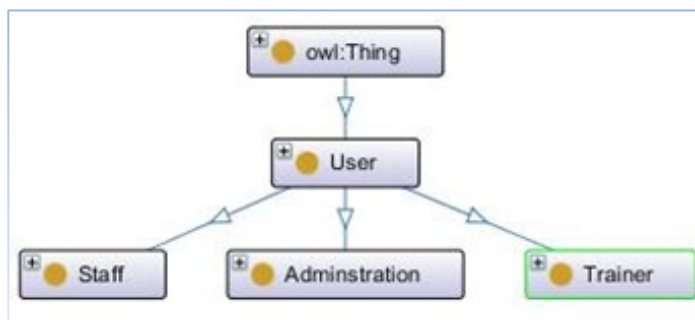
Figure 20: *Onto Graph in the Protégé show the online training Subjects*



Source: Author's own

Also, figure 21 shows the user class and subclasses using onto graph:

Figure 21: *Onto Graph in the Protégé show the User class with subclasses*



Source: Author's own

Ontology Metrics

Finally, in figure 22, the ontology metrics of the created ontology from Protégé have summarized that show the number of classes, data properties, objects properties, individuals, etc...

Figure 22: *Metrics list in the Protégé*

Metrics	
Axiom	2074
Logical axiom count	1718
Declaration axioms count	356
Class count	42
Object property count	13
Data property count	13
Individual count	288
Annotation Property count	3
SubClassOf	33
ObjectPropertyDomain	15
ObjectPropertyRange	15
FunctionalDataProperty	1
DataPropertyDomain	14
DataPropertyRange	12
ClassAssertion	267
ObjectPropertyAssertion	614
DataPropertyAssertion	743

Source: Author's own

CHAPTER SIX

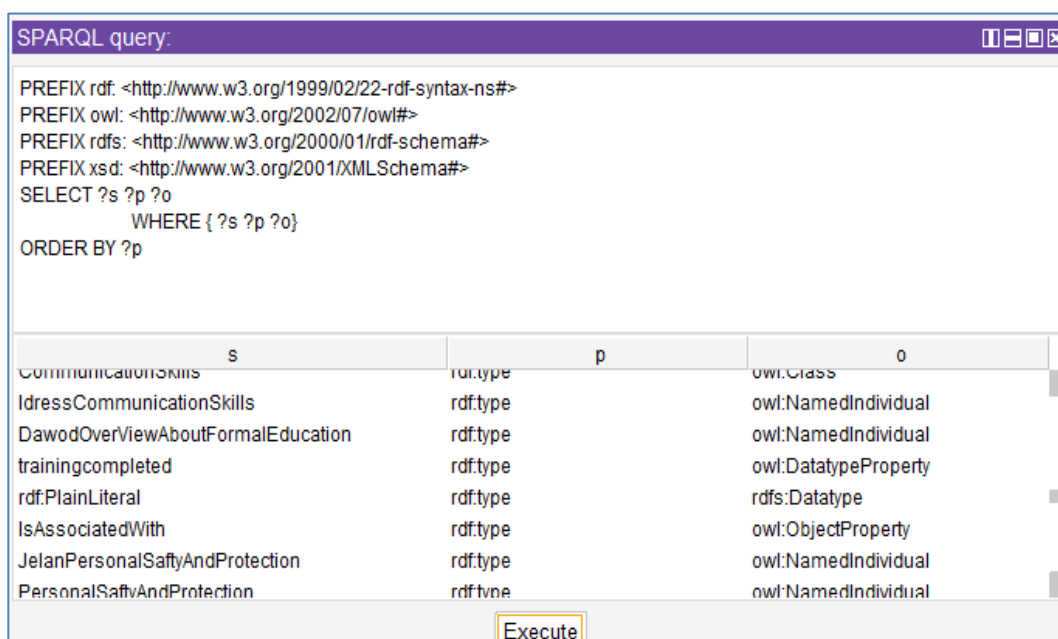
Querying The Proposed Ontology Using SPARQL

In this section, we will develop and do some SPARQL queries as an example to show data overall about 10 examples have been done as an answer to the competency questions and many other SPARQL can be developed it.

SPARQL Example

SPARQL is developed by W3C in 2008, is a standard query language for the Semantic Web (Powell & Hopkins, 2015). We should have overall information and knowledge about the structure of building SPARQL query, it is important to insure that the order of structure is too, Figure 23 shows an example SPARQL query and we divide the query into different important parts.

Figure 23: *Simple SPARQL Query Example*



Source: Author's owner

From the example above we will:

- Prefix declarations: show the URI

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: http://www.w3.org/2000/01/rdf-schema#

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

- Dataset definition: stating what RDF graph(s) is being queried.

In the example, it is not shown which is start by from and shows the RDF start point.

- A result clause: the information which should be returned

```
SELECT ?s ?p ?o
```

- The query pattern: shows the information that needs to be queried.

```
WHERE { ?s ?p ?o }
```

- Query modifiers: show the way of the show the query result.

```
ORDER BY ? p
```

