AMEH OJONUFEDO IBRAHIM
THE USE OF SEMANTIC WEB TECHNOLOGIES TO IMPROVE SEARCH STRUCTURE OF NEAR EAST UNIVERSITY INFORMATION SYSTEMS ENGINEERING WEBSITE
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A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By
AMEH OJONUFEDO IBRAHIM

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Systems Engineering

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Approval of Director of Graduate School of Applied Science

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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 materials and results that are not original to this work.

Name, Last name: AMEH OJONUFEDO IBRAHIM
Signature:
Date:

To my parents…

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Once again, may the Lord God be glorified.

ABSTRACT

The vision of the Semantic Web to propel the hyperlinked information disseminated on the Internet has gotten an overwhelming amount of thought by the semantic web scholars. The essential believed according to the scholars is to transform the present and normal web pages that we use on day to day basis into a Computer process-able data by including semantic metadata that depict resources and relations among them.

However, all the free and available information on the Internet simply has static content materials giving significance in a few settings, and these records can't be utilized adequately by various systems. Semantic Web approach will essentially change the adequacy of the Internet and will empower the reuse of data. It will be possible to merge data from various areas and process them together.

In this research work, ideas, such as representing knowledge with a Semantic Web language, reasoning, ontology processing, and querying on ontologies have been implemented to realize a Semantic Web application.

For the domain, a Web-based application system dealing with university as a domain has been selected. All the data have been moved into a database created using OWL Ontology called University Ontology. This University Ontology controls all the information and the structure of the created application.

In the Semantic search system application, it is possible for the user to construct questions and search for information about their courses, lecturers etc. The application is equipped for reacting genuinely regardless of how the questions are being constructed.

Keywords: Semantic web; search; ontology; ontology management; web interface.

ÖZET

Semantik Web'in internette aktarılan bilginin yayılmasını sağlayan vizyonu, semantik web araştırmacıları tarafından ezici bir miktarda düşünceye kavuşmuştur. Akademisyenlere göre en önemli olanı, günümüzde kullandığımız mevcut ve normal web sayfalarını, kaynakları ve bunların aralarındaki ilişkileri betimleyen semantik meta verileri içerecek şekilde Bilgisayar işlemine ait verilere dönüştürmektir.

Bununla birlikte, internetteki tüm ücretsiz ve mevcut bilgiler, birkaç ortamda önem kazanan statik içerik materyallerine sahiptir ve bu kayıtlar çeşitli sistemler tarafından yeterince kullanılamaz. Semantik Web yaklaşımı esas olarak İnternet'in yeterliliğini değiştirecek ve verilerin yeniden kullanımını güçlendirecektir. Verileri çeşitli alanlardan birleştirmek ve bunları birlikte işlemek mümkün olacak.

Bu araştırma çalışmasında, Anlamsal bir Web uygulaması olan Semantik Arama Sistemi'nin gerçekleştirilmesi için Semantik bir Web dili ile bilgi temsili, akıl yürütme, ontoloji işleme ve ontolojileri sorgulama gibi fikirler uygulanmıştır.

Alan için, üniversite ile bir alan olarak uğraşan Web tabanlı bir uygulama sistemi seçilmiştir. Tüm veriler, Üniversite Ontolojisi adı verilen OWL Ontology kullanılarak oluşturulan bir veritabanına taşındı. Bu Üniversite Ontolojisi, yaratılan uygulamanın tüm bilgilerini ve yapısını kontrol eder.

Semantik arama sistemi uygulamasında, kullanıcıların soruları ve dersleri, konuşmacıları vb. Hakkında bilgi aramaları mümkündür. Uygulama, soruların nasıl oluşturulduğuna bakılmaksızın gerçekten tepki vermek için hazırlanmıştır.

***Anahtar Kelimeler*:** Anlamsal ağ; arama; ontoloji; ontoloji yönetimi; web arayüzü

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LIST OF ABBREVIATIONS

OWL	Ontology Web Language
PHP	Hypertext Preprocessor
RAP	(RDF API for PHP)
RDF	Resource Description Framework
RDFS	Resource Description Framework Schema
SPARQL	SPARQL Protocol and RDF Query Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
WWW	World Wide Web
W3C	World Wide Web Consortium
XSD	Xml Schema Definition
XML	eXtensible Markup Language

CHAPTER 1
INTRODUCTION

At present, practically everything in our everyday life has an association with the Web in one way or the other. The World Wide Web has ended up being a champion among the most vital sectors, for example; e-business, entertainment, education, communication, and information sharing. By simply taking a glance at the diverse fields and sectors required in the Web it is not hard to state that the Web is not only a cutting edge method for accomplishing something, but rather it's a system that certainly won't simply decay in any circumstance but develops day by day.

Despite the fact that the Web is changing our method for living, it is likewise adjusting inside itself. Another stage is required where information on the World Wide Web (web) is given very much important meaning, in which it helps empowering individuals and Computers to work in collaboration i.e in partnership. As of now, the vast majority of the information introduced on the World Wide Web (web) can be comprehended by people but cannot by Computers system. The Web contains billions of records, which largely cannot be utilized successfully by various frameworks. Nevertheless, displaying the information in a very much arranged and organized way utilizing semantic tools will empower Computer system to process information at the semantic level, unlike the large portion of the present system that undergoes processing of information just at the syntax level.

"The Semantic Web" is another method for representing information empowering it to be characterized and exhibited at the semantic level, better empowering Computer system to process this information (Parsia, and Patel-Schneider, 2004). A conceivable acknowledgment of the previously mentioned process, if not by any means the only one, is to utilize Semantic Web technologies empowering the semantic meaning of the information. The Semantic Web is a system or work of information associated such that it is effortlessly executable by machines, on a vast scale all around. We can likewise characterize it just like a capable method for indicating information on the World Wide Web or as an overall associated information base. The present Web is the gathering of records and Computer are stating around these records. The end clients or users look for

records by posing the questions from web crawlers or googles. The computer understands the HTML code literally word by word by reading single words and shows the results regarding to it. However, it cannot understand the meaning behind those documents which the users parsing around. Let take a simple example of a phrase “I Love Photography”. The search engines understand it as a combination of words. However, if we change the syntax of the words then the computer does not really understand, e.g., the language is changed to Chinese or Norwegian “Jeg elsker fotografering”. In semantic Web, technology the computer will understand the meaning behind the phrases that the user likes to know about photography and the equipment of photography and all the things related to photography. The semantics are always the same regardless of change in syntax e.g., “I love Photography” is same as “I ♥ Photography”. The World Wide Web was proposed by Tim Berners Lee around three decades back it was imagined as a medium for human correspondence as well as for machine correspondence. The second 50% of that expectation is up until now hidden, with the disappointing outcome that immense measures of information accessible to the human enquirer cannot essentially be broken down and consolidated by machines. In modern era people have less time about the common things like appointment with the doctor, the time and place of appointment and booking of appointment. These are the kind of stuff which machine can perform for humans.

Tim Berners Lee when at the first come up with the idea of Web 2.0 his vision was not only for human-human communications but also for machine interaction. The contents on Web currently are majorly for humans. Let us take an example there is vast amount of information on the Web about, Weather, Airline schedule, Sports Stats, TV and Movies Guidelines. This information is easily available on the Web and can be seen but it is very difficult to use these contents or make it customizable on our own Website or any other application. To explain it better let us take the case of online calendars; it is very easy to see data but very difficult to pull out information and utilize it on other Websites or any portable device. Though Google has done a lot more work on that task to create an API with the help of which one can easily pull out information and utilize it anywhere. That is because of the use of OWL, RDF, SPARQL and many other new languages (Lee, 2004). With the help of these new languages, the concept of Web is changed and it is all in the new dimensions of search contents. The Semantic Web is a new idea and research going on

currently and the purpose behind this idea is to introduce artificial intelligence to the Web where:

1. Searches are not based on just the phrase match but the meaning behind those searches.
2. Automated reasoning by machines is possible.
3. Automated mash-up of information from different website are made available.
4. More intelligent search of information is possible.

Tim Berners Lee has divided the semantic Web into layers, which are

1. Unicode and URI layer.
2. XML, XML schema layer, and RDF layer.
3. RDFS ontology.
4. Sparql Query
5. Logic
6. Proof
7. Trust
8. User Interface

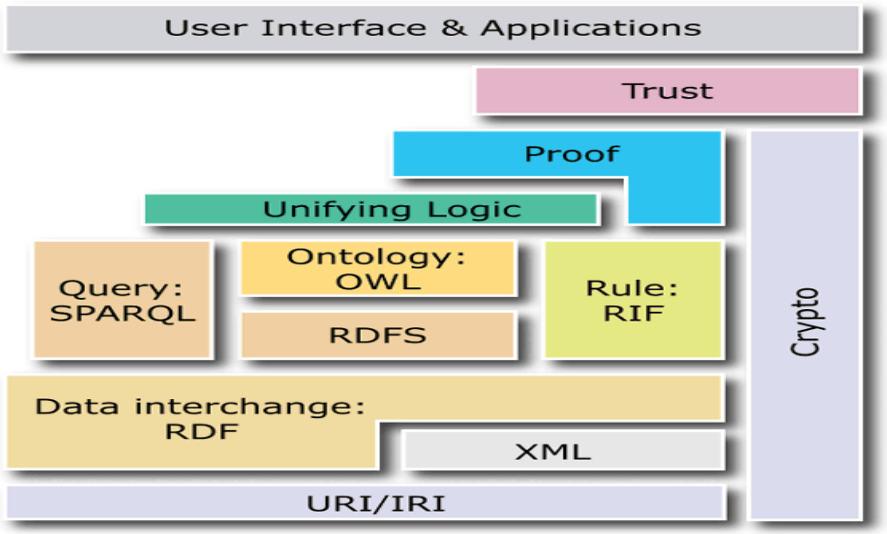

Figure 1.1: Semantic Layer

In this thesis work, knowledge representation with RDF, ontology, SPARQL and user interface concepts have been studied, and have been connected effectively in the created application.

1.1 Motivation

The motivation behind this research work is to investigate the potential favorable circumstances of Semantic Web in the design of Near East University Information Systems Engineering Website and to show how diverse innovations can be joined to make applications in light of ontologies.

1.2 Problem Statement

Considering the vast benefits that are experienced in the use of Semantic Web in building search system, Near East University Information Systems Engineering Website still experiences some flaws in the effective and efficient use of its search system. This research work is being conducted to investigate and research the Semantic Web concept, using it to improve search structure of Near East University Information Systems Engineering Website.

1.3 The Aim of the Study

The fundamental reason for this research work is to examine and inquire about the Semantic Web idea and get a strong comprehension of the ideas together with its challenges, issues and the capacity to be utilized as a part of genuine applications.

1.4 Specific Objectives of the Study

Some specific objectives of the study are as follows:

1. To improve search structure of Near East University Information Systems Engineering Website.
2. To gather and process different information located at different systems or places (such as Near East University Information Systems Engineering Website) on a single system such as (OWL ontology).
3. To execute queries on information gathered on OWL ontologies.

1.5 Scope and Limitation

The concentration of this research work is to explore and investigate the Semantic Web idea, using it to improve search structure of Near East University Information Systems Engineering Website. Due to time limit of the project this Research Work gives answer for

developing of ontology in the field of educational domain i.e. Near East University Information Systems Engineering only.

1.6 Importance of the Study

The result of this study is expected to provide a platform in which Near East University Information Systems engineering old and new students will be able to search for information regarding their courses and lecturers. In this study, the imperative parts of Semantic Web will be actualized to represent the knowledge domain.

The interface of the created system will make it possible for the users to communicate with the ontology processing part in a friendly and reasonable manner. With the help of the system, students can construct questions and look for information regarding their courses and lecturers just as they normally do in ordinary Web pages when searching for information. Users don't need to build SPARQL queries and also don't need to have prior knowledge of RDF, rather the handling unit of the server changes the constructed questions into SPARQL queries so as not to allow the students the pain of stressing over how precisely the data is being extricated, but present the obtained RDF data in humanly friendly format.

1.7 Overview of the Study

This research work is partitioned into chapters, each of which handles particular areas of the Semantic Web idea and the application executed.

Chapter one presents the Introduction and background of the study, then, in chapter two, the historical context of the semantic Web, the languages and tools of the Semantic Web and the domain area of the Semantic Web are shown. Chapter three deals with semantic portals and ontology. In the Fourth Chapter, the Domain of the System, the System Design and the Specifications have been clarified and exposed. Chapter five shows the Research Methodology and the Created Application examining System Interface and Structure thoroughly, Chapter six presents the user studies, data presentation, analysis and discussion. Lastly, the Conclusion, which is shown in Chapter seven.

CHAPTER 2
LITERATURE REVIEW (SEMANTIC WEB)

Internet has clearly improved the friendliness of digitally accessible data. Today, the Internet right now has more than three billion static reports and these reports are being accessed and used by more than 1 billion internet users all over the globe (Berners-Lee, 2001; Daconta, 2003). Hence, with this gigantic measure of information and since the information is introduced fundamentally in a characteristic form, it turned out to be progressively hard to discover, get to, present, and keep up applicable data. In this manner, a wide loophole has been left opened between the information kept in human understandable format and that readily available for machines.

In response to this issue, numerous innovative research activities have been created to advance accessible data with device handle capable semantics. An example of a current research going on is the **Semantic Web**. Sir Timothy John Berners-Lee (Berners-Lee, 2001) anticipates various routes in which engineers can utilize self-portrayals and different procedures so that setting understanding projects can specifically discover what clients need. Lee alluded to the eventual fate of the present World Wide Web (web) becoming "Semantic Web" i.e. "extended Web of machine-readable information and automated services that amplify the Web far beyond current capabilities". Figuring computers and robotized administrations will enhance in their ability and capacity to help people in accomplishing their objectives by "seeing" a greater amount of the data displayed on the Web, and along these lines giving more exact separating, ordering, and seeking of these data sources accessible on the Web. As Lee outlined (Berners-Lee, 2001); "The first step is putting data on the Web in a form that machines can naturally understand, or converting it to that form".

2.1 Overview of the Semantic Web

We should not see Semantic Web as a different Web (Parsia, 2004; Wang, 2004), But we should see it as an expansion of the present World Wide Web (web) we use in our day to day activities. It should be noted however, that the fundamental distinction between the

two Web is that the Semantic Web “is supposed to provide machine accessible meaning while in the Web this meaning is provided by external mechanisms”.

The Semantic Web is a significant and machine-reasonable Web asset, which data would then be able to be shared and taken care of both by means of robotized instruments, for instance, web search tools, and by individuals. The customers of Web assets, regardless of whether robotized devices or individuals are referred to what we called operators.

2.2 Information Recovery

2.2.1 From device to human

Semantic web technologies can be used on information to enhance data recovery in different methods. Let us look at what Tim Berners Lee said about that. He stated that, search devices "*do the equivalents of going through the library, reading every book, and allowing us to look things up based on the words found in some text*" (BernersLee, 2001). On the off chance that more graphic metadata were accessible, one would not, as when utilizing web indexes; need to depend on the notoriety of the asset as an affirmation of its importance. How might we make certain that frequently got to data against a few questions is significant to each other? We cannot be so sure that such relationships reliably exist.

It should be noted however that Librarians, who regularly go about as human middle people among the intricate relationship of the organized data and the frequently unclear questions of the data searcher realize that data recovery is frequently fragmented notwithstanding when data is organised well. At the point when organized badly, the results are disappointment in recovering data.

2.2.2 From human to machine

Tim Berners Lee (BernersLee, 2001), examined how information-mindful "operators" utilizing semantic data might be utilized to lead inquire about endeavors into regular assignments; for example, exploring human services supplier alternatives, remedy medications, or accessible arrangement times. A human scientist allotted for this undertaking generally directs each of these errands now.

2.3 Semantic Web Tools and Languages

Amid the most recent couple of years, a few ontology languages have been created. These languages depend on eXtensible Markup Language XML syntax. Some of the examples of ontology language created are as follows:

- Resource Description Framework (RDF),
- RDF Schema (RDFS),
- Ontology Exchange Language (XOL),
- Ontology Markup Language (OML),
- Simple HTML Ontology Extension (SHOE).

Semantic Web language, for example, XML, RDF, RDFS, OWL are utilized to compose, incorporate and explore the Web; in the meantime, enabling information reports to be connected and assembled in a consistent and important way. With the data condition that these principles can make, clients can inquiry and peruse data assets in a natural route with the assistance of infomation mindful machines frameworks.

It should be noted however that all the important data assets will be accessible through different sorts of expressive data and explanations, i.e., metadata in the Semantic Web world. Reasonable characterized information about the significance, use, availability or nature of Web assets will extensively encourage computerized handling of all the accessible Web data. The Semantic Web has the ability to empower the two party involves (i.e machines and human) to ask the Web questions. For idea like this to be acknowledged, other than the Web language, diverse instruments additionally must be produced with a specific end goal to deduce data from the Web. Deduction does rely on upon the language as well as on the diverse instruments that are as of now being created around the language. They are:

2.3.1 Extensible Markup Language (XML)

XML, which is abbreviated as eXtensible mark-up language is a machine language utilized for archives like HTML and so on. XML is as of now an extremely famous and successful method for trading data between PCs. XML language adjust to a very much-characterized

punctuation that is good with numerous parsers, which are broadly accessible. XML gives a capable answer for the grammar issue for information sharing. XML comprises of labels, which the client can make and utilize it for structure of the program and it is unique in relation to HTML labels.

XML can identify the type of documents, elements, attributes of those elements and the connection or relationship of those elements and documents. XML and HTML have quite a lot of differences. HTML is purely used to display or design the Web pages. The function of HTML is different from XML. HTML cannot save data while XML is used to store data in the document. Therefore, XML has no concern over the design and layout of Web content (data is separated from presentation markup).

XML can also be used as a good communication tool. If there are group of users using same tags in an application to express data, then these users can robustly communicate thus due to that, reason XML is known as easier platform of exchanging information between entities.

W3C is also known as World Wide Web consortium is the platform, which has been working to promote standards in technology for decades. With the help of XML the user can create self-created new tags, new elements in no time. Most of the browsers now a day's support XML.

```
<?xml version="1.0"?>
<Gift>
<to>Joshua</to>
<from>Peter</from>
<wordings>Happy Birthday to you!</wordings>
<body>Have a nice day</body>
</Gift>
```

Figure 2.1: Sample xml document

Toward the beginning of the line, there is statement of the XML and its form. It is important to incorporate that part in the XML code. The primary commitment of XML is giving a typical and transferable language structure for Web archives.

2.3.2 RDF (Resource Description Framework)

RDF is a very important system in semantic world. This system is important because whatever is left of in the the semantic world depends on. According to Wikipedia the free encylopedia, “The Resource Description Framework (RDF) is a family of World Wide Web Consortium (W3C) specifications originally designed as a metadata data model. It has come to be used as a general method for conceptual description or modeling of information that is implemented in web resources, using a variety of syntax notations and data serialization formats. It is also used in knowledge management applications”. RDF information can be serialized into various format, for example, RDF/XML, turtle, n-triple, JSON, and so forth. The RDF data model comprises of three sorts of data:

2.3.2.1 Resources

Resources are anything being depicted by RDF articulations. Some examples of a resource are as follows:

- A whole online report e.g. "http://www.w3.org/Overview.html",
- A piece of page on the net,
- A huge accumulation of records on the net. E.g. the whole website.

2.3.2.2 Properties

A property is a particular viewpoint, trademark, trait, or connection used to define a resource. An RDF property allows us to define or describe a recource. i.e the characteristics of individual of a class.

2.3.2.3 Statements

A statement in semantic web can be seen as a combination of a Resource, a Property, and a Property value. (A statement consists of the subject, predicate and objects).

How about we take a glimpse at some case of explanations to understand it better.
Example of a Statement: "The author of https://www.amehthesiswork.com/rdf is Ameh Ojonufedo Ibrahim".
Here the subject of the statement above is: https://www.amehthesiswork.com/rdf, the predicate is: The author and the object is Ameh Ojonufedo Ibrahim.

2.3.3 RDFS (RDF Schema)

RDFS is the composition language for RDF. RDF Schema expands RDF by presenting an arrangement of recognized resources into the language. This is identified with the route in which a conventional programming language can be reached out by characterizing new language characterized catchphrases.

2.3.4 OIL (Ontology Inference Layer)

According to free wikipedia, “OIL (Ontology Inference Layer or Ontology Interchange Language) can be regarded as an ontology infrastructure for the Semantic Web. OIL is based on concepts developed in Description Logic (DL) and frame-based systems and is compatible with RDFS. Dieter Fensel, Frank van Harmelen (Vrije Universiteit, Amsterdam), developed OIL and Ian Horrocks (University of Manchester) as part of the IST OntoKnowledge project. Much of the work in OIL was subsequently incorporated into DAML+OIL and the Web Ontology Language (OWL)”.

2.3.5 OWL (Web ontology language)

Ontology depicts the ideas in the domain and furthermore the connections that hold between those ideas. There are a few meanings of ontology each and everyone vary from each other. Another definition can be “ontology being a formal explicit description of concepts in a domain of discourse”. At the point when ontology is as one with the cases, it makes information base. OWL is the latest advancement in standard ontology languages created by the W3C Web Ontology Working Group (WebOnt).

This Ontology language gives three progressively expressive sublanguages intended for various clients in particular groups. They are:

- OWL lite

- OWL DL
- OWL full

2.3.6 Components of ontology

The following below are common components of ontologies:

- **Relationships:** Ways in which classes and individuals can identify with each other.
- **Individuals**: Instances.

  Axioms: Declarations in a consistent form.
- **Classes**: Kinds of things.
- **Attributes**: Characteristics that class can have.
- **Rules:** Sentences that represent the logical inferences that can be extracted from an attestation in a specific way.

CHAPTER 3
SEMANTIC PORTALS AND ONTOLOGY

A Web portal can be define as a website particularly designed to bring data from different sources, similar to search engines, emails, and forums together in a consistent manner. Typically, every data source gets its committed zone on the page for showing data; regularly, the client can design which ones to show. Variations of portals incorporate mashups and intranet "dashboards" for administrators and directors. The degree to which information content is shown in a "uniform manner" may primarily depend on the end users and the planned reason, and in addition the assorted variety of the information (Sah, June 2009).

3.1 Semantic Portal

“Semantic portal” indicates to sort out sites that contain accumulations of semantically organized data. Ontologies are utilized for organizing, getting to, sharing and the introduction of information. In this sense, web-based interfaces that are executed utilizing semantic web advances are known as semantic Portals. Service portals, Information portals or Community portals are types of web portals.

The goal of semantic portal is to comprehend the data sharing issues of web-based interfaces utilizing machine-processable metadata as well as their relationship. Furthermore, a semantic portal tries to enhance data access by utilizing semantic web tools (Sah, June 2009).

3.2 Semantic Portals State of Art

The following below are some semantic portals state of art:

3.2.1 SEAL

The SEAL structure was introduced to manage community websites and web portals. It is also used for giving and accepting data on a portal. The data in the portal is created by utilizing RDF ENGINES. “The primary elements of seal are semantics search, navigational

views, and semantic personalization. Its contents can be exhibited as HTML for people and RDF for operators (Sah, June 2009)".

3.2.2 OntoWeb

This is a dissemination tool for the EU-funded thematic network Onto Web. "The main roles of the portal are content delivery, perusing and inquiry. Onto Web is a Java applet combined with a customize web server which enables clients to peruse and alter information models over the web. Onto Web is currently accessible as an open service. Onto Web has been produced at the Knowledge Media Institute, at the Open University as a major aspect of a few European researches extends in the late 90s. It is fundamentally a Java based customer application associated with a particular Web server approaching ontologies developed with OCML (Sah, June 2009)".

3.2.3 MuseumFinland

This is a semantic Portal for Finnish Museum. It is an application of the semantic web portal generator ONTOVIEWS. "Its main features are a combined keyword and multi-facet search, and recommendation links (links generated using rules) (Sah, June 2009)".

3.2.4 SEMPort

This sematic portal is a portal in which contents editing are done through RDF file aggregator web interface, protégé. "Its search system is an ontology-based search that uses Jena API and Jena reasoner for navigation and search (Sah, June 2009)".

3.2.5 Proposed Semantic Search

This sematic portal is a portal in which contents editing are done through RDF file aggregator web interface, protégé. Its search system is an ontology-based search and uses RAP (RDF API for PHP) as its model and HermiT reasoners for navigation and search.

Table 3.1: Showing the Comparison of Different Features of Semantic Portals

S/N		SEAL	OntoWeb	MuseumFinland	SEMport	Proposed Semantic Search
1	**Content Editing**	Using RDF crawler and OntoEdit ontology	Uses web form and do not operate in real time	Uses a semi-automatic tool to convert XML data to RDF, protégé	Editing is done through RDF file aggregator web interface, protégé. Operate in real time	Editing is done through RDF file, web interface, protégé.
2	**Search**	Ontlogy based. Similar to query	Term based and template based	Combined keywords and multi-faceted search	Ontology based using Jena reasoner	Ontology based using RAP(RDF API for PHP)
3	**Inference**	F-Logic based during search and navigation	Same as SEAL. F-Logic based	SWI-Prolong inference engine for navigation and search	"Uses Jena rule-based reasoners for navigation and search"	Uses RAP and HermiT reasoners for navigation and search

3.3 Ontology

Ontology can be defined as a detail portrayal of specific ideas and the relationship among them in which the ideas are characterized inside a particular domain. The utilization of ontology is dependable with the definition since it is shattered into less difficult arrangements of such relations and idea definitions when handled.

Ontology languages are intended with the end goal of characterized learning, sharing and reusing it adequately. Ontology is an arrangement of things defined and composed utilizing a correct vocabulary. To determine the concept this is the fundamental approach utilized

because it has a few properties empowering AI processing system to share knowledge among them. That is to say, an ontological duty is a sort of an understanding including distinctive domain specifications to utilize a particular vocabulary when defining ideas. An ontology defined for a given domain is the base for the knowledge. Ontology empowers the meaning of a vocabulary i.e its terminology to express the information for some domain. It should be noted however that without given a definition to some vocabulary it is impractical to segment knowledge between various machines/operators.

Fundamentally, ontology can be likened like defining a set of information with every one of its properties so that different programs can utilize this information. Diverse processing system as domain autonomous applications and programming specialists utilize ontologies and knowledge based constructs worked with respect to top of an arrangement of ontologies.

The most approach used when defining a domain name in ontology is Class definitions. It should be noted however that Class definitions are appropriate to characterize and portray the diverse ideas in a given domain name. For instance, a class defining a pizza represents all the diverse pizza individuals that exist. Any pizza is an occurrence of the class defining and portraying a pizza. For instance, the subclasses of the class pizza can be "fiery pizza" and "non-hot pizza" in which the class pizza is a super-class of these two classes.
The following are critical elements of ontology (Lee, 2004):

- Sharing the formal definitions and vocabularies while depicting some idea.
- Capacity to reuse domain language.
- Detachment of operational knowledge and domain knowledge.
- Making domain presumptions unequivocal.

3.4 Uses of Ontologies

The Web Ontology Working Group at W3C identified the following list of major use cases of various ontologies (Lee, 2004).

1. Auto-completion
2. Browsing support.

3. Configuration support.
4. Controlled vocabulary.
5. Consistency checking (use of restrictions).
6. Generalization or specialization of search.
7. Interoperability support (information/process integration).
8. Search support (semantic search).
9. Sense "disambiguation" support.
10. Support for structured, comparative, and customized search.
11. Support validation and verification testing.

3.5 Differences between Ontologies and Relational Databases

Though ontologies and relational database have some resemblances, they vary in many vital features.

- Ontology is a characterizing or defining model for the information and not storage for information while a database is an information storehouse.
- Secondly, ontology can be utilized as a system to control information stored in it while database can be utilized to keep the distinctive information objects defined by ontology.
- Finally, querying of the stored information. When trying to search for information already stored using a relational database the returned information will be similar information stored beforehand. However, when trying to search for information already stored using ontology, together with some reasoning process, the returned information can be some inferred data, which was not stored beforehand but rather created from a few actualities represented by the ontology.

3.6 Building Ontologies

There are different means in which Ontologies can be built; this depends on different creator of Ontology and the domain to be demonstrated. The following is a rundown of the various ontology-building methods.

1. **Obtaining domain knowledge:** This involves gathering all the data assets of a given domain.

2. **Structural arrangement of the ontology:** This involves identifying domains idea and properties as well as their relationships.
3. **Constructing the ontology:** This involves adding ideas, properties, relations and instances to the ontology.
4. **Ontology confirmation:** This involves checking irregularities among the ontology component.

3.7 Ontology Tools

In semantic web, innovative instruments must bolster successful and productive work. Specifically, we require the accompanying components. With a specific end goal to adequately make utilization of the Semantic Web, various tools to have the capacity to utilize all the hidden strenght uncovered by the Semantic Web must bolster the clients.

The following are vital components expected to make Semantic Web proficiently and viably utilized:

- Ontology editors: This helps to effortlessly make and control ontologies.
- Annotation tools: This helps to connect data sources with various organizations.
- Reasoning services: This help to empower propelled query benefits.
- Inference engine: This can be utilized to reason about ontologies and the individuals characterized by those ontologies and to make new knowledge from existing one. Inference engine can be likened to be like SQL (Structured Query Language) query engine. Examples of Inference engine are Ontobroker, Racer, which can be utilized to execute mechanical quality projects, it makes uses of ontologies made with OWL/RDF.

3.8 Ontology Editors

3.8.1 Protégé

According to Wikipedia the free encyclopedia “Protégé is a free, open source ontology editor and a knowledge management system. Protégé provides a graphic user interface to define ontologies. It also includes deductive classifiers to validate that models are consistent and to infer new information based on the analysis of ontology. Protégé

empowers an advancement situation upheld by various outsider modules, directed to the particular wants of a particular knowledge domain. Protégé is also an ontology advancement stage that can without much of a stretch be reached out to incorporate different graphical parts, for example, diagrams and tables, media.

3.8.2 Ontolingua

The Ontolingua system gives clients the capacity to oversee, share and reuse distinctive ontologies put away on a remote ontology server. Ontolingua also gives a circulated synergistic condition to peruse, make, alter, adjust, and utilize ontologies. The system has been created at the Knowledge Systems Laboratory at Stanford University in the mid 90s.

3.8.3 WebODE

WebODE is developed in view of three-level engineering: the application server, the UI, and the database. The principle components of the WebODE knowledge model are ideas, gatherings of ideas, relations, constants and intances of particular definitions.

3.9 Ontology Query Languages

An ontology query can be understood of as a declaration whose outcome to be returned. Nevertheless, by and by a query engine has particular calculations accessible with which to work, and can in this way response to some particular kinds of question. Nevertheless, the executed query engines can have their particular calculations and methods for doing the basic things and can in this way just react to particular query.

This following below are some query languages:

- OWL-QL (OWL Query Language).
- RDQL (RDF data query language).
- RQL (A declarative query language for RDF).

CHAPTER 4
PROPOSED INFORMATION SYSTEMS ENGINEERING WEBSITE USING SEMANTIC WEB TECHNOLOGIES

This chapter exposed and reveals all the Semantic search system application design and specification executed for this research work. Specification with respect to choice of domain, services, and client facilities e.t.c was explained in details in this chapter.

The motivation behind this research work is to investigate the potential favorable circumstances of Semantic Web in the design of Near East University Information Systems Engineering Website and to show how diverse innovations can be joined to make applications in light of ontologies.

4.1 Overview of the System

There are a few advantages of ontology language. The created semantic search system for this research work depends on the utilization of Semantic Web tools and technologies in demonstrating the advantages. The system structure general overview is shown in Figure 4.1 below.

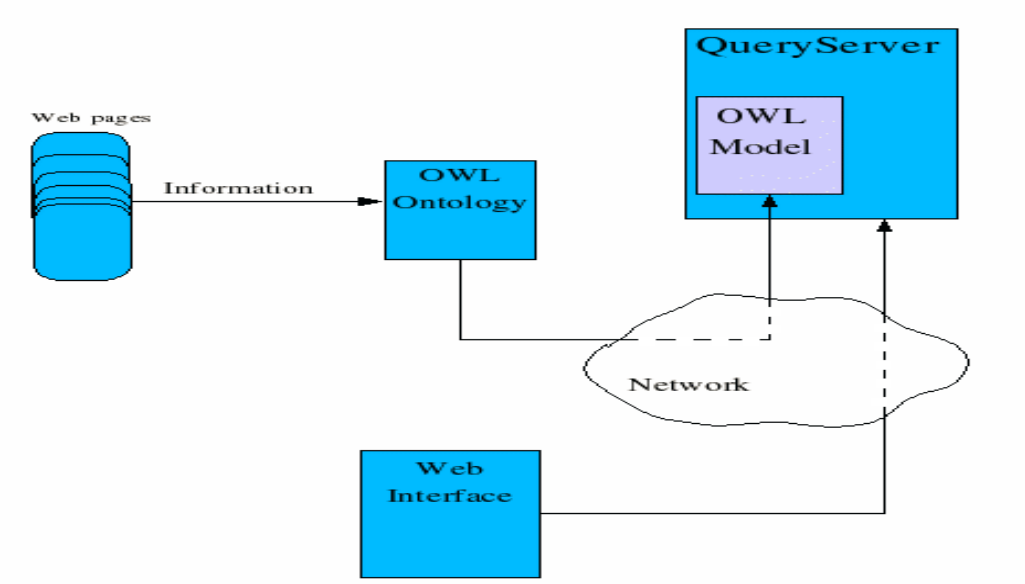

Figure 4.1: The system structure overview

The system is primarily an online interface for getting to querying content stored, in RDF format that is organized utilizing university ontology. The targeted domain is Near East University Information Systems Engineering Department whose data/information has been gathered from its Websites.

The ontology being processed is utilized to recover information for different information about courses and lecturer of the department and whatever other applicable information about the department. All the information displayed at the interface of the system is queried from an RDF file that is made in view of the developed university ontology.

The processing of the university ontology is being done on RAP model. The interface recovers the essential information from this model through a RDF API for PHP (RAP) connection. The Web interface is a different module connecting with RAP model just to acknowledge client information and show the information retrieved from the model.

As usefulness, the web interface gives a natural and simple to utilize interface enabling clients to peruse through the system and giving search capabilities so the clients can without much of a stretch find what they are searching for in view of a specific specification.

4.2 System Specifications

4.2.1 System domain

The targeted domain is Near East University Information Systems Engineering Department whose information/data has been gathered from its Websites. This was done by first creating university ontology and after that utilizing protégé ontology editor to populate the ontology by hand from information system engineering department website.

4.2.2 Storage and representation of information

The University, which serves as the domain of the system, is represented with ontology. Every information identified with Near East University Information Systems Engineering Department including properties, classifications and relationships are all stored in the university ontology file. This was done by using protégé.

4.2.3 Ontology language

OWL ontology is the ontology language utilized in creating the University ontology, this is because of it being presently the most capable and reliable ontology language compared to other ontology developing language.

4.2.4 Ontology processing

The processing of ontology is being performed on RAP (RDF API for PHP) model to make communication with the end user. The model is being gotten to through SPARQL queries and then sends results back as RDF.

4.2.5 Web interface

According to Wikipedia, Interface "is a set of commands or menus through which a user communicates with a program" It helps to handle the visual presentation of the system and gives route through the various menu of the system. It gives a simple to utilize search interface enabling the clients to write queries with various criteria.

4.2.6 Application development platform

The interface is executed utilizing the broadly utilized server side scripting language called PHP. According to Wikipedia, PHP "is a general-purpose scripting language that is especially suited to server-side web development which can be installed and run on any Web server".

4.3 System Design

The Search system application built for this research work is made up of three main parts; the University ontology, the RAP (RDF API for PHP) model and the interface. The university ontology created is the main data asset utilized for the application. All data are kept in the university ontology file constructed.

According to Open Source projects by the Web-based Systems Group, RAP "is a software package for parsing, querying, manipulating, serializing and serving RDF models", It allows quick access to University Ontology file by using the internal indexing and query optimization capabilities of the database.

In the wake of accessing the university ontology, the RAP (RDF API for PHP) model will be prepared to acknowledge demands from the system interface.

The interface is a PHP language that helps in the client interaction with the RAP model. The interface does not manage any information, but only involves in sending requests to the RAP model and showing the answers or feedback in an HTML formatted page. Interface is in charge of receiving client information, making demand information and transmitting the accepted information or message to the RAP model.