Figure 24: *Snapshot from Protégé to Show the Years of Experience of Trainer*

The screenshot shows the Protégé SPARQL Query window. The query is as follows:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX h: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
SELECT *
WHERE {
?Trainer rdf:type h:Trainer;
h:hasexperience ?hasexperience. }
```

The results table is as follows:

Trainer	hasexperience
SaraRobot	"1 Years" ^{^^} <http://www.w3.org/2001/XMLSchema#string>
JamalHassan	"6 Years" ^{^^} <http://www.w3.org/2001/XMLSchema#string>
AdilJane	"5 years" ^{^^} <http://www.w3.org/2001/XMLSchema#string>
AliAhmed	"3 Years" ^{^^} <http://www.w3.org/2001/XMLSchema#string>
AzadSaleem	"2 Years" ^{^^} <http://www.w3.org/2001/XMLSchema#string>

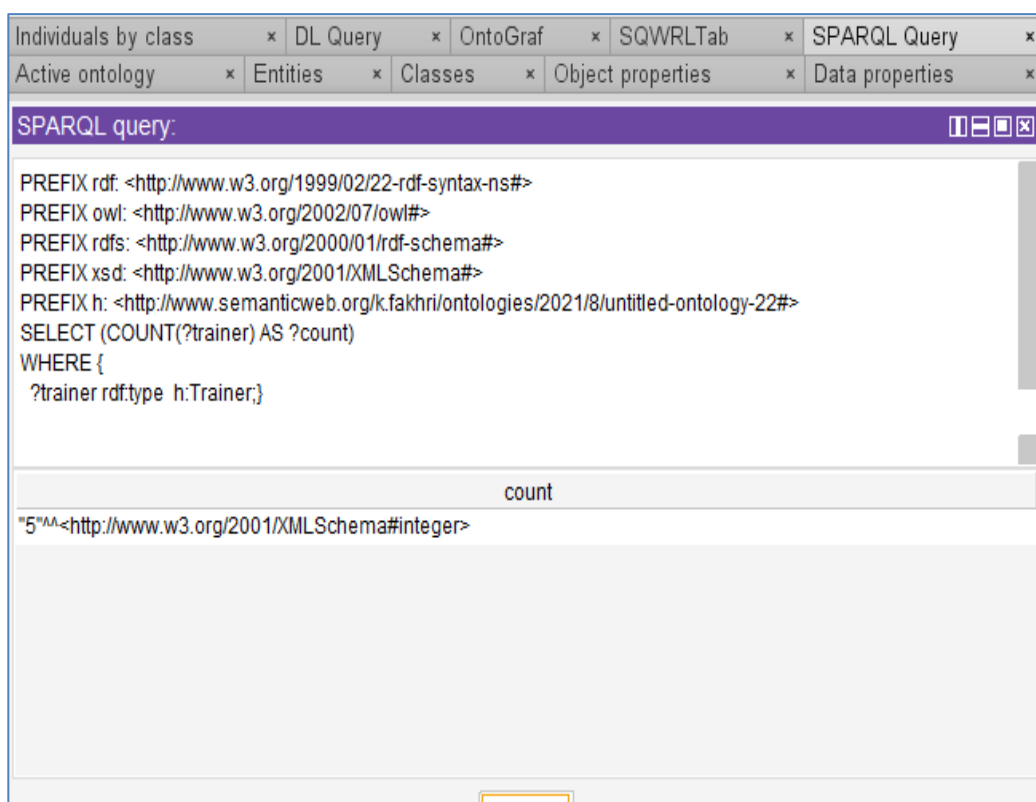
Source: Author's own

Now, different SPARQL queries are demonstrated in the following figures that show that once the data is in a machine-processable format, extensive SPARQL queries can be used to query the knowledge base in detail.

Trainer experience query: In SPARQL 24 the name and years of experience online training Trainers are shown.

Count Number of Trainers: In SPARQL 25 will show the overall number of trainers.

Figure 25: *Snapshot from Protégé to Show the Number of Trainers*



Source: Author's own

Online Training Subject Information: In the SPARQL Query shown 26 the information of online training subject from (Subject, Date of publish, Duration of training, Languages of the training, Level of the training and trainer that conduct the training).

\Child Rights training Test Result: In SPARQL shown 27return query of staff's name who complete the child rights online training will filter only the staff that has post-test results equal to or more than 4.

Staff Information: In the SPARQL Query shown 28 the information of staff by (Name, Department, Position And email).

Figure 26: Snapshot from Protégé to Online Training Information

SPARQL query:

```

PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX h: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
SELECT ?Training ?Date ?Durationoftraining ?Trainer ?Language ?Level
WHERE {
?Training rdfs:type h:TrainingOnlineSubject;
h:hasTrainingSubject ?subject;
h:trainingdatepublished ?Date;
h:durationoftraining ?Durationoftraining;
hitteachedby ?Trainer;
h:LanguageOfTraining ?Language;
h:LevelOfTraining ?Level;}

```

Training	Date	Durationoftraining	Trainer	Language	Level
PersonalSafetyAndProtection	"2020-02-22T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"35 Minutes" ^{^^} <http://w.AliAhmed	English	Advanced	
ProcessSafetyManagement	"2020-07-17T18:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"70 Minutes"	SaraRobot	English	Basic
QualityReportWriting	"2020-04-09T03:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"75 Minutes" ^{^^} <http://w.AdilJane	English	Intermediate	
StaffVelbing	"2020-09-06T15:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"55 Minutes" ^{^^} <http://w.AliAhmed	English	Intermediate	
GenderEquality	"2020-01-11T04:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"35 Minutes" ^{^^} <http://w.AliAhmed	English	Basic	
EmergencyWASHResponse	"2018-01-19T02:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"98 Minutes"	AliAhmed	Arabic	Advanced
NGOPolicy	"2021-08-15T10:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"180 Minutes"	AdilJane	English	Basic
UseOfMicrosoftOffice	"2020-11-08T01:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"78 Minutes"	JamalHassan	English	Intermediate
OverViewAboutNonFormalEducation	"2020-07-03T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"135 Minutes"	AzadSaleem	English	Intermediate
WASHContextInHumanitran	"2021-02-06T16:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"115 Minutes"	AzadSaleem	Arabic	Basic
OverViewAboutFormalEducation	"2021-09-08T16:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>	"155 Minutes"	AliAhmed	English	Intermediate

Execute

Source: Author's own

Figure 27: Snapshot from Protégé to Show Pretest and Posttest of the Staff which has Child Rights Online Training with Condition for Posttest Result

SPARQL query:

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX h: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
Select ?StaffName ?OnlineTraining ?PreTest?PostTest
Where{?StaffName rdfs:type h:Staff.
?StaffName h:hasTraining?t
?t h:isAssociatedWith h:ChildRight.
?t h:isAssociatedWith ?OnlineTraining.
?t h:PreTestResult ?PreTest.
?t h:PostTestResult ?PostTest.
FILTER (?PostTest>=4)}

```

StaffName	OnlineTrai...	PreTest	PostTest
FahimaRasheed	ChildRight	"2" ^{^^} <http://www.w3.org/2001/XMLSchema#integer>	"6" ^{^^} <http://www.w3.org/2001/XMLSchema#integer>
HawarMostafa	ChildRight	"2" ^{^^} <http://www.w3.org/2001/XMLSchema#integer>	"6" ^{^^} <http://www.w3.org/2001/XMLSchema#integer>
AlanAhmed	ChildRight	"7" ^{^^} <http://www.w3.org/2001/XMLSchema#integer>	"9" ^{^^} <http://www.w3.org/2001/XMLSchema#integer>

Execute

Source: Author's own

Figure 28: Staff Information

SPARQL query:

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX x: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
SELECT *
WHERE {
?Staff rdf:type x:Staff;
x:hasDepartment ?Department;
x:StaffAffiliation ?Position;
x:email ?email.}

```

Staff	Department	Position	email
FahimaRasheed	skos:Protection	"ChildProtectionAssistant"	"fahima1989@yahoo.com"
ZiyadSaleem	skos:WASH	"WASHOfficer"	"Ziyadsaleem@gmail.com"
JelanAli	skos:FSL	"FSL Officer"	"JelanAli@company.com"
DiyarHameed	skos:Security	"SaftyAndSecurityAssistant"	"DiyarHameed1@gmail.com"
IsmailMustafa	skos:WASH	"WASH Officer"	"Ismail24@gmail.com"
AlanAhmed	skos:Protection	"ChildProtectionAssistant"	"Alanahmed@gmail.com"
BareenJasim	skos:Admin	"LogisticOfficer"	"BareenJasim@company.com"
BareenJasim	skos:Logistic	"LogisticOfficer"	"BareenJasim@company.com"
BerivanKamal	skos:Education	"EducationAssistant"	"Berivan1994@gmail.com"
DawodGebrael	skos:Education	"EducationOfficer"	"DawodGebrael@yahoo.com"
KordeenKhairy	skos:HR	"HummanResurceOfficer"	"kordeenkhairy18@gmail.com"
IdreesAhmed	skos:Finance	"FinanceOfficer"	"IdreesAhmed@gmail.com"
HawarMostafa	skos:HR	"OfficeManager"	"HawarMostafa@oamil.com"

Execute

Source: Author's own

Online training Result: In SPARQL 29 show each staff which completed training and conducted pre and post-test result.

Figure 29: Snapshot from Protégé to show staff and online training take also the pre and post-test

SPARQL query:

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX u: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
Select *
Where {?x rdf:type u:Staff.
?x u:hasTraining?t.
?t u:PreTestResult ?pretest.
?t u:PostTestResult ?posttest.}

```

x	t	pretest	posttest
IsmailMustafa	IsmailPersonalSaftyAndProtect	"5"	"5"
IsmailMustafa	IsmailWASHThroughSchool	"2"	"3"
IsmailMustafa	IsmailWASHContextInHumantr	"5"	"7"
IsmailMustafa	IsmailEmergencyWASHRespo	"2"	"5"
IsmailMustafa	IsmailNGOPolicy	"4"	"4"
IsmailMustafa	IsmailStaffWelbing	"6"	"4"
IsmailMustafa	IsmailCommunicationSkills	"6"	"9"
DiyarHameed	DiyarStaffWelbing	"7"	"8"
DiyarHameed	DiyarPersonalSaftyAndProtecti	"5"	"6"
DiyarHameed	DiyarUseOfMicrosoftOffice	"4"	"8"
DiyarHameed	DiyarNGOInduction	"8"	"10"
BerivanKamal	BerivanPersonalSaftyAndProte	"6"	"8"
BerivanKamal	BerivanOverViewAboutFormalE	"6"	"9"

Execute

To use the reasoner click Reasoner > Start reasoner Show Inferences

Source: Author's own

Date of publication: In SPARQL 30 show the online training and the date that published and show it by date order

Figure 30: Snapshot from Protégé to show the date of online training Published which has been order

SPARQL query:

```

PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX h: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
SELECT ?TrainingSubject ?date
WHERE {
?TrainingSubject rdfs:type h:TrainingOnlineSubject; h:hasTrainingSubject ?subject;
h:trainingdatepublished ?date;
}
ORDER BY ?date

```

TrainingSubject	date
EmergencyWASHResponse	"2018-01-19T02:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
WASHThroughSchool	"2018-05-02T11:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
CommunicationSkills	"2019-03-03T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
AccountingPrinciple	"2019-03-03T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
ITSecurity	"2019-04-04T10:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
WomenRight	"2019-06-28T14:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
OverViewAboutFleetManagement	"2019-06-28T14:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
DataProtection	"2019-09-24T11:30:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
GenderEquality	"2020-01-11T04:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
PersonalSaftyAndProtection	"2020-02-22T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
QualityReportWriting	"2020-04-09T03:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>

Execute

To use the reasoner click Reasoner > Start reasoner Show Inferences

Source: Author's own

Date of publish with the condition: In SPARQL 31 shows the online training and date published after (2020-02-01) also will show only the first 10 online training

Figure 31: Snapshot from Protégé to Show Date of Published Online Training for the date newest than 2020-02-01

SPARQL query:

```

PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX h: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
SELECT ?TrainingSubject ?date
WHERE {
?TrainingSubject rdfs:type h:TrainingOnlineSubject; h:hasTrainingSubject ?subject;
h:trainingdatepublished ?date;
FILTER (?date >= "2020-02-01T12:00:00"^^xsd:dateTime)
}
ORDER BY ?date
Limit 10

```

TrainingSubject	date
PersonalSaftyAndProtection	"2020-02-22T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
QualityReportWriting	"2020-04-09T03:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
OverViewAboutNonFormalEducation	"2020-07-03T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
ProcessSaftyManagement	"2020-07-17T18:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
FinanceOverview	"2020-07-22T11:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
StaffWelbing	"2020-09-06T15:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
OverViewAboutSupplyChain	"2020-09-15T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
FSLConsept	"2020-10-03T12:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
UseOfMicrosoftOffice	"2020-11-08T01:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>
WASHContextInHumantrian	"2021-02-06T16:00:00" ^{^^} <http://www.w3.org/2001/XMLSchema#dateTime>

Execute

To use the reasoner click Reasoner > Start reasoner Show Inferences

Source: Author's own

Oldest and newest date published: In SPARQL 32 show the oldest and newest date published online training.