4.4 The University Ontology

For representing information about Information Systems Engineering Website, an OWL ontology called University Ontology is created. The developed ontology contains the following parts:

1. Classes and class hierarchy.
2. Object properties.
3. Data properties.
4. Individuals.

4.4.1 Classes and class hierarchy

The classes and class hierarchy of the university ontology is presented in the Figure 4.2. The number of classes may not be as much as compared to existing educational knowledge based ontologies. This is because the construction of ontology depends on the developer, and that is how much the developer wants to extend. The classes in this project are shown in Figure below.

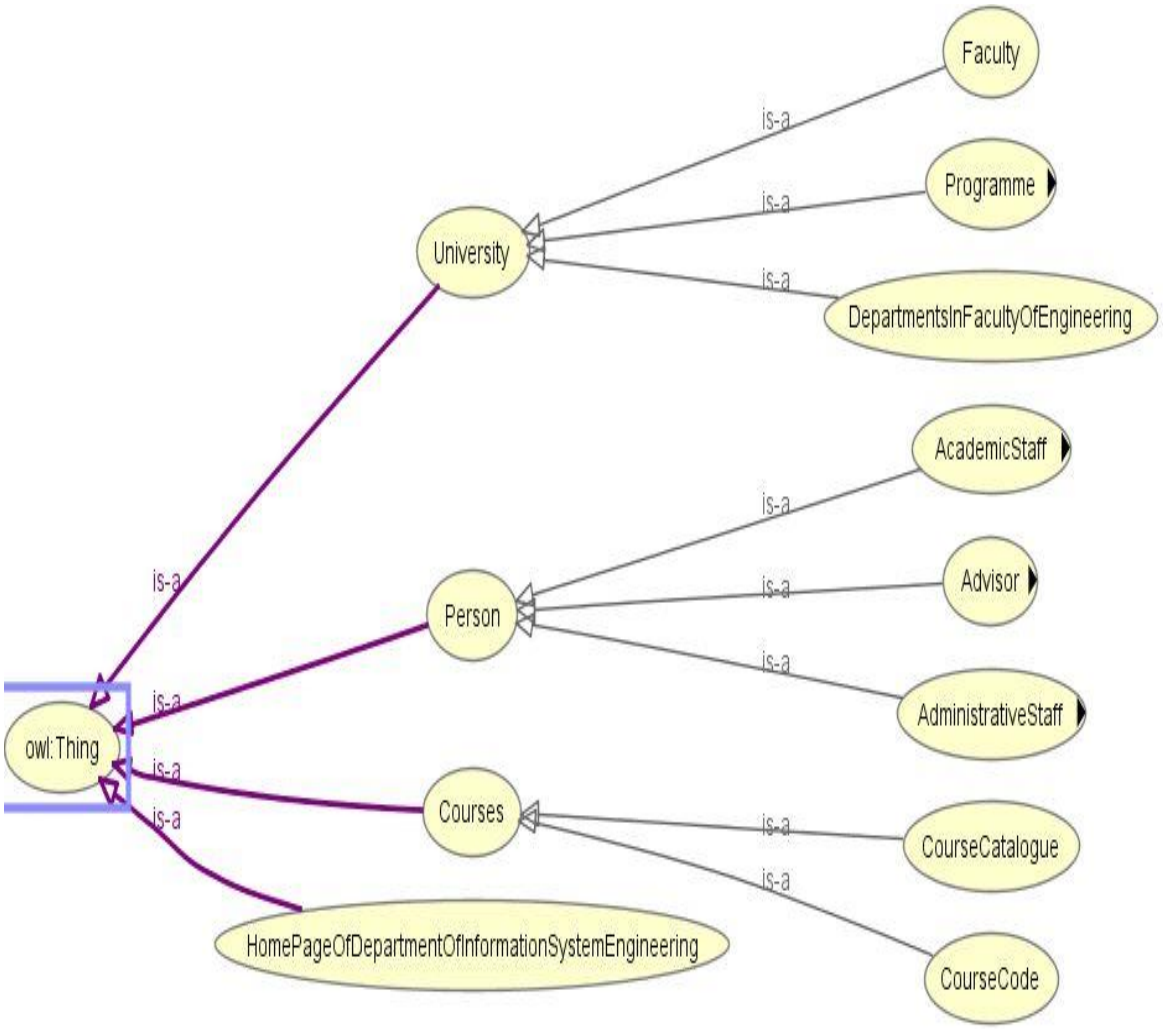

Figure 4.2: OWLViz representation of the university ontology class hierarchy using protégé

4.4.2 Object properties of ontology

Object properties links two individuals with each other. The object properties have their range and domain. In the University ontology, there are several object properties used as shown in figure 4.3. Some of them are inverse of each other. The object properties, which are used in this project, are mentioned in the figure 4.3 below. The screen shot of the usage of some of the various object properties are shown below.

Figure 4.3: Object properties of the university ontology

4.4.3 Data type properties

In ontology data type properties plays a vital role. Object properties are utilized for relationship between two classes i.e they link two individuals together while data type properties are used to save some data value, for example adding the property NameCourse, NameCode, Email address, etc. In this project there are several data type properties used which are shown in the figure 4.4 below.

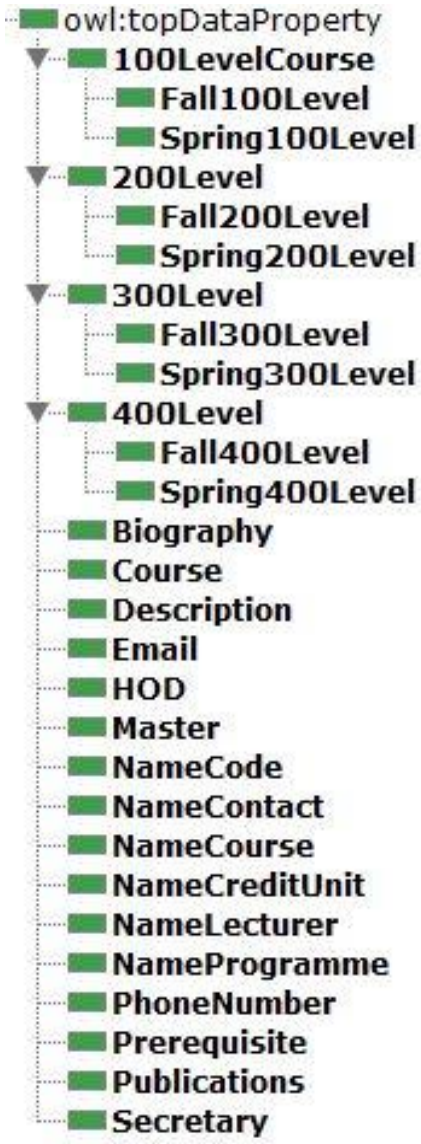

Figure 4.4: List of data type properties of the university ontology

4.4.4 Individuals

Individuals are manually added using the protege ontology editor. Instances of course and lecturer class are shown below in figure 4.5 and 4.6 respectively. In the course of creating the instances, it should be noted however that it was time consuming. Instance creation needs expert knowledge in semantic web.

In future, we will either integrate instance generation into webpage creation interface or screen scrappers. This can be created to take RDF data from Information Systems Engineering Website automatically.

Figure 4.5: Instances of course

Figure 4.6: Instances of lecturer

CHAPTER 5
IMPLEMENTATION AND RESEARCH METHODOLOGY

This chapter portrays the usage of the system, research design and methods employed in the collection of data for the study. In particular, it examines the usage, OWL ontology, RAP (RDF API for PHP) and Web interface, research design, sampling procedure and size, research instruments validity and reliability of the research work instruments, population of study, data analysis, and data gatherings.

5.1 Implementation

The semantic search system comprises of three (3) parts; University ontology, RAP (RDF API for PHP) model and System interface; executed with different technologies. According to Wikipedia the free encyclopedia, RAP "is a software package for parsing, querying, manipulating, serializing and serving RDF models", It allows quick access to University Ontology file by using the internal indexing and query optimization capabilities of the database.

In the wake of accessing the university ontology, the RAP (RDF API for PHP) model will be prepared to acknowledge demands from the system interface. The RAP (RDF API for PHP) model load the created university ontology given and makes an inward model with the goal that it can be handled. It gives an interface enabling systems to unite and communicate together. The RAP (RDF API for PHP) model processes the constructed user's questions, makes vital queries on the loaded university ontology model and returns the proper answer back to the user's framework through a comparable system interface. For this sittuation, the user framework is the System interface. The user interface gives usefulness to send information inform of request to the RAP (RDF API for PHP) model and to show the outcomes in a human friendly manner. A client or user may construct a question keeping in mind the end goal to search for a few courses or may click to view some list listed under a menu part, and so on. The type of the information (requests) sent to the RAP (RDF API for PHP) model relies on upon such unique functionalities given by the semantic search system interface.

The university ontology portrayed in the past section has been made by making utilization of the Protégé ontology editor with the help of HermiT reasoner to check the consistency of the ontology during the creation process.

5.2 RAP (RDF API for PHP) Model

As mentioned above, according to wikipedia "RAP is a software package for parsing, querying, manipulating, serializing and serving RDF model. It is a semantic Web toolkit for PHP developers. It started, at the Freie Universität Berlin in 2002, as an open source project and has been extended with internal and external code". RAP allows quick access to Ontology file by using the internal indexing and query optimization capabilities of a database.

The primary process of the RAP model is to listens to incoming requests, creates a reaction and then sends it back to the user.

RAP (RDF API for PHP) Model reacts diversely for various sorts of requests made by the user process. A basic convention permits the correct communication between the customer (end user) and RAP model.

5.3 System Interface

The System interface is a PHP application that shows information to the end users in HTML format. It makes utilization of a system interface relying upon the associations when communicating with the RAP model. The clients (end users) ask diverse questions and then sent to RAP model before processing the answers in an unexpected way. At whatever point the client explores through the diverse menu, the Web interface makes legitimate request to the RAP model to fill the page with the correct information content requested by the client. The Semantic search Interface has a search pane. In this search pane, the end user can specifically enter the courses, lecturers and so forth.

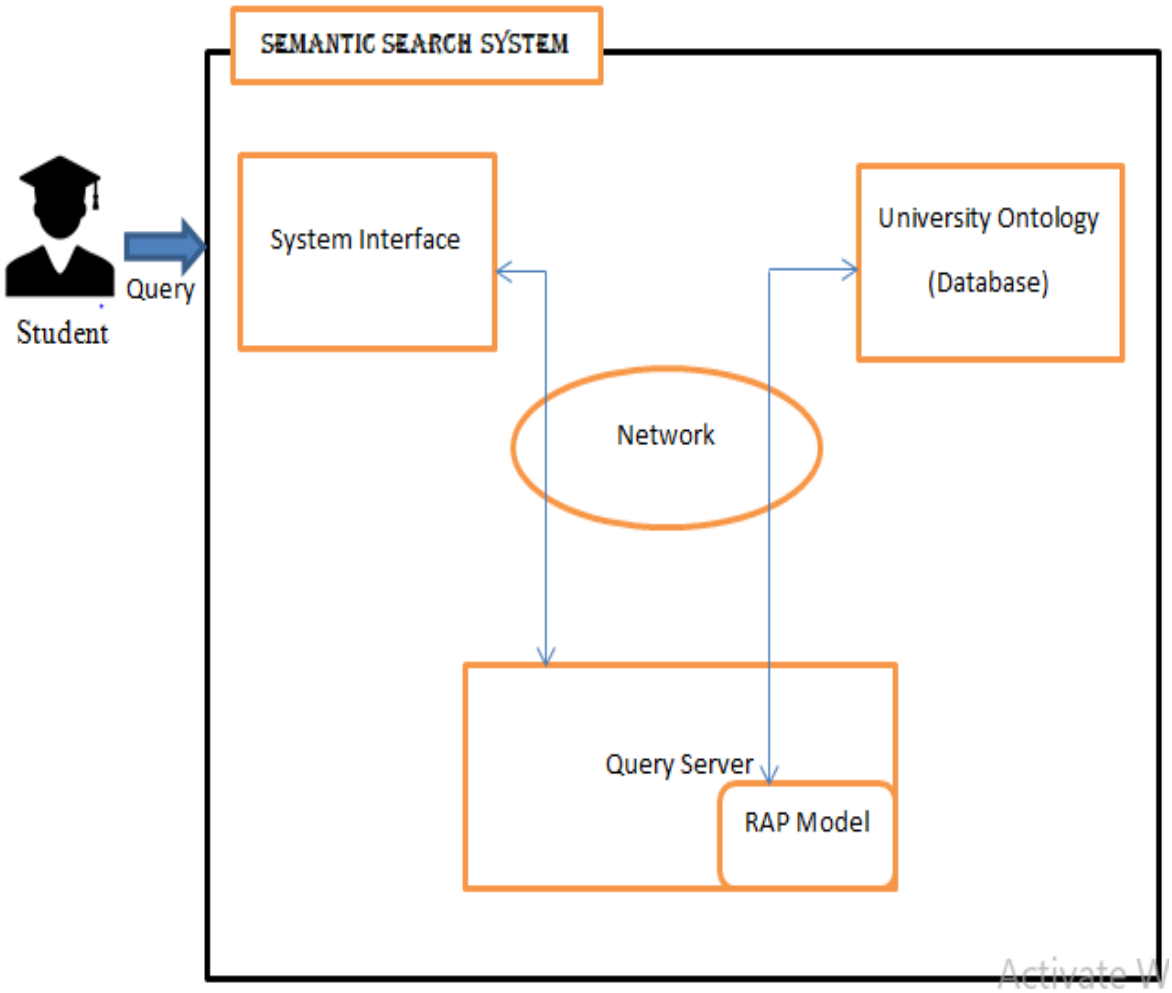

Figure 5.1: System architecture

5.3.1 Screen shot of the home page

Below figure is the screen shot of the system Home page. This is used to aid navigation to other pages through the provided menu.

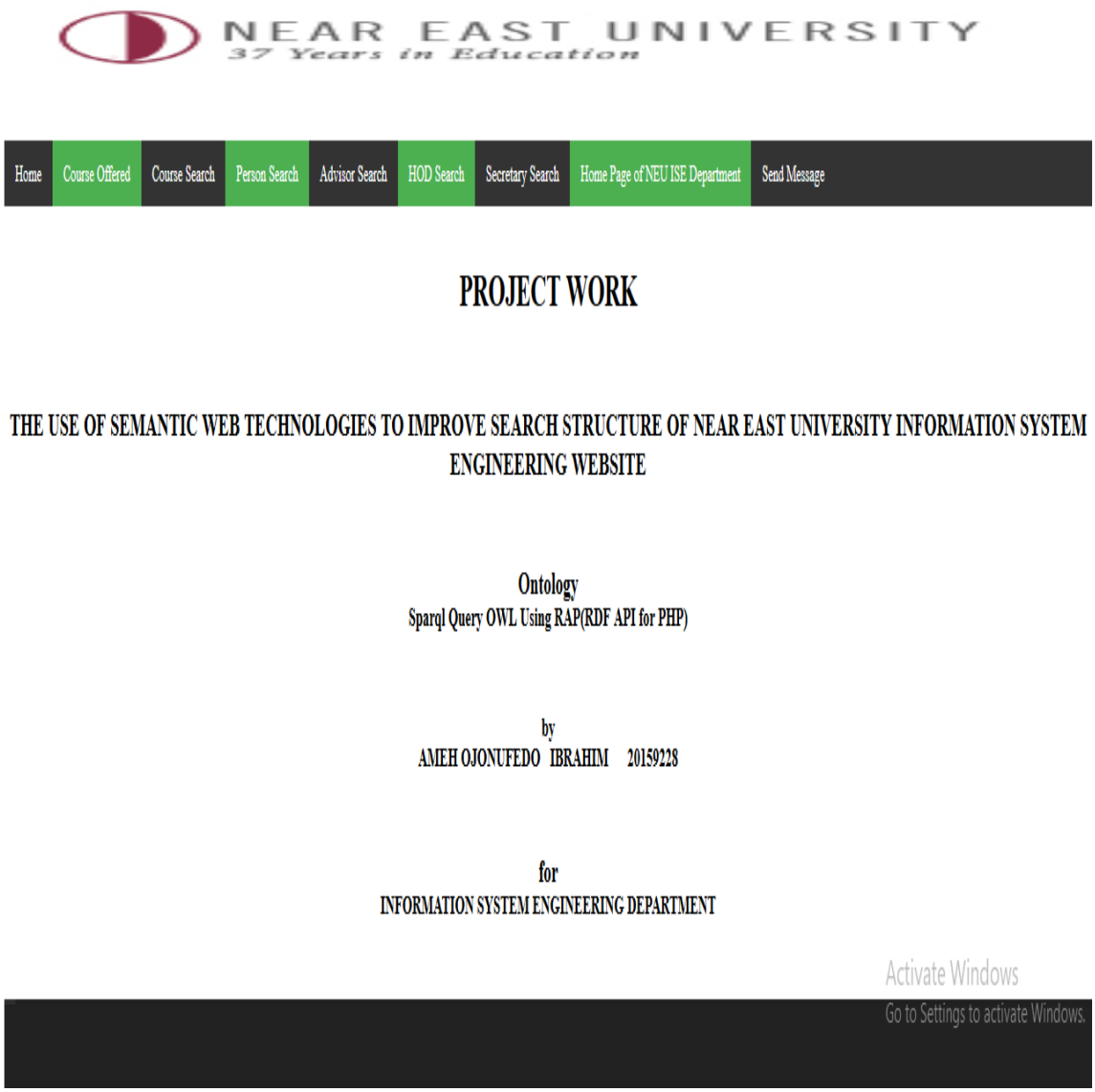

Figure 5.1: Screen shot of the home page

5.3.2 Course offered page screen shot

Here the user can select any class category by navigating through the home page of the system and then clicking on the menu “course offered” for example first year fall semester and know the courses he or she will be offering for that semester.