Figure 32: Snapshot from Protégé to show the oldest and newest date of online training

The screenshot shows the Protégé SPARQL query editor with the following query:

```
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX h: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
SELECT (min(?date) as ?OldestTraining) (max(?date) as ?NewestTraining)
WHERE {
  ?TrainingSubject rdf:type h:TrainingOnlineSubject; h:hasTrainingSubject|?subject;
  h:trainingdatepublished ?date;
}
```

The results table shows the following data:

OldestTraining	NewestTraining
"2018-01-19T02:00:00" <u>AA</u> <http://www.w3.org/2001/XMLSchema#dateTime>	"2021-09-08T16:00:00" <u>AA</u> <http://www.w3.org/2001/XMLSchema#dateTime>

An "Execute" button is visible at the bottom of the query editor.

Source: Author's own

Staff reaction: After staff complete training they have the option to react to or evaluate the online training so, SPARQL shows 33 the reaction or evaluation of each staff if we have to the online training.

Figure 33: Snapshot from Protégé to show Evaluation of each staff on the online training take

The screenshot shows the Protégé SPARQL query editor with the following query:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX u: <http://www.semanticweb.org/k.fakhri/ontologies/2021/8/untitled-ontology-22#>
Select ?StaffName ?OnlineTraining ?Reaction
Where{?StaffName rdf:type u:Staff.
?StaffName u:hasTraining?t.
?t u:IsAssociatedWith ?OnlineTraining.
Optional{
?t u:EvaluateTrainingAS?Reaction.
}
}
```

The results table shows the following data:

StaffName	OnlineTraining	Reaction
DiyarHameed	UseOfMicrosoftOffice	
DiyarHameed	CommunicationSkills	Verygood
DiyarHameed	NGOInducation	
BerivanKamal	PersonalSaftyAndProtection	Good
BerivanKamal	OverViewAboutFormalEducation	Excellent
BerivanKamal	CommunicationSkills	Good
BerivanKamal	NGOPolicy	Good
BerivanKamal	OverViewAboutNonFormalEducation	Excellent
BerivanKamal	QualityReportWriting	
BerivanKamal	UseOfMicrosoftOffice	
BerivanKamal	NGOInducation	Verygood
AlanAhmed	WomenRight	Poor
AlanAhmed	GenderEqualitv	

An "Execute" button is visible at the bottom of the query editor.

Source: Author's own

Pre and post-test result of staff: In the SPARQL 34 show the online training that has been started by Ismail Mustafa who is the staff in the organization show the Pretest and post-test result and if the training has not been completed will not have post-test result.

Figure 34: *Ismail Mustafa Pre and post-test result*

Annotation properties x Individuals by class x OntoGraf x SWRLTab x SPARQL Query x
Active ontology x Entities x Classes x Object properties x Data properties x

SPARQL query: ⏏ ⏏ ⏏ ⏏

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX u: <http://www.semanticweb.org/K.fakhri/ontologies/2021/8/untitled-ontology-22#>
Select ?OnlineTraining ?PreTestResult ?PostTestResult

Where{
u:IsmailMustafa u:hasTraining ?t.
?t u:isAssociatedWith ?OnlineTraining.
?t u:PreTestResult ?PreTestResult.
optional{
?t u:PostTestResult ?PostTestResult.
}
}
```

OnlineTraining	PreTestResult	PostTestResult
PersonalSafetyAndProtection	"5" <xsd:integer>< td=""> <td>"5"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"5" <xsd:integer>< td=""> </xsd:integer><>
NGOInducation	"7" <xsd:integer>< td=""> <td></td> </xsd:integer><>	
WASHThroughSchool	"2" <xsd:integer>< td=""> <td>"3"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"3" <xsd:integer>< td=""> </xsd:integer><>
WASHContextInHumantrian	"5" <xsd:integer>< td=""> <td>"7"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"7" <xsd:integer>< td=""> </xsd:integer><>
EmergencyWASHResponse	"2" <xsd:integer>< td=""> <td>"5"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"5" <xsd:integer>< td=""> </xsd:integer><>
NGOPolicy	"4" <xsd:integer>< td=""> <td>"4"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"4" <xsd:integer>< td=""> </xsd:integer><>
StaffWelbing	"6" <xsd:integer>< td=""> <td>"4"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"4" <xsd:integer>< td=""> </xsd:integer><>
QualityReportWriting	"3" <xsd:integer>< td=""> <td></td> </xsd:integer><>	
CommunicationSkills	"6" <xsd:integer>< td=""> <td>"9"<xsd:integer>< td=""> </xsd:integer><></td></xsd:integer><>	"9" <xsd:integer>< td=""> </xsd:integer><>

Execute

Source: Author's own

CHAPTER VII

Semantic Web Rule Language

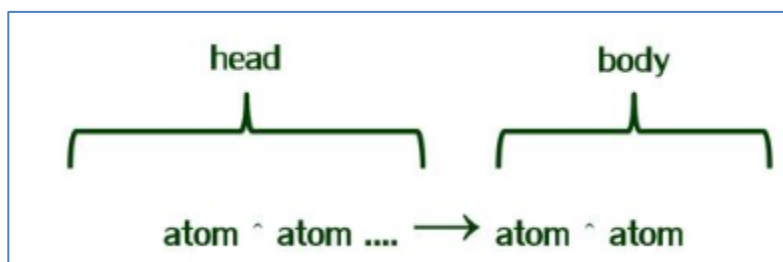
In this section, we develop number of SWRL rules to automatically infer new knowledge from the existing metadata.

SWRL Introduction

The construction of Semantic web rule, it consists of two main sides. Each side work as part and each part consist of many atoms. Between atoms, there are AND relations (Xu & Zhang, 2022) as shown in the figure 35 :

The left side is head that is conditional part, IF happen then the right hand-side is fired.

Figure 35: *SWRL Structure*



Source :(Gao, 2022)

Here in the figure 36, the developed SWRL rules for the proposed ontology are demonstrated.

Figure 36: *Snapshot of Rule Tab in the protégé*

Active ontology x Entities x Classes x Object properties x Data properties x Individuals by class x SWRLTab x					
	Name	Rule			Comment
<input checked="" type="checkbox"/>	S1	Staff(?x) ^ hasDepartment(?x, skos:Protection) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubje...			
<input checked="" type="checkbox"/>	S10	Staff(?x) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(?training1, NGOPolicy) ^ trainingco...			
<input checked="" type="checkbox"/>	S2	Staff(?x) ^ hasDepartment(?x, skos:HR) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(?trai...			
<input checked="" type="checkbox"/>	S3	Staff(?x) ^ hasDepartment(?x, skos:FSL) ^ TrainingCompletedAutoCheck(?x, Yes) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(...			
<input checked="" type="checkbox"/>	S4	Staff(?x) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(?training1, CommunicationSkills) ^ t...			
<input checked="" type="checkbox"/>	S5	Staff(?x) ^ hasDepartment(?x, skos:WASH) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(?t...			
<input checked="" type="checkbox"/>	S6	Staff(?x) ^ hasDepartment(?x, skos:Security) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(...			
<input checked="" type="checkbox"/>	S7	Staff(?x) ^ hasDepartment(?x, skos:Finance) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(...			
<input checked="" type="checkbox"/>	S8	Staff(?x) ^ hasDepartment(?x, skos:Logistic) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(...			
<input checked="" type="checkbox"/>	S9	Staff(?x) ^ hasDepartment(?x, skos:IT) ^ hasTraining(?x, ?t1) ^ IsAssociatedWith(?t1, ?training1) ^ hasTrainingSubject(?trai...			

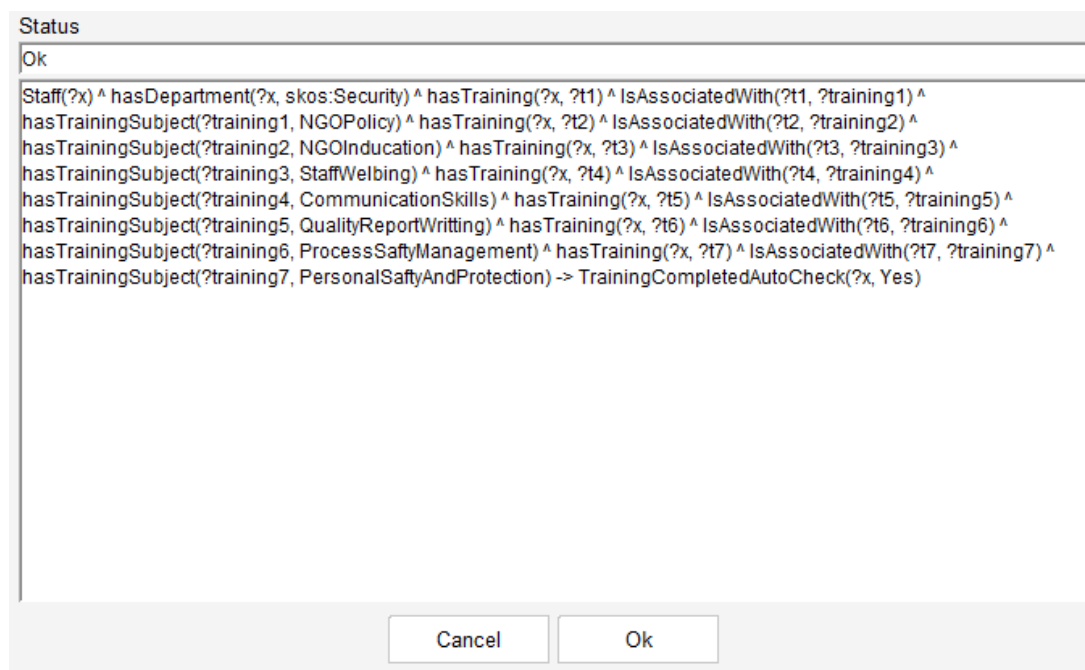
Source: Author's Owner

About 10 rules have been develop in our protégé lets have explanation in 3 different rules.

Example 1

This rule demonstrates whether a staff completed the mandatory training or not according to the department they worked in.

Figure 37: Snapshot from Protégé of SWRL Example one



Source: Author's owner

In this SWRL, it shows that:

IF(he/she is staff AND work in the department security, AND have the training Subject NGOPolicy

AND have the training Subject NGOInducation AND have the training Subject StaffWelbing

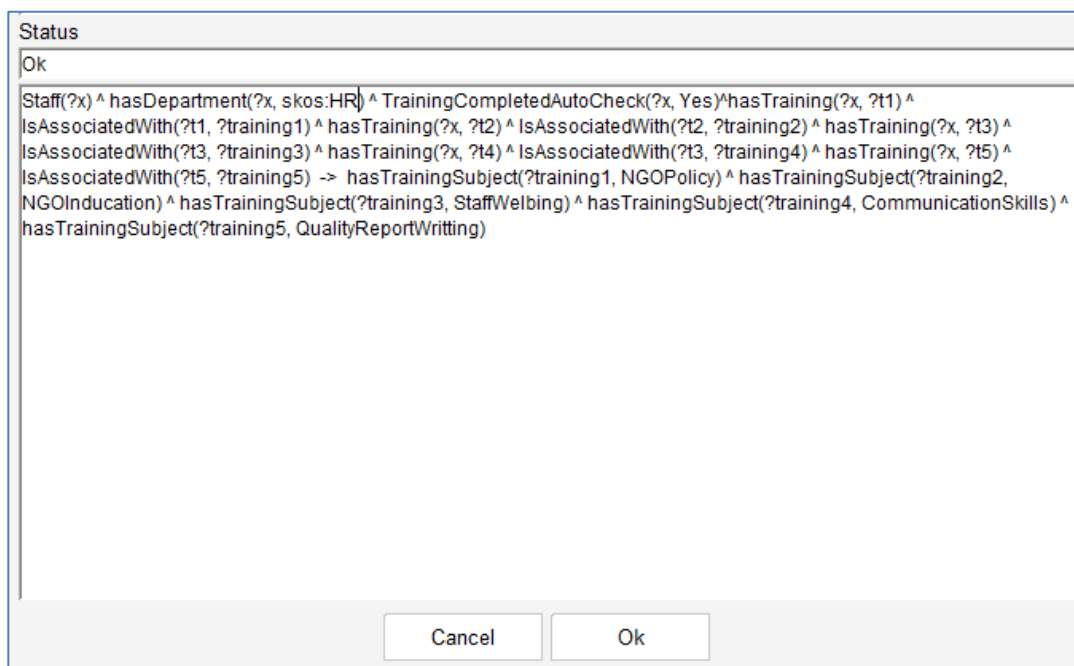
AND have the training Subject CommunicationSkills AND have the training Subject QualityReportWriting , AND Have the training Subject CommunicationSkills , AND Have the training Subject ProcessSaftyMangament, AND have the training subject PersonalSaftyandProtection)