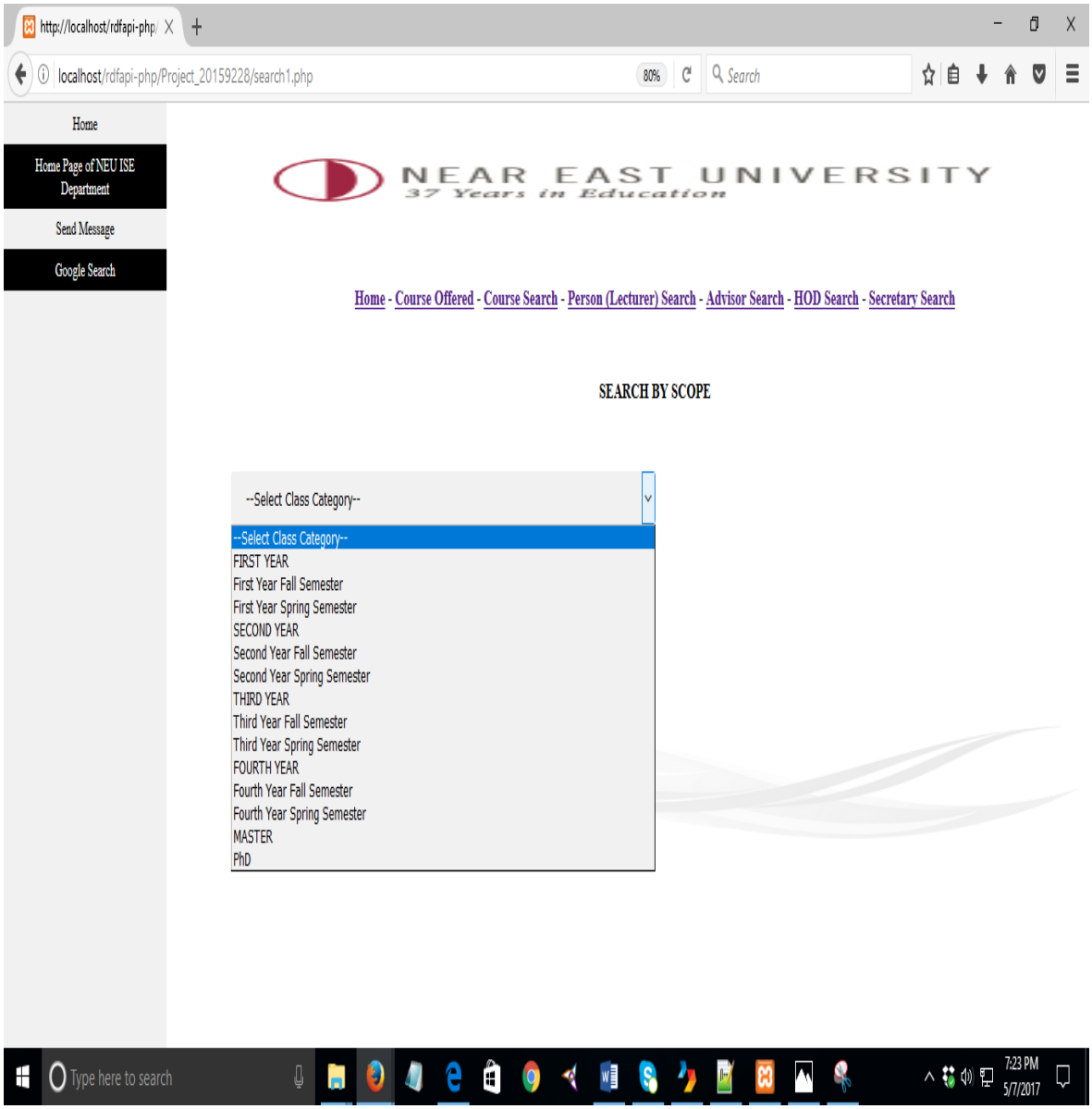

Figure 5.2: Course offered page screen shot

5.3.3 Screen shot for course search page

Here the user is expected to type in any course he or she is willing to find information about. This can be done by navigating through the home page of the system and then clicking on the menu “course search”. When the page opens, the user is expected to follow the instruction on the search pane by entering the course name they want to find.

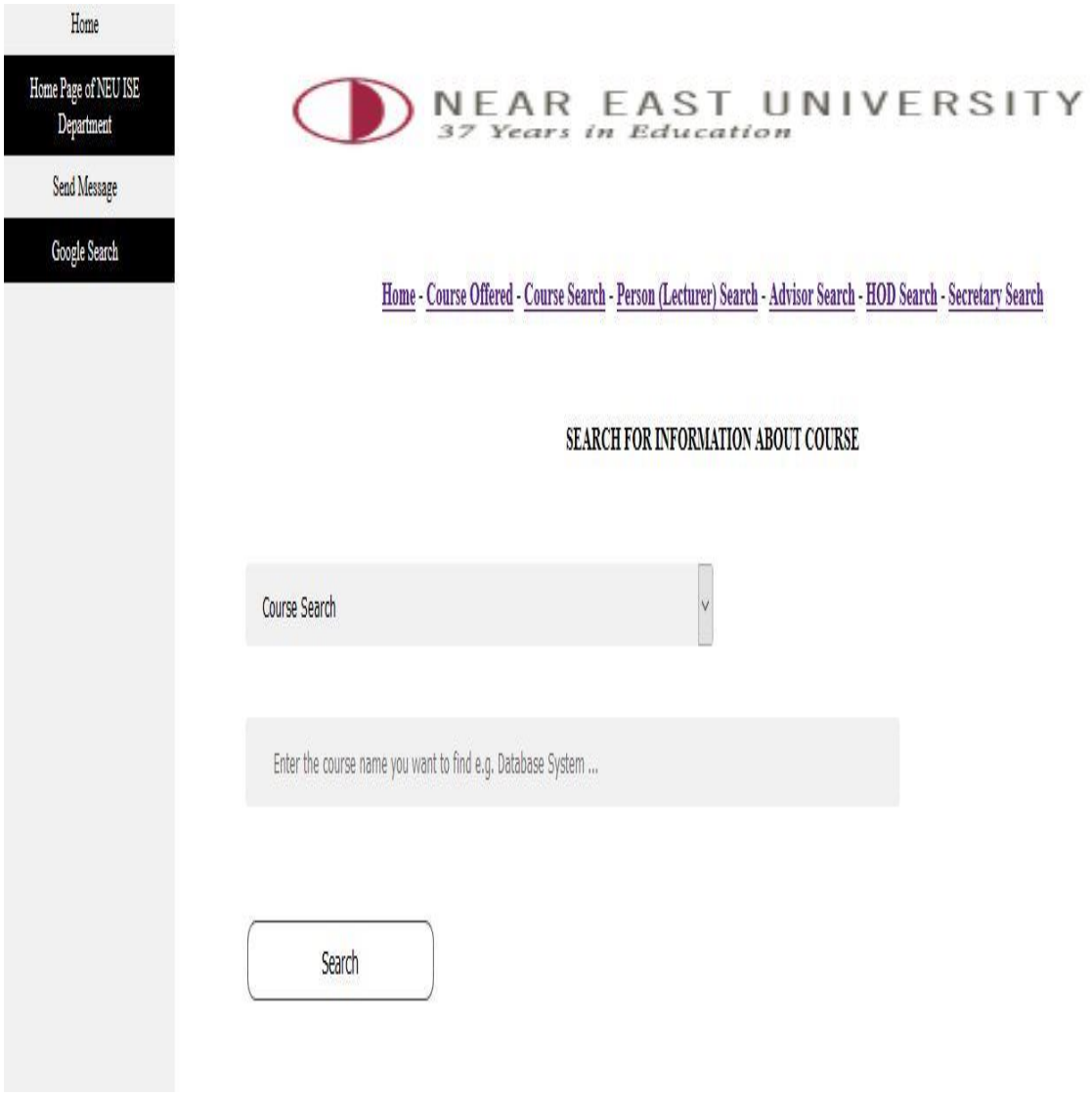

Figure 5.3: Course search page screen shot

5.3.4 Screen shot for person search page

Here the user is expected to type in any person's name e.g lecturer's name, advisor's name, secretary's name e.t.c he or she is willing to find information about. This can also be done by navigating through the home page of the system and then clicking on the menu "person search". When the page opens, the user is expected to follow the instruction on the search pane by entering the person's name they want to find.

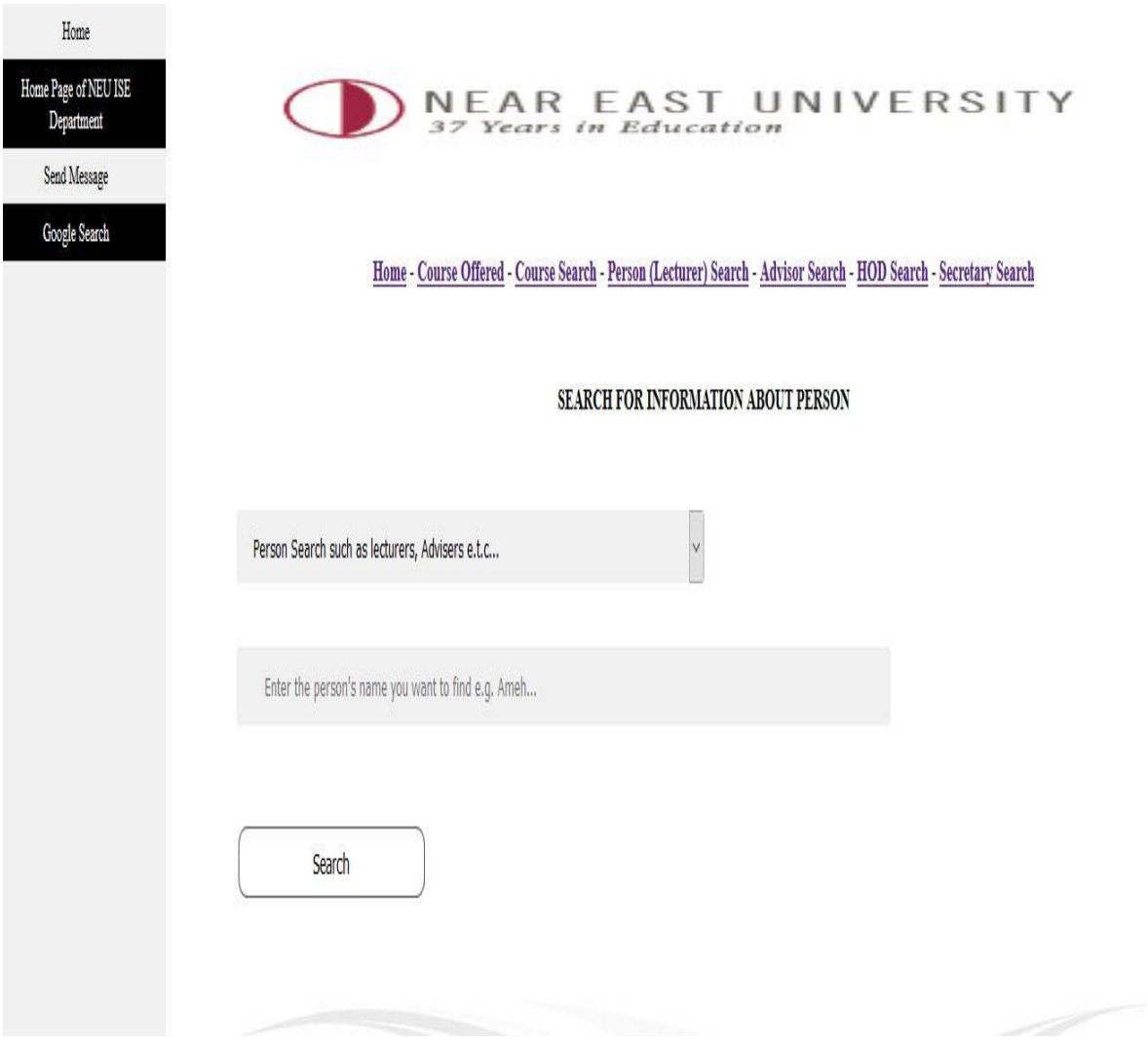

Figure 5.4: Screen shot for person search page

5.3.5 Screen shots for sample search

The following figure below shows some examples of how the search system of the reseach work works.

5.3.5.1 Search for second year spring semester courses:

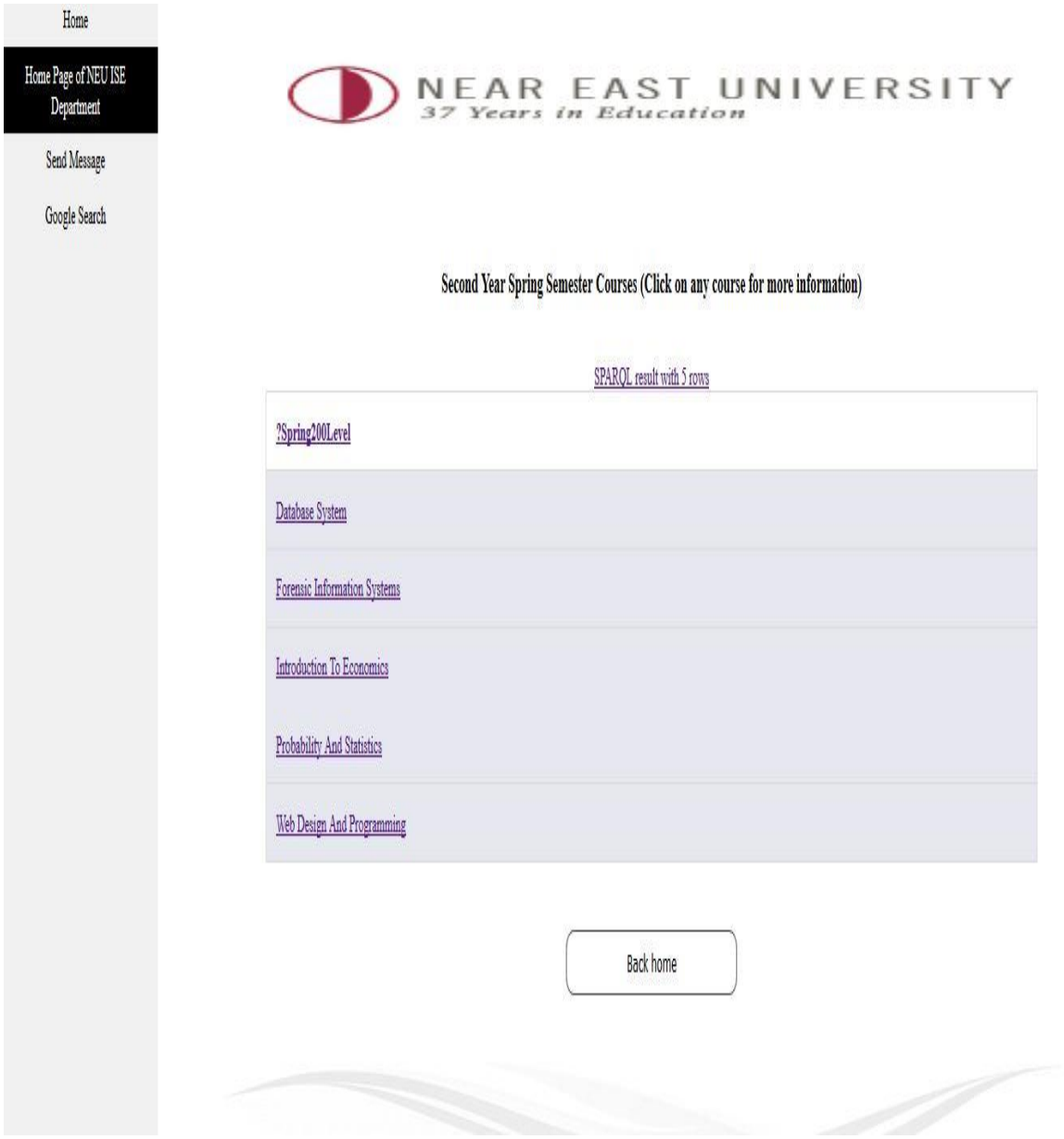

Figure 5.5: Screen shot for Search for second year spring semester courses

Sparql Code for Search for Second Year Spring Semester Courses

```
{               $x='

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

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

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

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

                PREFIX m: <http://www.semanticweb.org/kingameh/thesis#>

                SELECT ?Spring200Level

    WHERE {

                    ?x m:Spring200Level ?Spring200Level.

                }

                ';

                echo "<h3>Second Year Spring Semester Courses (Click on any course
                for more information)</h3><br>";

                // Create a new MemModel

                $ameh = $model->sparqlQuery($x,'HTML');

                ?>

                <a href="course.php"><?php echo $ameh; ?></a>

                <?php

  }
```

Figure 5.6: Sparql code for search for second year spring semester courses

5.3.5.2 Search to find more information such as the code, unit, and lecturer e.t.c about the course semantic Web

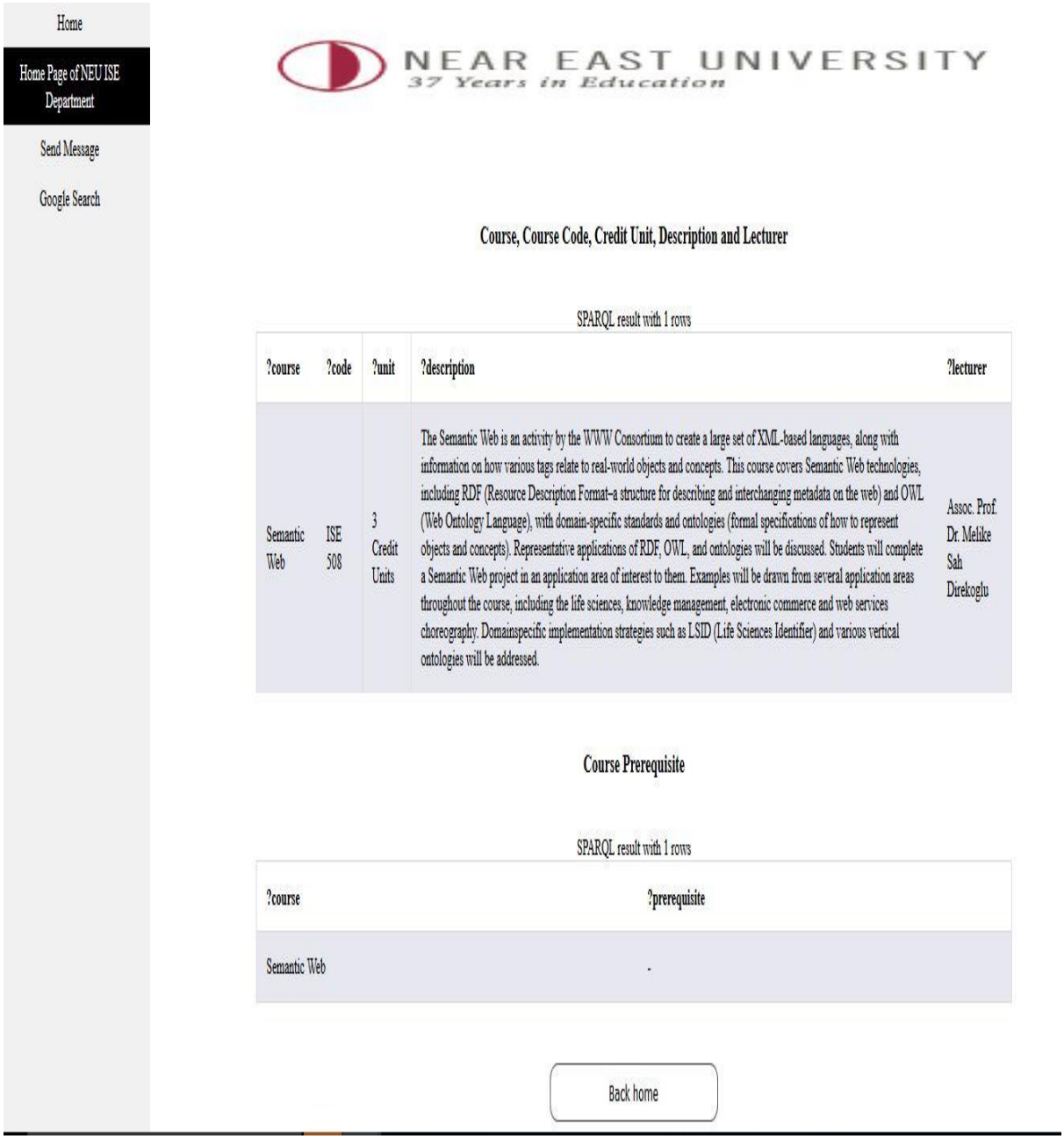

Figure 5.7: Search to find more information such as the code, unit, and lecturer e.t.c about the course semantic web