- > Then he/she completed all training

Example 2

This rule demonstrates whether a mandatory online training subject that employ should complete according to department they working in.

Figure 38: *Snapshot from Protégé of SWRL Example Two*



Source: Author's owner

In this SWRL it showed that:

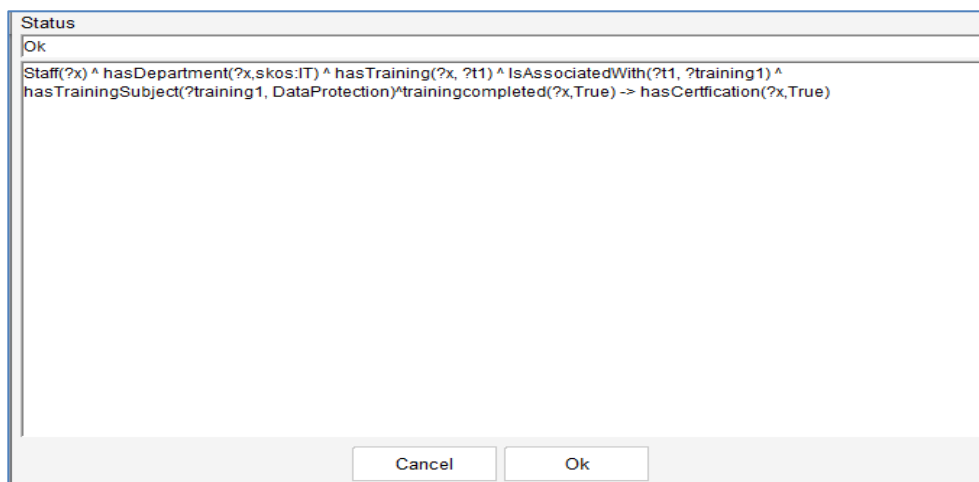
IF(he/she is staff ,AND work in the department HR,AND completed all training)

- > Then he/she should take five online training with subject (NGOPolicy ,NGOInducation , StaffWelbing ,CommunicationSkills and QualityReportWriting)

Example 3

This rule demonstrates whether a employ in IT Department complete the online training subject (Data Protection) if yes to have certification for it.

Figure 39: Snapshot from Protégé of SWRL Example Three



Source: Author's owner

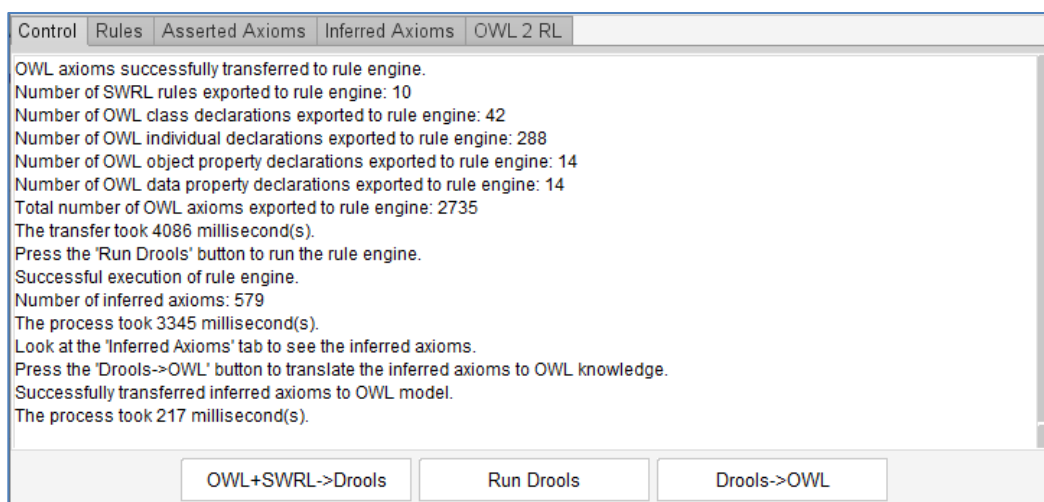
In this SWRL it showed that:

IF (he/she is staff , AND work in the department IT,AND has online training subject of Data Protection ,AND completed Data Protection)

- >Then he/she should certification

Here in figure 40 after (OWL+SWRL->Drools),(Run Drools) and (Drools->OWL) have been pressed the control tab from the protégé have been snapshot and shown in figure 40

Figure 40: SWRL Control Tab



Source: Author's owner

CHAPTER VIII

Evaluation of Ontology

In this Chapter, we will evaluate our ontology design regarding the two types of functional requirements and scheme metrics.

Functional Requirements

We have provided detailed SPARQL queries in chapter six to illustrate that these functional requirements can be supported by the proposed ontology. The table demonstrates that the provided ontology allows searching and browsing from different perspectives. As illustrated in chapter 6, SPARQL queries can be written to search and browse humanitarian projects staff training knowledge based on training subjects, language, level of training, dates and therefore forth.

Table 5: *Functional Requirement Table*

User will be able to Search by	Browsing
Online training subject	Reaction or evaluation of the participant
Languages of the online training	Online training information
Level of the online training	Online training materials .
Trainer of the online training	Staff information (name, position, department, date of joint the organization and ID number ...etc.)
Duration of the online training	Trainer information (Name , ID number ,Years of experience and training teacheretc.).
Date of published the online training	
Reaction or evaluation of the participant	
Oldest online training in the web	
Newest online training in the web	
Result of the pre and post test	
Mandatory online training that should employ receive	

Source: Author's owner

Metadata Completeness

Metadata completeness is a metric that shows for each instance in our ontology how much it is complete. Take all the object properties and data properties that have been a domain for a class and count if the property assertion is applied, higher values refer to higher metadata completeness of the metadata. (Sah, 2011;Ochoa, 2009).

Equation 1:

Metadata Completeness

$$\text{Metadata Completeness} = \frac{\sum \text{Filled Field (Prperties)Value}}{\sum \text{Total Field(Properties)Value per class}}$$

In this section, we will evaluate metadata completeness our ontology instances regarding Table 6 and 7, shows domains of object and data properties. The value 1 is considered if this property value exists.

Table 6: *Domain and metadata completeness value of Object Properties*

Object properties	Class	Value
hasDepartment	User	1
hasTraining	User	1
skos:broader	skos:Concept	1
skos:narrower	skos:Concept	1
Itteachedby	TrainingOnlineSubject	1
Publishedby	TrainingOnlineSubject	1
EvaluateTrainingAS	TrainingOnlineSubject	1
LanguageOfTraining	TrainingOnlineSubject	1
LevelOfTraining	TrainingOnlineSubject	1
hasTrainingSubject	TrainingOnlineSubject	1
IsAssociatedWith	TrainingOnlineSubject	1

Source: Author's Owner

Table 7: *Domain and metadata completeness value Data Properties*

Data Properties	Class	Value
Dateofjoint	User	1
StaffAffiliation	User	1
Email	User	1
Hasexperience	User	1
IDNumber	User	1
hasCertfication	TrainingOnlineSubject	1
Durationoftraining	TrainingOnlineSubject	1
trainingcompleted	TrainingOnlineSubject	1
Trainingcontain	TrainingOnlineSubject	1
trainingdatepublished	TrainingOnlineSubject	1
PostTestResult	TrainingOnlineSubject	1
PreTestResult	TrainingOnlineSubject	1

FahimaRasheed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
HalizAli	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
HawarMostafa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
IdreesAhmed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
IsmailMustafa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
JelanAli	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
KordeenKhairy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
NabasSulaiman	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
WafaIbrahim	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
ZiyadSaleem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1

Source: Author's own

As an illustration, the metadata completeness of online training subjects' class instances is shown in Table 9. Compared to table 8, it is observed that online training subjects are less complete.

Table 9: *Metadata Completeness of Training Online Subjects Instances*

Training online subject	has Cer tification n	Dura tiono frain ning	traini ngco mple ted	Trai ning cont ain	trainin gdatep ublish ed	Post Test Resu lt	Pre Test Res ult	Itte ach edb y	Publ ishe dby	Eval uate Trai ning AS	Lan gua geO fTr aini ng	Lev elOf Trai ning	has Tra inin gSu bje ct	IsA ssoc iat ed Wit h	Value
Account ingPrinc iple	No	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	0.5
ChildRi ghts	No	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	0.5
FSLCon sept	No	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	0.5
NGOPo licy	No	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	0.5
Women Right	No	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	0.5
HawarA ccountin gPrincip le	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No	Yes	0.429
AlanChi ldRights	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No	Yes	0.429
JelanFS LConse pt	Yes	No	Yes	No	No	Yes	Yes	No	No	No	No	No	No	Yes	0.357
Bareen NgoPoli cy	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No	Yes	0.429
Fahima Women Rights	Yes	NO	Yes	No	No	Yes	Yes	No	No	No	No	No	No	Yes	0.357

Schema Metrics

It is the methodology that used to evaluate the design of the ontology. (Devi, 2006), (Ajami & Mcheick, 2018) which consist of many types in figure 42 will explain and implement calculation according to our ontology:

Figure 42: *Snapshot from Protégé show ontology metrics*

Metrics	
Axiom	2074
Logical axiom count	1718
Declaration axioms count	356
Class count	42
Object property count	13
Data property count	13
Individual count	288
Annotation Property count	3
SubClassOf	33
ObjectPropertyDomain	15
ObjectPropertyRange	15
FunctionalDataProperty	1
DataPropertyDomain	14
DataPropertyRange	12
ClassAssertion	267
ObjectPropertyAssertion	614
DataPropertyAssertion	743

Source: Author's owner

Attribute Richness (AR): Here we will have the average between the number of attributes and a total number of classes, and as much as the number of attributes increases, it will show the quality and knowledge information in ontology design. Equation 2 shows the relationship, and we implement it according to our ontology.

Equation 2:

Attribute Richness

$$AR = \frac{\text{Number of Attributes of all classes}}{\text{Number of classes}}$$

As demonstrated in figure 42, we have 13 object properties, 13 datatype properties and 42 classes. Therefore, an AR value of $AR = \frac{26}{42}$, $AR = 0.619$. Since our class hierarchy is very detailed comparing to the number of attributes associated to classes, AR value is slightly low.

Inheritance Richness (IR): The value of the IR will measure the level of distribution of the information between classes and relationship assertions. We calculate this by taking the average between the number of inherent relationships over the number of the total classes: (Gangemi et al., 2005)

Equation 3:

Inheritance Richness

$$IR = \frac{\text{Number of inheritance Relationships}}{\text{Number of classes}}$$

As shown in ontology metrics (figure 42), there are 42 Classes and about sub classes 33 into the ontology. Therefore we have an IR value of $IR = \frac{33}{42} = 0.79$, which shows the IR richness of the ontology.

Relationship Richness (RR)

Here we will show the number or percentage of the non-inheritance relationship over the total number of relationships we had as inherent and non-inherent, as shown in equation 4:

Equation 4:

Relationship Richness

$$RR = \frac{\text{Number of non inheritance Relationships}}{\text{Number of inheritance relationships} + \text{Number of non inheritance relationship}}$$

Where, RR formula is re-written as follows since relationships are represented with the object property.

$$RR = \frac{\text{Number of object properties}}{\text{Number subclasses} + \text{Number of object properties}}$$

Then, RR is calculated as $RR = \frac{13}{33+13} = 0.28$. RR This is low since our class sub-hierarchy is comprehensive, and the number of non-inheritance relationships (object properties) is down. However, for our small domain of training, these object properties are enough to represent online training subjects in detail.