Sparql Code for Search to find more information such as the code, unit, and lecturer e.t.c about the course semantic Web

```
{
                    $x='
                    PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
                    PREFIX owl: <http://www.w3.org/2002/07/owl#>
                    PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
                    PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
                    PREFIX m: <http://www.semanticweb.org/kingameh/thesis#>
                    SELECT ?course ?code ?unit ?description ?lecturer
    WHERE {
                    ?x m:HasCourseCode ?y.
                    ?x m:HasCreditUnit ?z.
                    ?x m:HasDescription ?a.
                   ?x m:HasLecturer ?b.
                    ?x m:NameCourse ?course.
                     ?y m:NameCode ?code.
                     ?z m:NameCreditUnit ?unit.
                      ?a m:Description ?description.
                      ?b m:NameLecturer ?lecturer.
                    FILTER regex(str(?course),"'.$_POST["sparql"]."',"i")
                    }';
                    echo "<h3>Course, Course Code, Credit Unit, Description and Lecturer</h3><br>";
                    // Create a new MemModel
                    echo $model->sparqlQuery($x,'HTML');
```

Figure 5.8: Sparql Code for Search to find more information such as the code, unit, and lecturer e.t.c about the course semantic web

5.3.5.3 Search to find more information such as phone number, email, e.t.c about Assoc. Prof. Dr. Melike Sah Direkoglu

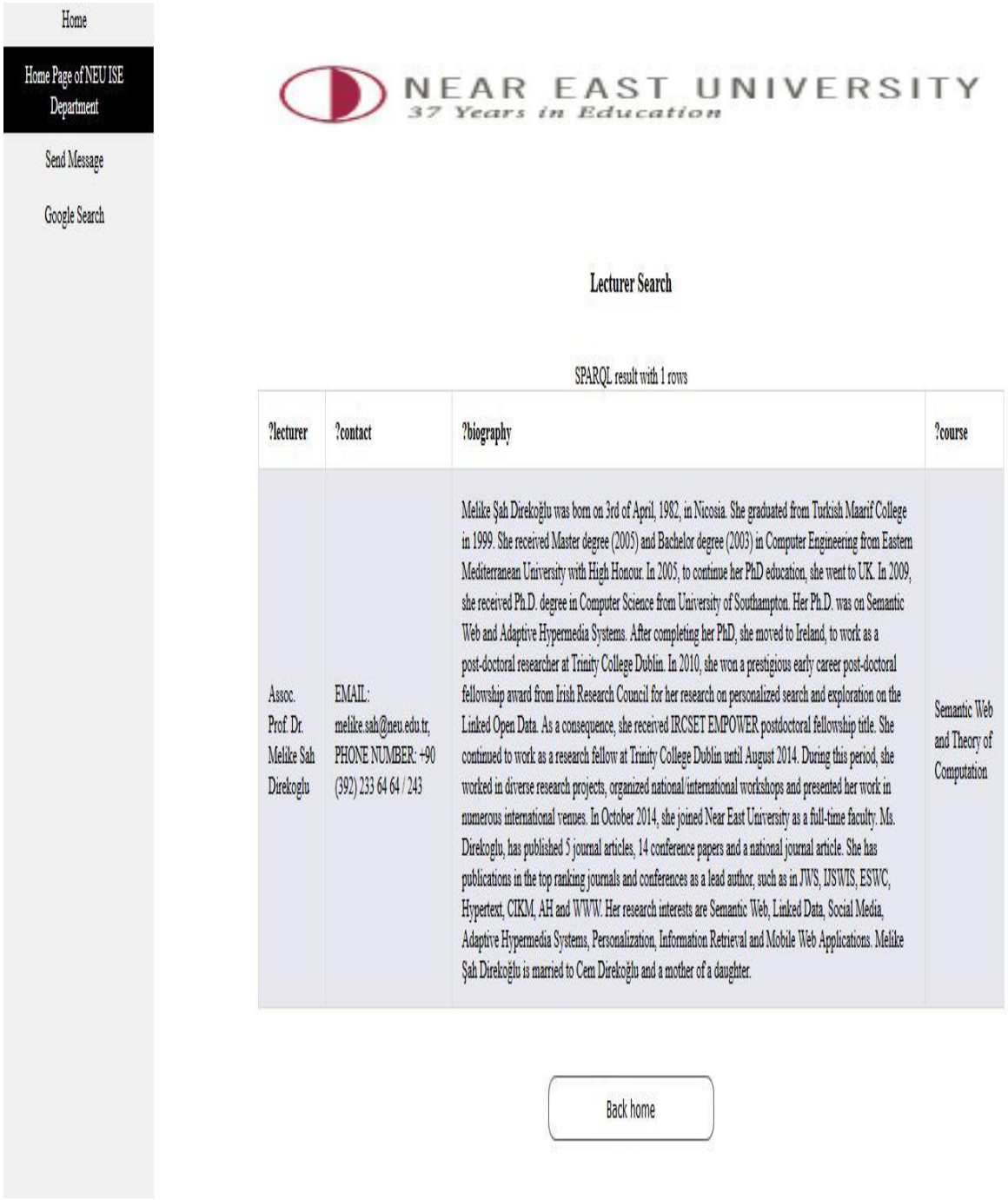

Figure 5.9: Search to find more information such as phone number, email, e.t.c about Assoc. Prof. Dr. Melike Sah Direkoglu

Sparql Code for Search to find more information such as phone number, email, e.t.c about Assoc. Prof. Dr. Melike Sah Direkoglu

```
{
        $x='
        PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
        PREFIX owl: <http://www.w3.org/2002/07/owl#>
        PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
        PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
        PREFIX m: <http://www.semanticweb.org/kingameh/thesis#>
        SELECT ?lecturer ?contact ?biography ?course
    WHERE {
            ?x m:HasEmail ?y.
            ?x m:HasBiography ?z.
            ?x m:TeachesCourse ?a.
            ?x m:NameLecturer ?lecturer.
            ?y m:NameContact ?contact.
            ?z m:Biography ?biography.
            ?a m:Course ?course.
        FILTER regex(str(?lecturer),"'.$_POST["sparql"].'","i")
        }';
        echo "<h3>Lecturer Search</h3><br>";
        // Create a new MemModel
        echo $model->sparqlQuery($x,'HTML'); }
```

Figure 5.10: Sparql code for Search to find more information such as phone number, email, e.t.c about Assoc. Prof. Dr. Melike Sah Direkoglu

5.4 Research Design

Choosing survey as the research design for this research work was needed by the nature of the study. This research is a questionnaire research that collects data from individuals from the selected populace with the guide of Questionnaire in order to evaluate the semantic search system being built. It permits only a sample population to be utilized to represent the whole population.

5.5 Population of Study

The objective population for this research work is the students of Near East University Information Systems engineering department. The population entailed mainly the students of Near East University Information Systems engineering department. This is because they are the end user to the built proposed semantic search system.

5.6 Sampling Procedure and Sample Size

Simple random sampling technique was the sampling procedure used for this research work; this was used to select the number of respondents. The population formed the basis for the sample. Thus, this consists of only the students of Near East University Information Systems engineering department and a sample size of 20 students.

5.7 Research Instruments

The major instrument that was utilized for this research work is survey questionnaire, which was outlined and constructed by the researcher. The decision of this instrument was incited by its dependability and legitimacy of the appropriate responses. This is so in light of the fact that the interaction between the researcher and the respondents, which could bias the reactions to the questions in the questionnaire, is petty.

5.8 Validity of the Instrument

Remembering the true objective to guarantee the validity of the instrument for the study, the researcher constructed the questionnaire and was edited and reconstructed by his supervisor.

5.9 Method of Data Collection

Information for the study was gathered through the utilization of questionnaire constructed. The survey questionnaire was given to the respondents by the researcher by meeting, the students involved.

5.10 Method of Data Analysis

The method of data analysis used was the descriptive statistical technique comprised of tables, average and percentage. This was used in investigating the information gathered and furthermore demonstrating the respondent's reaction rate and their reactions to questions.

The formula below is used:

$$\frac{SDx1 + Dx2 + Fx3 + SAx4 + Ax5}{\text{Sample size number}}$$

Figure 5.11: Formula for data analysis

5.11 Recoding of Item Responses

5-point Likert scale questionnaires were used. "SD = strongly disagree, D = disagree, F = fair, SA = strongly agree, A = agree"

NB: If the average score is below 2.5 it shows that the users Disagreed and if above 2.5 shows that they agreed.

CHAPTER 6
USER STUDIES, EVALUATIONS, ANALYSIS AND DISCUSSIONS

The focus of this research work is on *"the use of semantic Web technologies to improve search structure of Near East University Information Systems Engineering Website"*. In this chapter user studies were evaluated, data collected were analyzed, interpreted and discussed.

6.1 User Studies

The following user study was performed to evaluate the semantic search system. They are:

1. The capability to help end-users in finishing the tasks and
2. The ease of use (i.e. user satisfaction).

6.1.1 Hypothesis

In this research work user's studies, the purpose is to experiment the listed hypothesis (Intelligent guess) below:

6.1.1.1 Task assistance

Task assistance is the capability of the system to help a client's look for data. Specifically, how viable and effective is the search-system in searching for information. The following are hypothesis for task assistance (Task completion time, and page view count was used to test these guess):

- Semantic search system better help students seek for information than Near East University Information Systems Engineering Website search system.
- Semantic search system helps students' to be more efficient when completing any giving task.
- Semantic search system helps students' to be more effective for task completion than Near East University Information Systems Engineering Website search system.

6.1.1.2 Client Approval

This can be seen as an apparent ease of use of different roles given by the Semantic search system. The presumption is that clients see the Semantic search system being more helpful in finishing the tasks given to them than Near East University Information Systems Engineering Website search system. The following are hypothesis about the user satisfaction:

- Students are more satisfied with Semantic search system than Near East University Information Systems Engineering Website search system. Questionnaires are used to test this.
- Semantic search system outperforms Near East University Information Systems Engineering Website search system in usability. To assess this hypothesis Post-Questionnaire and usability questionnaires were used.
- Users find Semantic search system to be more motivating and engaging than Near East University Information Systems Engineering Website search system. Questionnaires are used to test this.

6.1.2 Experimental setup

The evaluation of the system is based on task-based information. Task completion time was followed from the very first displays of the questions right till when users submit their answers. The following below shows the order of the experiment.

First and foremost, students were told to fill a form about their background and experiences in the use of the everyday normal Web search such as google search, yahoo search e.t.c.

6.1.2.1 Experiment with first system called system A

The two systems (Semantic search system or Near East University Information Systems Engineering Website search system) were presented to the students randomly so as to balance the effect of bias. Firstly, we show the students some sample of how the search system A (Near East University Information Systems Engineering Website search system)

works. An example query was given to them before finally giving them the real semantic search system task. At that point, the students played out the given search task using the first System called system A and were made a request to pen down the appropriate responses. After filling the form about their search background and experiences, students were given the following to fill:

- A post-survey questionnaire.
- A usability questionnaire.

6.1.2.2 Experiment with second system called system B

Secondly, we also show the students some sample of how the search system B (Semantic search system) works. In addition, an example query was given to them before finally giving them the real semantic search system task. At that point, the students played out the given search task using the Second System called system B and were made a request to pen down the appropriate responses. After filling the form about their search background and experiences, students were given the following to fill:

- A post-survey questionnaire.
- A usability questionnaire.

6.2 Presentation and Analysis of Data According to Responses to the Research Questionnaire

6.2.1 About your search experiences and background

This deals with the search experiences and background of the respondents.

Table 6.1: Study Degree Programme of Respondents

S/N	Programme	No of Respondents	Percentage %
1	Undergraduate	12	60.0
2	Master	8	40.0
	Total	20	100

In view of the response of the respondents in Table 6.1, it was reveal that 12(60.0%) of the respondents are undergraduate students and 8(40.0%) are master students.

Table 6.2: How often do you use Information Systems Engineering Website to search for information (i.e. course information, lecturer information, etc.)?

S/N	Period	No of Respondents	Percentage %
1	"Frequent times in a year"	18	90.0
2	"Frequent times in a month"	2	10.0
3	"Frequent times in a week"	-	-
4	"Frequent times in a day"	-	-
	Total	20	100

Table 6.2 revealed the the students search background and experience. 90.0% of the respondents said they use Information Systems Engineering Website to search for information "frequent times in a year" to seek for information while 10.0% of the respondents said they use Information Systems Engineering Website to search for information "frequent times in a month" to seek for information on the website. This implies that Near East University Information Systems Engineering Website search system is not being used often to search for information.

Table 6.3: How often do you use Web search engines (crawlers) to gather information?

S/N	Period	No of Respondents	Percentage %
1	"Frequent times in a year"	-	-
2	"Frequent times in a month"	1	5.0
3	"Frequent times in a week"	2	10.0
4	"Frequent times in a day"	17	85.0
	Total	20	100

Table 6.3 revealed also some information on how often the users use web search engine to gather information. 17(85.0%) of the respondents reveal that they use web search crawlers "frequent times in a day" to seek for information, 2(10.0%) of the respondents reveals that

use web search crawlers “frequent times in a week” to seek for information, 1(5.0%) of the respondents reveal that they use web search crawlers “frequent times in a week” to seek for information and none for frequent times in a year. This implies that search engine (crawlers) is a vital part of everyday online.

Table 6.4: Evaluation Tasks for Near East University Information Systems Engineering Website Search System (System A) and Semantic Search System (System B)

S/N	Task	System A		System B	
		Time	**Pages**	**Time**	**Pages**
1	Find the list of courses to be offered by a 200 Level student.	55 secs	6	11secs	3
2	Assuming this year, you will take the course “*Object Oriented Programming*” and you are willing to find the lecturer taking the course. Find the lecturer.	84secs	6	42secs	3
3	Using the system search for the course description, course credit and lecturer for the course *Advanced image Processing*	2.20secs	6	1.10sec	3
4	Using the system search for the course code and lecturer and pre-requisite for the course Software Engineering.	62 secs	6	38secs	3
5	Using the answer of the lecturer name for task 3 and 4, and then search for the lecturer’s contact such as phone number and email.	75secs	6	35secs	3
6	Assuming you are an undergraduate student search for your Advisor and there after search for his or her contact details.	2.44secs	6	1.22secs	3
7	Find your Head of Department and his contact details.	2.55secs	4	2.32secs	5
8	Search for your departmental secretary and her contact details.	2.44secs	4	2.12secs	5
	Average Total	**2.31secs**	**5.5**	**1.11secs**	**3.50**

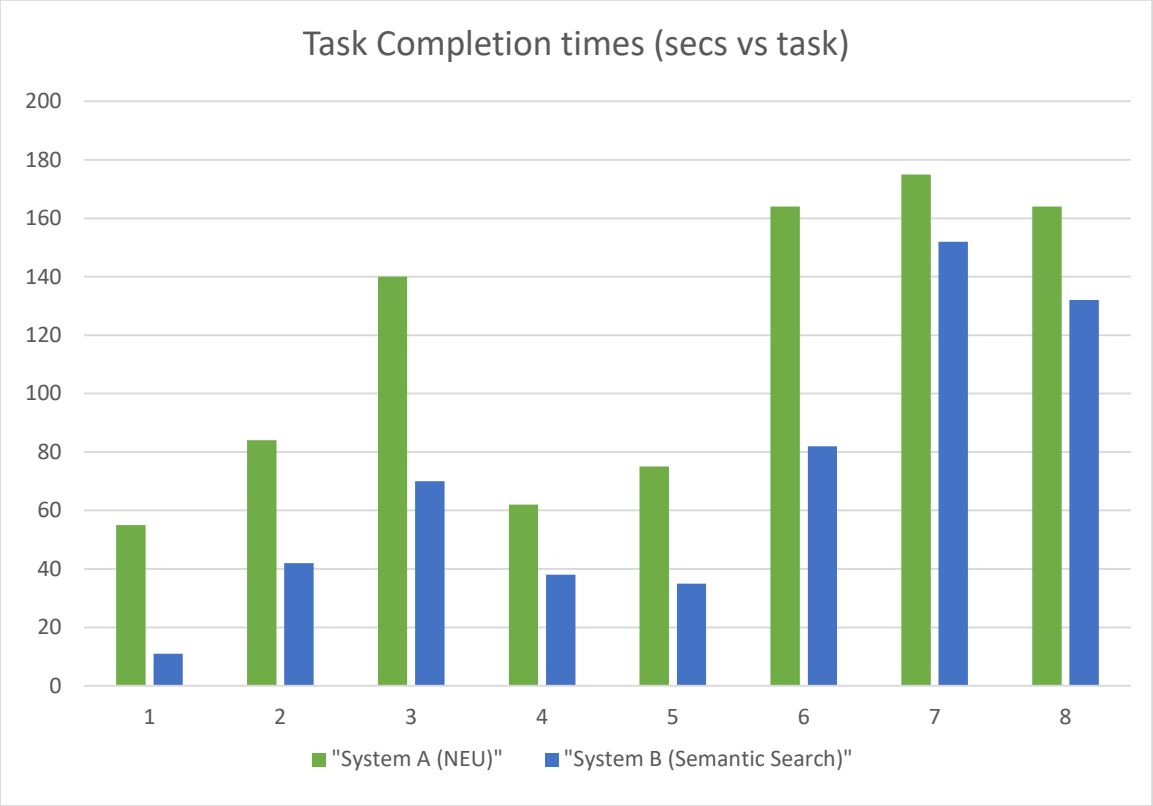

Figure 6.1: Bar chart for task completion times

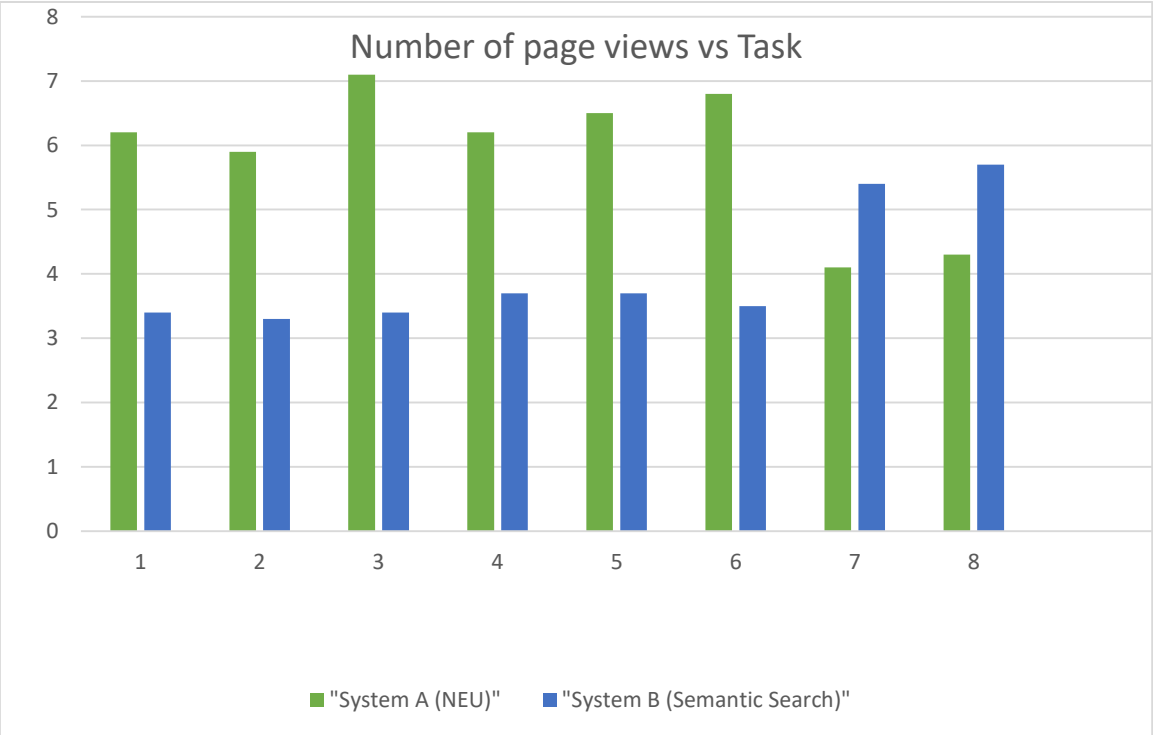

Figure 6.2: Bar chart for number of page views

6.3 Task Assistance (Hypothesis) Result

As indicated in the guesses above, the objective of the Semantic search system is to help a student search for information content better than Near East University Information Systems Engineering Website search. The outcome gotten when the task completion time was conducted shows that Semantic search called system B performed more than Near East University Information Systems Engineering Website search called system A with a mean (average) score of 1.11 (min: secs) vs 2.31 (mins: secs).

Another area is the number of pages visited and views by the students before getting to their result. The goal of the semantic search system is to help gives the finest information content needed, so that students can achieve what they are looking with few number of page views. We can evaluate this by comparing number of clicks across the two systems and tasks there after. The result reveals that students viewed more pages for all tasks to seek for their desired information when using Near East University Information Systems Engineering Website search system. On average, when using Near East University Information Systems Engineering Website search system students' required 5.50 pages' views, on the other hand when using Semantic search system, they required 3.50 pages' view.

The result demonstrates that students achieved their desired information even more effortlessly utilizing Semantic search system. Shorter job finishing times and lesser page views. These discoveries are likewise followed up by post questionnaires questions. The following below are the result analysis of post-questionnaire questions of the both system.

Table 6.5: Post-Questionnaire for Information Systems Engineering Website Search System

SD = strongly disagree, D = disagree, F = fair, SA = strongly agree, A = agree

NB: If the average score is below 2.5 it shows that the users Disagreed and if above 2.5 shows that they agreed.

It should be noted however, that question 1, 2, 4, and 9 are negative while question 3, 5, 6, 7, 8, 10, 11 and 12 are positive in Post-Survey Questionnaire.

Formula: $\frac{SDx1 + Dx2 + Fx3 + SAx4 + Ax5}{\text{Sample size number}}$ Where Sample Size = 20

S/N	Questions	SD	D	F	A	SA	Average
1	"I needed to search thorough before I discovered fascinating information contents"	6	5	-	3	6	**2.9**
		6	**10**	**-**	**12**	**30**	
2	"I invested less energy asking questions and additional time perusing"	8	3	-	4	5	**2.75**
		8	**6**	**-**	**16**	**25**	
3	"I was less presented to unessential information content"	-	-	-	11	9	**4.45**
		-	**-**	**-**	**44**	**45**	
4	"The task was complex"	4	5	-	3	8	**3.3**
		4	**10**	**-**	**12**	**40**	
5	"I did well on tasks"	12	4	-	3	1	**1.85**
		12	**8**	**-**	**13**	**5**	
6	"The guidance manual was helpful to solve the tasks"	4	7	-	6	3	**2.85**
		4	**14**	**-**	**24**	**15**	
7	"I am happy with the system performance, direction and help"	4	5	-	5	6	**3.2**
		4	**10**	-	**20**	**30**	
8	"I found the presentation of the results report helpful"	3	8	-	6	3	**2.9**
		3	**16**	**-**	**24**	**15**	
9	"I felt guided to invalid results thus I can correct them"	15	5	-	-	-	**1.25**
		15	**10**	**-**	**-**	**-**	
10	"I found the interaction with the system motivating".	-	5	-	12	3	**3.65**
		-	**10**	**-**	**48**	**15**	
11	"I found the interaction with the system engaging".	-	3	-	14	3	**3.85**
		-	**6**	**-**	**56**	**15**	
12	"I found the interaction with the system fun".	3	4	-	6	7	**3.5**
		3	**8**	**-**	**24**	**35**	

Table 6.6: Post-Questionnaire for Semantic Search System

SD = strongly disagree, D = disagree, F = fair, SA = strongly agree, A = agree

NB: If the average score is below 2.5 it shows that the users Disagreed and if above 2.5 shows that they agreed. It should be noted however, that question 1, 2, 4, and 9 are negative while question 3, 5, 6, 7, 8, 10, 11 and 12 are positive in Post-Survey Questionnaire

Formula: $\frac{SDx1 + Dx2 + Fx3 + SAx4 + Ax5}{\text{Sample size number}}$ Where Sample Size = 20

S/N	Questions	SD	D	F	A	SA	Average
1	"I needed to search thorough before I discovered fascinating information contents"	11 **11**	6 **12**	- **-**	1 **4**	2 **10**	**1.85**
2	"I invested less energy asking questions and additional time perusing"	13 **13**	3 **6**	- **-**	2 **8**	2 **10**	**1.85**
3	"I was less presented to unessential information content"	- **-**	- **-**	- **-**	8 **32**	12 **60**	**4.6**
4	"The task was complex"	6 **6**	10 **20**	- **-**	2 **8**	2 **10**	**2.2**
5	"I did well on tasks"	- **-**	2 **4**	- **-**	3 **12**	15 **75**	**4.55**
6	"The guidance manual was helpful to solve the tasks"	1 **1**	6 **12**	- **-**	4 **16**	9 **45**	**3.7**
7	"I am happy with the system performance, direction and help"	2 **2**	1 **2**	- -	8 **32**	9 **45**	**4.05**
8	"I found the presentation of the results report helpful"	1 **1**	3 **6**	- **-**	7 **28**	9 **45**	**4**
9	"I felt guided to invalid results thus I can correct them"	18 **18**	2 **4**	- **-**	- **-**	- **-**	**1.1**
10	"I found the interaction with the system motivating".	- **-**	1 **2**	- **-**	13 **52**	6 **30**	**4.2**
11	"I found the interaction with the system engaging".	- **-**	1 **2**	- **-**	11 **44**	8 **40**	**4.3**
12	"I found the interaction with the system fun".	3 **3**	2 **4**	- **-**	8 **32**	7 **35**	**3.7**

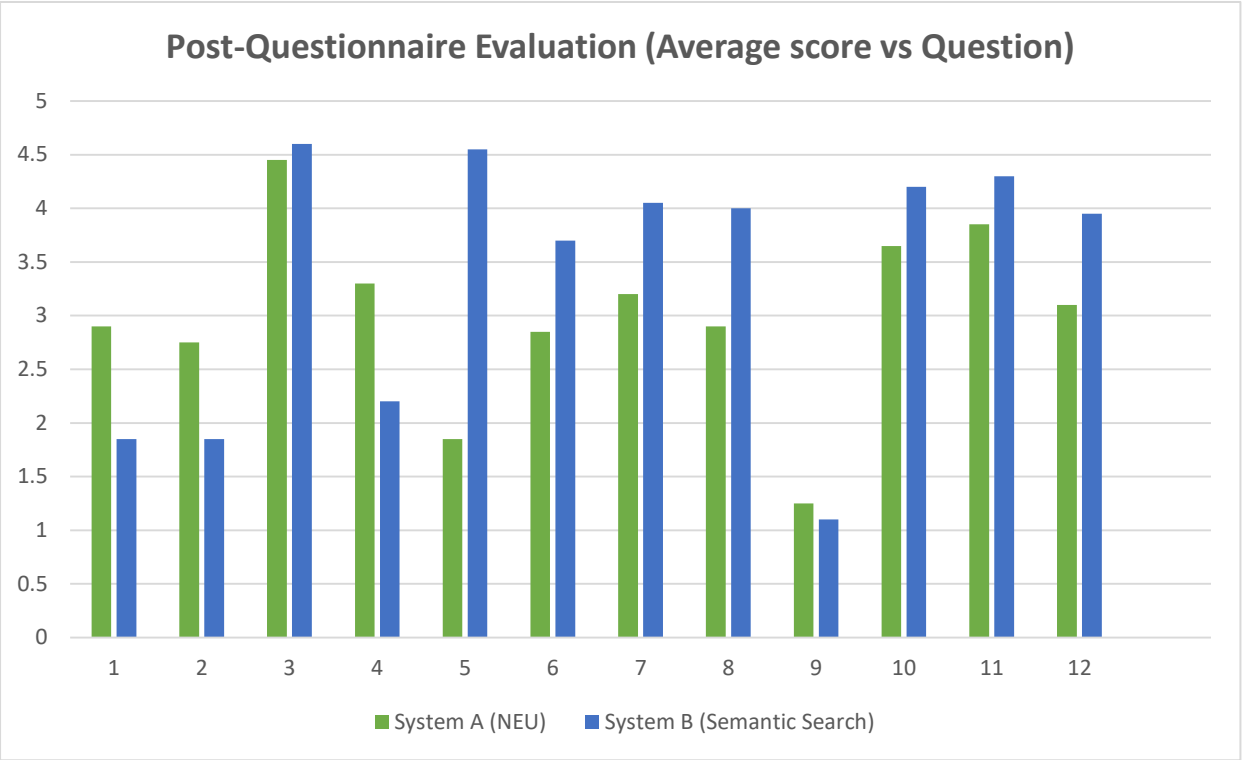

Figure 6.3: Bar chart for post-questionnaire evaluation

6.4 Result Analysis of Table 6.5 (Post-Questionnaire for Information Systems Engineering Website Search System)

Table 6.5 shows the frequency of responses by the respondents on the evaluation of Near East University Information Systems Engineering Website search system. The table shows that majority of the respondents **agreed** with the statement "I needed to search thorough before I discovered fascinating information contents" using Near East University Information Systems Engineering Website search with a mean (average) score of 2.9.

As shown in table 6.5, it was divulges that majority of the respondents **agreed** with the statement "i invested less energy asking questions and additional time perusing" using Near East University Information Systems Engineering Website search with a mean (average) score of 2.75.

It was also discovered in table 6.5 that majority of the respondents **agreed** with the statement “i was less presented to unessential information content” using Near East University Information Systems Engineering Website search with a mean (average) score of 4.45.

Table 6.5 also discloses that majority of the respondents **agree** with the view “the task was complex” when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.3.

Likewise, as shown in table 6.5, the data divulges that majority of the respondents **disagreed** with the statement “i did well on tasks” using Near East University Information Systems Engineering Website search with a mean (average) score of 1.85.

Similarly, as revealed in table 6.5, the data exposes that majority of the respondents **agreed** with the view “the guidance manual was helpful to solve the tasks” when using Near East University Information Systems Engineering Website search with a mean (average) score of 2.85.

As shown in table 6.5, the data discloses that majority of the respondents **agreed** with the statement “i am happy with the system performance, direction and help” when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.20.

It was also made known in table 6.5 that majority of the respondents **agreed** with the view “i found the presentation of the results report helpful” using Near East University Information Systems Engineering Website search with a mean (average) score of 2.90.

Similarly, as shown in table 6.5, the data reveals that majority of the respondents **disagreed** with the view “i felt guided to invalid results thus I can correct them” when using Near East University Information Systems Engineering Website search system with a mean (average) score of 1.25.

It was also discovered in table 6.5 that majority of the respondents **agreed** with the statement “i found the interaction with the system motivating” when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.65.

It was also revealed in table 6.5 that majority of the respondents **agreed** with the view “i found the interaction with the system engaging” when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.85.

Finally, it was exposed in table 6.5 that majority of the respondents **agreed** with the statement “i found the interaction with the system fun” when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.10.

6.5 Result Analysis of Table 6.6 (Post-Questionnaire for Semantic Search System)

Table 6.6 shows the frequency of responses by the respondents on the evaluation of Semantic Search System. The table shows that majority of the respondents **disagreed** with the statement “i needed to search thorough before I discovered fascinating information contents” using Semantic Search with a mean (average) score of 1.85.

As shown in table 6.6, it was divulges that majority of the respondents **disagreed** with the statement “i invested less energy asking questions and additional time perusing” using Semantic Search with a mean (average) score of 1.85.

It was also discovered in table 6.6 that majority of the respondents **agreed** with the statement “i was less presented to unessential information content” using Semantic Search with a mean (average) score of 4.60.

Table 6.6 also discloses that majority of the respondents **disagree** with the view “the task was complex” when using Semantic Search system with a mean (average) score of 2.20.

Likewise, as shown in table 6.6, the data divulges that majority of the respondents **agreed** with the statement “i did well on tasks” using Semantic Search system with a mean (average) score of 4.55.

Similarly, as shown in table 6.6, the data exposes that majority of the respondents **agreed** with the view “the guidance manual was helpful to solve the tasks” when using Semantic Search system with a mean (average) score of 3.7.

As shown in table 6.6, the data discloses that majority of the respondents **agreed** with the statement “i am happy with the system performance, direction and help” when using Semantic Search system with a mean (average) score of 4.05.

It was also revealed in table 6.6 that majority of the respondents **agreed** with the statement “i found the presentation of the results report helpful” when using Semantic Search system with a mean (average) score of 4.0.

Similarly, as shown in table 6.6, the data reveals that majority of the respondents **disagreed** with the view “i felt guided to invalid results thus i can correct them” when using Semantic Search system with a mean (average) score of 1.1.

It was also shown in table 6.6 that majority of the respondents **agreed** with the statement “i found the interaction with the system motivating” when using Semantic Search system with a mean (average) score of 4.2.

It was also discovered in table 6.6 that majority of the respondents **agreed** with the view “i found the interaction with the system engaging” when using Semantic Search system with a mean (average) score of 4.3.

Finally, it was exposed in table 6.6 that majority of the respondents **agreed** with the statement “i found the interaction with the system fun” when using Semantic Search system with a mean (average) score of 3.95.

These findings revealed that Semantic Search System was more effective than Near East University Information Systems Engineering Website search system. In fact, searching information while using Semantic Search System was much better than Near East University Information Systems Engineering Website search system. In data gathering, clients felt more directed and happier with Semantic Search System compared to Near East University Information Systems Engineering Website search system. These results are supported by completion time for the task, and page views number.

Generally, the hypothesis for assistance to the various tasks clearly shows the advantages of Semantic Search system. Semantic Search System performed better than Near East University Information Systems Engineering Website search system.

Table 6.7: Post-Questionnaire TTEST Evaluation Table

A TTEST is a type of statistics used to determine significant differences between the averages of two groups.

	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10		Q11		Q12	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	1	1	1	1	4	4	1	1	1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
	1	1	1	1	4	4	1	1	1	2	1	2	1	1	1	2	1	1	2	4	2	4	1	1
	1	1	1	1	4	4	1	1	1	4	1	2	1	2	1	2	1	1	2	4	2	4	1	2
	1	1	1	1	4	4	1	1	1	4	1	2	1	4	2	2	1	1	2	4	4	4	1	2
	1	1	1	1	4	4	2	1	1	4	2	2	2	4	2	4	1	1	2	4	4	4	2	4
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	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	2	2	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	2	5	5	5	5	5	5
AVERAGE	2.9	1.85	2.75	1.85	4.45	4.6	3.3	2.2	1.85	4.55	2.85	3.7	3.2	4.05	2.9	4	1.25	1.1	3.65	4.2	3.85	4.3	3.1	3.95
TTEST P-Value	0.018079		0.041051		0.17748		0.0131		5E-09		0.036502		0.036194		0.006562		0.111538		0.028877		0.043073		0.034852	

Above table is the TTEST evaluation between the average of Information Systems Engineering Search System (System A) and Semantic Search System (System B). TTEST was used to determine the significant differences between System A and System B with the p-value of:

If p < alpha = 0.05 (It is Statistically Significant)

If p > alpha = 0.05 (It is not Statistically Significant)

Above table revealed that Q1, Q2, Q4, Q5, Q6, Q7, Q8, Q10, Q11, Q12 are statistically significant because their p-value are lesser than 0.05 while Q3 and Q9 are statistically insignificant because their p-value are greater than 0.05.