Average Population: Here, we will have an average between the number of the individual over the total number of classes s shown in the equation 5:

Equation 5:

Average Population

$$AP = \frac{\text{Number of Individuals}}{\text{Number of classes}}$$

For the proposed ontology $AP = \frac{288}{42} = 6.86$ that illustrates a good number of class instance population.

Axiom Class Ratio: This metric describes the ratio between axioms and classes. It is calculated as the average amount of axioms per class.

Equation 6:

Average Population

$$\text{Axiom Class Ratio} = \frac{\text{Axioms}}{\text{Number of Classes}}$$

For the proposed ontology $\text{Axiom Class Ratio} = \frac{2074}{42} = 49.38$ that shows the richness of the axioms compared to the total number of classes.

Class Richness (CR): Finds the average of the number classes without instances (individual) over the total number of the classes as shown Equation 7. Lower values of CR shows richer classes:

Equation 7:

Class Richness

$$CR = \frac{\text{Number of class without Instance}}{\text{Number of class}}$$

CR value is calculated as, $CR = \frac{2}{42} = 0.048$ that shows the richness of the classes. In

Table 10, summary of the metrics are provided.

Table 9: *Summary of the Scheme Metrics Values*

Schema metric	Value
Attribute Richness	0.619
Relationship Richness	0.28
Inheritance Richness	0.79
Average Population	6.86
Class Richness	0.048
Axiom Class Ratio	49.38

Source: Author's owner

Cohesion Metric

Cohesion metric measures the degree of the strangeness of the relation of the classes. High cohesion means higher quality and strong relations between OWL classes and object properties. Traditionally it has been used to refer to the degree of relatedness in object-oriented design (Chidamber & Kemerer, 1994).

NoR Class: Stand for the Number of root classes according to the tree-based relationship. In our ontology, root classes mean the main classes. (without counting the subclasses).

Equation 8:

NoR Class

$$\text{NoR} = \sum \text{Main classes}$$

In our ontology, NoR=9 which is the number of root classes. These root classes are Answers, Languages, Level, skos:concept, Test, TrainingEvaluation, TrainingMaterials, TrainingOnlineSubject And User.

NoL class: Stand for Number of Leaf classes according to the tree based relationship. Leaf classes in the ontology mean the all sub-classes plus classes without sub-classes:

Equation 9:

NoL class

$$\text{NoL} = \sum \text{Subclasses of classes} + \sum \text{Classes Without subclasses}$$

NoL for our ontology is 39 that includes the following classes as shown in Figure 8: Staff, Trainer, Administration, PdfFile, PowerpointFile, AccountingPrinciple, ChildRight, CommunicatioSkills, DataProtection, EmergencyWASHResponse, FinanceOverview, FSLConsept, GenderEquality, ITSecurity, NGOInducation, NGOPolicy, OverViewAboutFleetManagement, OverViewAboutFormalEducation, OverViewAboutNonFormalEducation, OverViewAboutSupplyChain, PersonalSaftyAndProtection, ProcessSaftyManagemnet, QualityReportWriting, StaffWelbing, StateofFSLInTheRegion, SustainableLivelihoodApproaches, UseOfMicrosoftOffice, WASHContextInHumantrian, WASHThroughSchool, WomenRight, Video, Webpage, WordDocument, Answers, Languages, Level, skos:concept, Test, TrainingEvaluation, TrainingMaterials, TrainingOnlineSubject And User.

ADIT-LN : Stands for Average Depth of Inheritance Tree of Leaf Nodes (Yao et al., 2005) which is the average between the number of subclasses over classes with subclasses as shown in the equation 10:

Equation 10:

ADIT-LN

$$\text{ADIT-LN} = \frac{\sum \text{Number of Subclasses}}{\sum \text{Number of Classes With subclaess}}$$

For the proposed ontology $\text{ADIT-LN} = \frac{33}{3} = 11$ that shows a good average depth for the class hierarchy.

In the table 10, cohesion metrics are summarized.

Table 10: *Summary of Cohesion Metrics Values*

Cohesion metric	Value
NoR	9
NoL	39
LADIT-LN	11

Source: Author's Owner

CHAPTER IX

Conclusions and Future Work

In this thesis, we develop a novel humanitarian staff training ontology to assist humanitarian organizations to manage online training activities for each employee. Also take a part of show information and activities of online training subject and trainers. Details of the ontology design is outlined, SPARQL queries are developed t is possible to find staff members who are appropriate for a given humanitarian activity. Additionally, we use a Semantic Web Rule Language which been stand from (SWRL) rules to deduce information about trainers' and staffs' training activities. Finally, the quality of the created metadata is evaluated using ontology metrics. In this way, we can assist humanitarian organizations to manage online trainings of large number of staff in different locations.

In future, a user friendly user interface will be developed. Thus, non-expert humanitarian staff can use it to track the progress of their staff trainings with the help of machine process able metadata also plan to evaluate application of this project after usage by number of humanitarian worker to evaluate interim in need to any edit or add.

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Appendix

Appendix 1

RDF/XML code it shared by Google drive, and can be access by this link:

<https://docs.google.com/document/d/13OTg1o0JKWr0OZB9YIVO26fGZH3nMizK/edit?usp=sharing&oid=111486192882551173413&rtpof=true&sd=true>

Appendix 2**Ethical Approval Document**

Date: 12/1/2023

To the **Graduate School of Applied Sciences**

The research project titled “STAFF TRAINING ONTOLOGY FOR HUMANTRIAN ORGANIZATIONS” has been evaluated. Since the researcher(s) will not collect primary data from humans, animals, plants or earth, this project does not need to go through the ethics committee.

Title: Prof Dr**Name Surname: Melike Şah Direkoğlu****Signature:****Role in the Research Project: Supervisor**

Appendix 3

Similarity Report

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Regards,

Prof Dr Melike Şah Direkoğlu.