Table 6.8: SUS Usability Questionnaire for Information Systems Engineering Website Search System

SD = strongly disagree, D = disagree, F = fair, SA = strongly agree, A = agree.

NB: If the average score is below 2.5 it shows that the users Disagreed and if above 2.5 shows that they agreed. It should be noted however, that question 2, 4, 6, 8, and 10 are negative while question 1, 3, 5, 7, and 9 are positive in SUS Usability Questionnaire.

Formula: $\frac{SDx1 + Dx2 + Fx3 + SAx4 + Ax5}{\text{Sample size number}}$ Where Sample Size = 20

S/N	Questions	SD	D	F	A	SA	Average
1	"I think that I might want to utilize this system as often as possible".	10 **10**	5 **10**	- **-**	3 **12**	2 **10**	**2.1**
2	"I found the system needlessly difficult".	5 **5**	7 **14**	- **-**	6 **24**	2 **10**	**2.65**
3	"I thought the system was simple to utilize".	8 **8**	3 **6**	- **-**	6 **24**	3 **15**	**2.65**
4	"I feel that I would require the help of a specialized	4 **4**	14 **28**	- **-**	- **-**	2 **10**	**2.1**
5	"I found the different roles in this system were very much incorporated".	3 **3**	10 **20**	- **-**	5 **20**	2 **10**	**2.65**
6	"I thought there was excessively irregularity in this system".	4 **4**	7 **14**	- **-**	4 **16**	5 **25**	**2.95**
7	"I would envision that a great many people would figure out how to utilize this system	4 **4**	5 **10**	- -	6 **24**	5 **25**	**3.15**
8	"I found the system extremely lumbering to utilize".	6 **6**	3 **6**	- **-**	3 **12**	8 **40**	**3.2**
9	"I felt exceptionally confident utilizing the system".	2 **2**	5 **10**	- **-**	8 **32**	5 **25**	**3.45**
10	"I required studying many things before I could start using this system".	3 **3**	3 **6**	- **-**	6 **24**	8 **40**	**3.65**

Table 6.9: SUS Usability Questionnaire for Semantic Search System

SD = strongly disagree, D = disagree, F = fair, SA = strongly agree, A = agree.

NB: If the average score is below 2.5 it shows that the users Disagreed and if above 2.5 shows that they agreed. It should be noted however, that question 2, 4, 6, 8, and 10 are negative while question 1, 3, 5, 7, and 9 are positive in SUS Usability Questionnaire.

Formula: $\frac{SDx1 + Dx2 + Fx3 + SAx4 + Ax5}{\text{Sample size number}}$ Where Sample Size = 20

S/N	Questions	SD	D	F	A	SA	Average
1	"I think that I might want to utilize this system as often as possible".	1 **1**	5 **10**	- **-**	3 **12**	11 **55**	**3.9**
2	"I found the system needlessly difficult".	11 **11**	7 **14**	- **-**	2 **8**	- **-**	**1.65**
3	"I thought the system was simple to utilize".	3 **3**	4 **8**	- **-**	6 **24**	7 **35**	**3.5**
4	"I feel that I would require the help of a specialized	7 **7**	13 **26**	- **-**	- **-**	- **-**	**1.65**
5	"I found the different roles in this system were very much incorporated".	3 **3**	2 **4**	- **-**	11 **44**	4 **20**	**3.55**
6	"I thought there was excessively irregularity in this system".	11 **11**	5 **10**	- **-**	3 **12**	1 **5**	**1.9**
7	"I would envision that a great many people would figure out how to utilize this system	2 **2**	1 **2**	- -	9 **30**	8 **40**	**4**
8	"I found the system extremely lumbering to utilize".	9 **9**	7 **14**	- **-**	3 **12**	1 **5**	**2**
9	"I felt exceptionally confident utilizing the system".	1 **1**	1 **2**	- **-**	10 **40**	8 **40**	**4.15**
10	"I required studying many things before I could start using this system".	6 **6**	9 **18**	- **-**	3 **12**	2 **10**	**2.3**

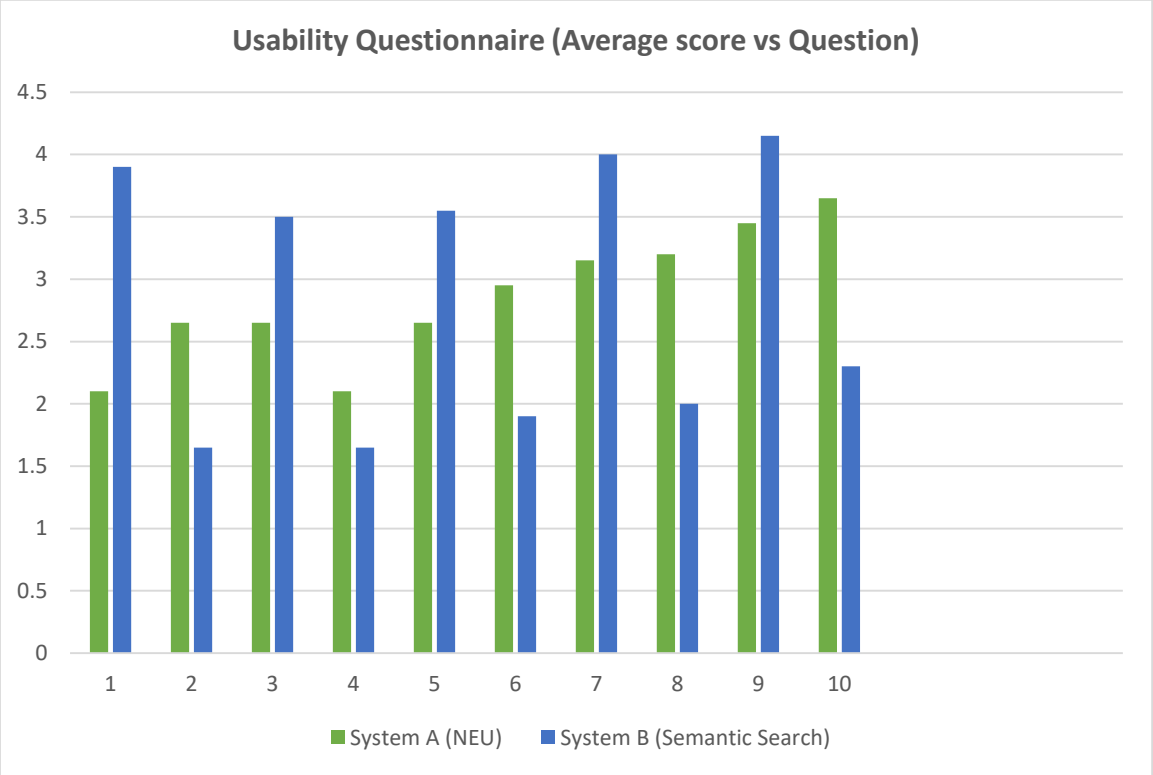

Figure 6.4: Bar chart for usability questionnaire evaluation

6.6 Result Analysis of Table 6.8 (SUS Usability Questionnaire for Information Systems Engineering Website Search System)

Table 6.8 shows the frequency of responses by the respondents on the evaluation of Near East University Information Systems Engineering Website search system. The table shows that majority of the respondents **disagreed** with the statement "i think that I might want to utilize this system as often as possible" when using Near East University Information Systems Engineering Website search with a mean (average) score of 2.1.

As shown in table 6.8, it was divulges that majority of the respondents **agreed** with the statement "i found the system needlessly difficult" when using Near East University Information Systems Engineering Website search with a mean (average) score of 2.65.

It was also discovered in table 6.8 that majority of the respondents **agreed** with the statement "i thought the system was simple to utilize" when using Near East University Information Systems Engineering Website search with a mean (average) score of 2.65.

Table 6.8 also discloses that majority of the respondents **disagree** with the view "i feel that i would require the help of a specialized individual to have the capacity to utilize this system" when using Near East University Information Systems Engineering Website search with a mean (average) score of 2.1.

Likewise, as shown in table 6.8, the data divulges that majority of the respondents **agreed** with the statement "i found the different roles in this system were very much incorporated" using Near East University Information Systems Engineering Website search with a mean (average) score of 2.65.

Similarly, as revealed in table 6.8, the data exposes that majority of the respondents **agreed** with the view "i thought there was excessively irregularity in this system" when using Near East University Information Systems Engineering Website search with a mean (average) score of 2.95.

As shown in table 6.8, the data discloses that majority of the respondents **agreed** with the statement "i would envision that a great many people would figure out how to utilize this system rapidly" when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.15.

It was also made known in table 6.8 that majority of the respondents **agreed** with the view "I found the system extremely lumbering to utilize" using Near East University Information Systems Engineering Website search with a mean (average) score of 3.2.

Similarly, as shown in table 6.8, the data reveals that majority of the respondents **agreed** with the view "i felt exceptionally confident utilizing the system" when using Near East University Information Systems Engineering Website search system with a mean (average) score of 3.45.

Finally, it was exposed in table 6.8 that majority of the respondents **agreed** with the statement “i required studying many things before i could start using this system” when using Near East University Information Systems Engineering Website search with a mean (average) score of 3.65.

6.7 Result Analysis of Table 6.9 (SUS Usability Questionnaire for Semantic Search System)

Table 6.9 shows the frequency of responses by the respondents on the evaluation of semantic search system. The table shows that majority of the respondents **agreed** with the statement “i think that i might want to utilize this system as often as possible” with an average score of 3.9.

As shown in table 6.9, it was divulges that majority of the respondents **disagreed** with the statement “i found the system needlessly difficult” when using semantic search system with a mean (average) score of 1.65.

It was also discovered in table 6.9 that majority of the respondents **agreed** with the statement “i thought the system was simple to utilize” when using semantic search system with a mean (average) score of 3.5.

Table 6.9 also discloses that majority of the respondents **disagree** with the view “i feel that i would require the help of a specialized individual to have the capacity to utilize this system” when using semantic search system with a mean (average) score of 1.65.

Likewise, as shown in table 6.9, the data divulges that majority of the respondents **agreed** with the statement “i found the different roles in this system were very much incorporated” using semantic search system with a mean (average) score of 3.55.

Similarly, as revealed in table 6.9, the data exposes that majority of the respondents **disagreed** with the view “i thought there was excessively irregularity in this system” when using semantic search system with a mean (average) score of 1.90.

As shown in table 6.9, the data discloses that majority of the respondents **agreed** with the statement “i would envision that a great many people would figure out how to utilize this system rapidly” when using semantic search system with a mean (average) score of 4.0.

It was also made known in table 6.9 that majority of the respondents **disagreed** with the view “i found the system extremely lumbering to utilize” using semantic search system with a mean (average) score 2.0.

Similarly, as shown in table 6.9, the data reveals that majority of the respondents **agreed** with the view “i felt exceptionally confident utilizing the system” when using semantic search system with a mean (average) score of 4.15.

Finally, it was exposed in table 6.9 that majority of the respondents **disagreed** with the statement “i required studying many things before i could start using this system” when using semantic search system with a mean (average) score of 2.3.

6.8 Discussion of Results

In respects to the respondent's responses, the researchers while conducting this research work made do with the students of Near East University Information Systems Engineering Department.

The results evidently demonstrated an interface was provided which empowered students carrying out both data gathering and information discovery tasks more efficiently and effectively. Specifically, students were reliably quicker and seen less number of pages. The following are the aggregate rundown of the findings:

1. The results show that Semantic search system better aid students seek for information faster than Near East University Information Systems Engineering Website search system.
2. Semantic search system helps students to be more efficient
3. Semantic search system also aids students to be more effective in the course of completing their various tasks than Near East University Information Systems Engineering Website search system.

4. Students are more ok with Semantic search system than Near East University Information Systems Engineering Website search system.
5. Semantic search system outperforms Near East University Information Systems Engineering Website search system in usability.
6. Students find Semantic search system to be more motivating and engaging than Near East University Information Systems Engineering Website search system.

Table 6.10: SUS Usability Questionnaire TTEST Evaluation Table

TTEST was used to determine the significant differences between System A and System B with the p-value of: if p < alpha = 0.05 (**It is Statistically Significant**) If p > alpha = 0.05 (**It is not Statistically Significant**).

	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	4	1	1
	1	2	1	1	1	2	1	1	2	2	1	1	1	4	1	1	2	4	2	1
	1	2	1	1	1	2	2	1	2	2	2	1	2	4	1	1	2	4	2	1
	1	2	2	1	1	2	2	1	2	4	2	1	2	4	1	1	2	4	2	1
	1	4	2	1	1	2	2	1	2	4	2	1	2	4	2	1	2	4	4	2
	1	4	2	1	1	4	2	2	2	4	2	1	2	4	2	1	4	4	4	2
	1	4	2	1	2	4	2	2	2	4	2	1	2	4	2	1	4	4	4	2
	1	5	2	1	2	4	2	2	2	4	2	1	4	4	4	2	4	4	4	2
	2	5	2	1	2	4	2	2	2	4	2	1	4	4	4	2	4	4	4	2
	2	5	2	2	4	4	2	2	2	4	4	2	4	4	4	2	4	4	4	2
	2	5	4	2	4	4	2	2	2	4	4	2	4	5	5	2	4	5	5	2
	2	5	4	2	4	5	2	2	4	4	4	2	4	5	5	2	4	5	5	2
	2	5	4	2	4	5	2	2	4	4	4	2	4	5	5	2	4	5	5	2
	4	5	4	2	4	5	2	2	4	4	5	2	5	5	5	2	5	5	5	4
	4	5	4	2	4	5	2	2	4	5	5	4	5	5	5	4	5	5	5	4
	4	5	4	2	5	5	2	2	4	5	5	4	5	5	5	4	5	5	5	4
	5	5	5	4	5	5	5	2	5	5	5	4	5	5	5	4	5	5	5	5
	5	5	5	4	5	5	5	2	5	5	5	5	5	5	5	5	5	5	5	5
AVERAGE	2.1	3.9	2.65	1.65	2.65	3.5	2.1	1.65	2.65	3.55	2.95	1.9	3.15	4	3.2	2	3.45	4.15	3.65	2.3
TTEST P-Value	0.000172		0.006512		0.049132		0.049558		0.019621		0.013421		0.03312		0.009805		0.040264		0.002621	

Above table revealed that Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, and Q10 are statistically significant because their p-value are lesser than 0.05.

CHAPTER 7
CONCLUSION

The purpose of this research work is to build a semantic search system for Near East University Information Systems Engineering Department utilizing the Semantic Web technologies.

In this thesis work the vital aspects of the topic “Semantic Web” to represent the domain (University Ontology) has been integrated. In the database, the relationship between the various information readily available and their properties have been represented so that it can be used in a way that can be consumed by the machine and processed through OWL protege reasoning systems such as HermiT.

The semantic search system has been built in three main parts; they are “University Ontology, RAP (RDF API for PHP) model and the User Interface”. The database (University Ontology) has been built utilizing ontology protégé. Ontology processing is being performed on RAP (RDF API for PHP) model in order to create communication with the end users. It empowers Querying and reasoning to be performed effectively by the built semantic search system.

The user interface helps communication with the end users possible by allowing the end users communicate with the ontology processing part in a human fathomable way. The end users can construct questions and look for information about their courses or lecturers as they normally do in normal Web pages when searching for information. Users do not need to build SPARQL queries or have prior knowledge of RDF; instead, the ontology processing part converts the constructed questions into RDF queries so that the end users do not have to worry about how the information is being retrieved.

“Semantic Web” is the future of the World Wide Web (www). Many companies such as Google, Facebook etc. are already making use of semantic web tools and technologies. As various tools and technologies are being created in addition with my experience gotten so far, I vehemently have the confidence that Semantic Web will become the principal

technology used when working with complex information. I also vehemently believe that making used of Semantic Web technologies will become the principal method in representing and processing information cause of its fast nature.

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APPENDICES

APPENDIX 1

ETHICS APPROVAL PAGE

12.05.2017

Dear Ameh Ojonefedo İbrahim,

Your application titled "**The Use Of Semantic Web Technologies to Improve Search Structure of Near East University Information Systems Engineering Website**" with the application number YDÜ/FB/2017/1 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assist. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnc Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.

YAKIN DOĞU ÜNİVERSİTESİ

BILIMSEL ARAŞTIRMALAR ETIK KURULU

12.05.2017

Sayın Ameh Ojonefedo İbrahim,

Bilimsel Araştırmalar Etik Kurulu'na yapmış olduğunuz YDÜ/FB/2017/1 proje numaralı ve **"The Use Of Semantic Web Technologies to Improve Search Structure of Near East University Information Systems Engineering Website"** başlıklı proje önerisi kurulumuzca değerlendirilmiş olup, etik olarak uygun bulunmuştur. Bu yazı ile birlikte, başvuru formunuzda belirttiğiniz bilgilerin dışına çıkmamak suretiyle araştırmaya başlayabilirsiniz.

Yardımcı Doçent Doktor Direnç Kanol

Bilimsel Araştırmalar Etik Kurulu Raportörü

Direnç Kanol

Not: Eğer bir kuruma resmi bir kabul yazısı sunmak istiyorsanız, Yakın Doğu Üniversitesi Bilimsel Araştırmalar Etik Kurulu'na bu yazı ile başvurup, kurulun başkanının imzasını taşıyan resmi bir yazı temin edebilirsiniz.

APPENDIX 2

CONSENT LETTER

Information Systems Engineering Dept,
Near East University,
Lefkosa, North Cyprus.

RESEARCH QUESTIONNAIRE ON: THE USE OF SEMANTIC WEB TECHNOLOGIES TO IMPROVE SEARCH STRUCTURE OF NEAR EAST UNIVERSITY INFORMATION SYSTEMS ENGINEERING WEBSITE

Dear Respondents,

I am a master student of the department of Information Systems Engineering, Near East University, Lefkosa, North Cyprus conducting a research on "the use of semantic Web technology to improve search structure of Near East University Information Systems Engineering Website"

Below are some questions designed to enable me collect data relevant to the study. I will be very grateful if you will read the content of the evaluation properly, tick the correct option where necessary, and return same to me. All responses would be treated with utmost confidentiality and used only for the purpose of study. All the collected data is anonymously stored to protect information about participants.

The evaluation is in two parts: a hand on evaluation of how the system works and a follow-up questionnaire. The first part will help us understand the interfaces, in order to see errors and improvements while the second part will help us learn if you are satisfied with the interfaces.

Please note we are evaluating the system not your performance with it. Your feedback will help improve the system.

Thanks for your cooperation.

Yours sincerely,

AMEH OJONUFEDO IBRAHIM

20159228.

APPENDIX 3 (QUESTIONNAIRE)

ABOUT YOUR SEARCH EXPERIENCES AND BACKGROUND

1 What programme are you studying? Please state if you are doing your master degree or undergraduate. If undergraduate, state your level.

	Frequent times in a year	Frequent times in a month	Frequent times in a week	Frequent times in a day
2 How often do you use Information Systems Engineering Website to search for information (i.e. course information, lecturer information, etc.)?	1	2	3	4
3 How often do you use Web search engines to gather information?	1	2	3	4

EVALUATION TASKS FOR THE INFORMATION SYSTEMS ENGINEERING WEBSITE

You will be asked to perform a set of tasks, using the system. The evaluator will explain the tasks ahead of time. He will also show you how it work and then you will be given time to try it out yourself before the actual test.

1. Find the list of courses to be offered by a 200 Level student.
2. Assuming this year you will take the course "*Object Oriented Programming*" and you are willing to find the lecturer taking the course. Find the lecturer.
3. Using the system search for the course description, course credit and lecturer for the course *Advanced image Processing.*
4. Using the system search for the course code and lecturer and pre-requisite for the course *Software Engineering*.
5. Using the answer of the lecturer name for task 3 and 4, and then search for the lecturer's contact such as phone number and email.
6. Assuming you are an undergraduate student search for your Advisor and there after search for his or her contact details.
7. Find your Head of Department and his contact details.
8. Search for your departmental secretary and her contact details.
9. In this task, you are free to do two tasks of your own. For example, you can find any course of your choice, find any lecturer of your choice and the courses they teach e.t.c. Write down this task on the papers provided and comment on it.

Thank you for your help in conducting the research.

EVALUATION TASKS FOR SEMANTIC SEARCH

You will be asked to perform a set of tasks, using the system. The evaluator will explain the tasks ahead of time. He will also show you how it work and then you will be given time to try it out yourself before the actual test.

1. Find the list of courses to be offered by a 400 Level student.
2. Assuming this year you will take the course "*Advanced Web Development*" and you are willing to find the lecturer taking the course. Find the lecturer.
3. Using the system search for the course description, course credit and lecturer for the course "Physics II".
4. Using the system search for the course code and lecturer and pre-requisite for the course "*Database System"*.
5. Using the answer of the lecturer name for task 3 and 4, and then search for the lecturer's contact such as phone number and email.
6. Assuming you are a master student search for your Advisor and there after search for his or her contact details.
7. Find your Head of Department and his contact details.
8. Search for your departmental secretary and her contact details.
9. In this task, you are free to do two tasks of your own. For example, you can find any course of your choice, find any lecturer of your choice and the courses they teach e.t.c. Write down this task on the papers provided and comment on it.

Thank you for your help in conducting the research.

POST-QUESTIONNAIRE FOR INFORMATION SYSTEMS ENGINEERING WEBSITE

Strongly Disagree Disagree Fair Agree Strongly Agree

1 I needed to search thorough before I discovered fascinating information contents.

1	2	3	4	5

2 I invested less energy asking questions and additional time perusing.

1	2	3	4	5

3 I was less presented to unessential information content

1	2	3	4	5

4 The task was complex.

1	2	3	4	5

5 I did well on tasks.

1	2	3	4	5

6 The guidance manual was helpful to solve the tasks.

1	2	3	4	5

7 I am happy with the system performance, direction and help.

1	2	3	4	5

8 I found the presentation of the results report helpful

1	2	3	4	5

9 I felt guided to invalid results thus I can correct them.

1	2	3	4	5

10 I found the interaction with the system motivating.

11 I found the interaction with the system engaging.

12 I found the interaction with the system fun.

.

POST-QUESTIONNAIRE FOR SEMANTIC SEARCH

Strongly Disagree Disagree Fair Agree Strongly Agree

1 I needed to search thorough before I discovered fascinating information contents.

1	2	3	4	5

2 I invested less energy asking questions and additional time perusing.

1	2	3	4	5

3 I was less presented to unessential information content

1	2	3	4	5

4 The task was complex.

1	2	3	4	5

5 I did well on tasks.

1	2	3	4	5

6 The guidance manual was helpful to solve the tasks.

1	2	3	4	5

7 I am happy with the system performance, direction and help.

1	2	3	4	5

8 I found the presentation of the results report helpful

1	2	3	4	5

9 I felt guided to invalid results thus I can correct them.

1	2	3	4	5

10 I found the interaction with the system motivating.

	1	2	3	4	5
11 I found the interaction with the system engaging.					
	1	2	3	4	5
12 I found the interaction with the system fun.					
	1	2	3	4	5

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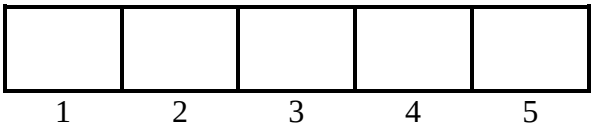
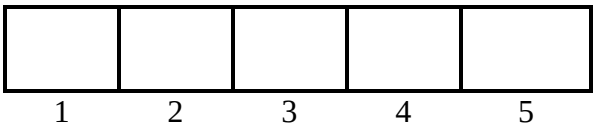
SUS USABILITY QUESTIONNAIRE FOR INFORMATION SYSTEMS ENGINEERING WEBSITE

Strongly Disagree Disagree Fair Agree Strongly Agree

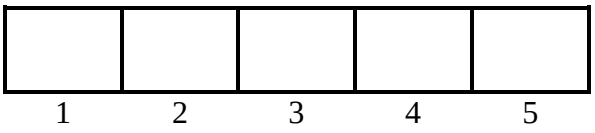
1 I think that I might want to utilize this system as often as possible.



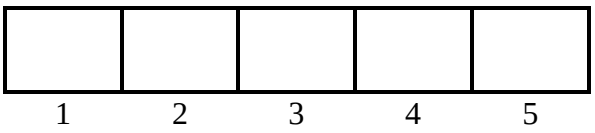
2 I found the system needlessly difficult.



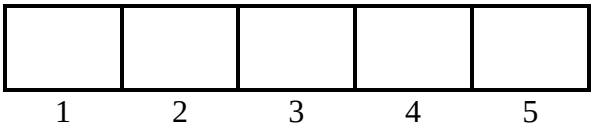
3 I thought the system was simple to utilize.



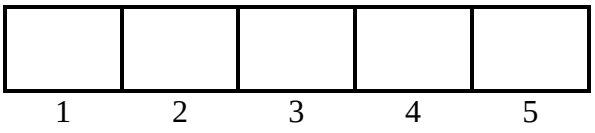
4 I feel that I would require the help of a specialized individual to have the capacity to utilize this system.



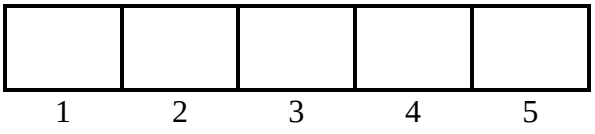
5 I found the different roles in this system were very much incorporated.



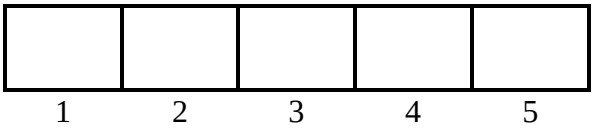
6 I thought there was excessively irregularity in this system.



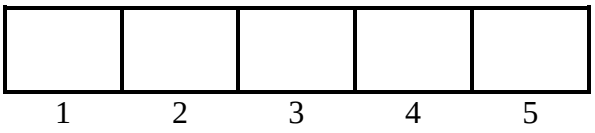
7 I would envision that a great many people would figure out how to utilize this system rapidly.



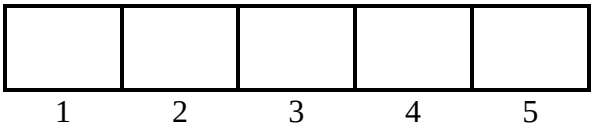
8 I found the system extremely lumbering to utilize..



9 I felt exceptionally confident utilizing the system.



10 I required studying many things before I could start using this system.



SUS USABILITY QUESTIONNAIRE FOR SEMANTIC SEARCH

Strongly Disagree Disagree Fair Agree Strongly Agree

1 I think that I would like to use this system frequently.

2 I found the system unnecessarily complex.

3 I thought the system was easy to use.

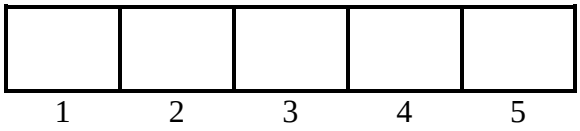
4 I think that I would need the support of a technical person to be able to use this system.

5 I found the various functions in this system were well integrated.

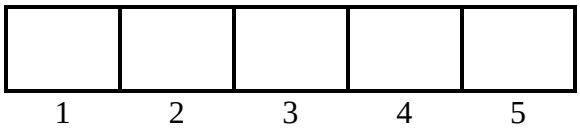
6 I thought there was too much inconsistency in this system.

7 I would imagine that most people would learn to use this system very quickly.

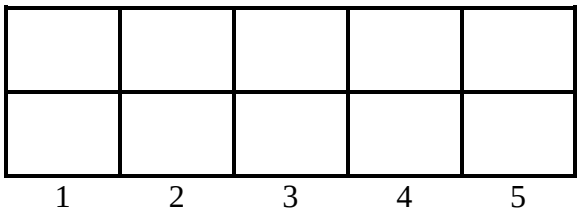
8 I found the system very cumbersome to use.



9 I felt very confident using the system.



10 I needed to learn a lot of things before I could get going with this system.



APPENDIX 4 (SOURCE CODE)

Code Home Page of the System

```
<!DOCTYPE html>
<html>
<head>
<div style="margin-left:0%; padding:0px 16px;height:500px;">
<div style="margin-right:0%; padding:0px 16px;height:500px;">
<img src="neu.png" alt="Smiley face" width="95%" height="135">
<link rel="stylesheet" href="css/style1.css" type="text/css"></style>
<ul>
<li><a href="index.php">Home</a></li>
<li><a class="active" href="search1.php">Course Offered</a></li>
<li><a href="course.php">Course Search</a></li>
<li><a class="active" href="lecturer.php">Person Search</a></li>
<li><a href="advisor.php">Advisor Search</a></li>
<li><a class="active" href="hod.php">HOD Search</a></li>
<li><a href="secretary.php">Secretary Search</a></li>
<li><a class="active" href="https://neu.edu.tr/academic/faculties/faculty-of-
engineering/departments/department-of-information-systems-engineering/">Home Page of
NEU ISE Department</a></li>
<li><a href="http://gmail.com">Send Message</a></li>
</ul>
</head>
<body>
<br>
  <h1 align="center">PROJECT WORK</h1>
  <br>
<h2 align="center">THE USE OF SEMANTIC WEB TECHNOLOGY TO IMPROVE
SEARCH STRUCTURE OF NEAR EAST UNIVERSITY INFORMATION SYSTEMS
ENGINEERING WEBSITE</h2>
  <br>
```

```
 <h3 align="center"><big>Ontology</big><br>Sparql Query OWL Using RAP(RDF API for PHP)</h3>
 <br>
 <h3 align="center">by<br> AMEH  OJONUFEDO   IBRAHIM      20159228</h3>
 <br>
 <h3 align="center"><big>for</big><br>INFORMATION SYSTEM ENGINEERING DEPARTMENT</h3>
 <br><br>
 <img src="bg.png" alt="Smiley face" width="100%" height="135">
</div>
</body>
</html>
```

Code for Course Offered

```
<!DOCTYPE html>
<html>
<head>
<style>
body {
   margin: 0;
}

ul {
   list-style-type: none;
   margin: 0;
   padding: 0;
   width: 15%;
   text-align: center;
   background-color: #f1f1f1;
   position: fixed;
```

```
    height: 100%;
    overflow: auto;
}

li a {
    display: block;
    color: #000;
    padding: 8px 16px;
    text-decoration: none;
}

li a.active {
    background-color: #000000;
    color: white;
}

li a:hover:not(.active) {
    background-color: #555;
    color: white;
}

textarea {
    width: 60%;
    height: 150px;
    padding: 12px 20px;
    box-sizing: border-box;
    border: 2px solid #ccc;
    border-radius: 4px;
    background-color: #f8f8f8;
    font-size: 16px;
    resize: none;
}
```

```
input[type=text] {
    width: 70%;
    height: 50px;
    box-sizing: border-box;
    border: 0px solid #ccc;
    border-radius: 4px;
    font-size: 16px;
    background-color: #f1f1f1;
    background-position: 10px 10px;
    background-repeat: no-repeat;
    padding: 12px 20px 12px 40px;
}

select {
    width: 50%;
    padding: 12px 20px;
    border: none;
    font-size:16px;
    border-radius: 4px;
    background-color: #f1f1f1;
}

.button {
    width: 20%;
    padding: 10px 20px;
    text-align: center;
    text-decoration: none;
    display: inline-block;
    font-size: 18px;
    margin: 4px 2px;
    -webkit-transition-duration: 0.4s; /* Safari */
```

```
    transition-duration: 0.4s;
    cursor: pointer;
    background-color: white;
    color: black;
    border-radius: 12px;
    border: 2px solid #555555;
}
.button:hover {background-color: #e7e7e7;}
</style>


</head>
<body>

<ul>
  <li><a href="http://localhost/rdfapi-php/Project_20159228/index.php">Home</a></li>
   <li><a class="active" href="https://neu.edu.tr/academic/faculties/faculty-of-engineering/departments/department-of-information-systems-engineering/">Home Page of NEU ISE Department</a></li>
   <li><a href="http://gmail.com">Send Message</a></li>
   <li><a class="active" href="http://google.com">Google Search</a></li>
</ul>

<div style="margin-left:20%; padding:0px 16px;height:500px;">
    <img src="neu.png" alt="Smiley face" width="95%" height="135">
<br>
<h3 align="center"><?php
echo '<a href="http://localhost/rdfapi-php/Project_20159228/index.php">Home</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/search1.php">Course Offered</a>
-
<a href="http://localhost/rdfapi-php/Project_20159228/course.php">Course Search</a> -
```

```
<a href="http://localhost/rdfapi-php/Project_20159228/lecturer.php">Person (Lecturer)
Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/advisor.php">Advisor Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/hod.php">HOD Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/secretary.php">Secretary
Search</a>';
?></h3>

 <br>
  <h3 align="center">SEARCH BY SCOPE</h3>

<br><br>
<form action="show1.php" method="post" align="center">
  <div class="select-style">
  <select name="select">
          <option value="0">--Select Class Category--</option>
          <option value="2">FIRST YEAR</option>
          <option value="3">First Year Fall Semester</option>
          <option value="4">First Year Spring Semester</option>
          <option value="5">SECOND YEAR</option>
          <option value="6">Second Year Fall Semester</option>
          <option value="7">Second Year Spring Semester</option>
          <option value="8">THIRD YEAR</option>
          <option value="9">Third Year Fall Semester</option>
          <option value="10">Third Year Spring Semester</option>
          <option value="11">FOURTH YEAR</option>
          <option value="12">Fourth Year Fall Semester</option>
          <option value="13">Fourth Year Spring Semester</option>
          <option value="14">MASTER</option>
          <option value="15">PhD</option>
  </select>
  </div>
```

```
  <br><br><br>
  <input type="submit" value="Search" class="button">
</form>

  <br><br><br>
  <img src="bg1.png" alt="Smiley face" width="100%" height="100">
</div>

</body>
</html>
```

Code for Course Search

```
<!DOCTYPE html>
<html>
<head>
<style>
body {
    margin: 0;
}

ul {
    list-style-type: none;
    margin: 0;
    padding: 0;
    width: 15%;
```

```
    text-align: center;
    background-color: #f1f1f1;
    position: fixed;
    height: 100%;
    overflow: auto;
}

li a {
    display: block;
    color: #000;
    padding: 8px 16px;
    text-decoration: none;
}

li a.active {
    background-color: #000000;
    color: white;
}

li a:hover:not(.active) {
    background-color: #555;
    color: white;
}
```

```
textarea {
    width: 60%;
    height: 150px;
    padding: 12px 20px;
    box-sizing: border-box;
    border: 2px solid #ccc;
    border-radius: 4px;
    background-color: #f8f8f8;
    font-size: 16px;
    resize: none;
}

input[type=text] {
    width: 70%;
    height: 50px;
    box-sizing: border-box;
    border: 0px solid #ccc;
    border-radius: 4px;
    font-size: 16px;
    background-color: #f1f1f1;
    background-position: 10px 10px;
    background-repeat: no-repeat;
    padding: 12px 20px 12px 40px;
```

```
}

select {
    width: 50%;
    padding: 12px 20px;
    border: none;
    font-size:16px;
    border-radius: 4px;
    background-color: #f1f1f1;
}

.button {
    width: 20%;
    padding: 10px 20px;
    text-align: center;
    text-decoration: none;
    display: inline-block;
    font-size: 18px;
    margin: 4px 2px;
    -webkit-transition-duration: 0.4s; /* Safari */
    transition-duration: 0.4s;
    cursor: pointer;
    background-color: white;
```

```
    color: black;
    border-radius: 12px;
    border: 2px solid #555555;
}
.button:hover {background-color: #e7e7e7;}
</style>


</head>
<body>

<ul>
  <li><a href="http://localhost/rdfapi-php/Project_20159228/index.php">Home</a></li>
  <li><a class="active" href="https://neu.edu.tr/academic/faculties/faculty-of-engineering/departments/department-of-information-systems-engineering/">Home Page of NEU ISE Department</a></li>
  <li><a href="http://gmail.com">Send Message</a></li>
  <li><a class="active" href="http://google.com">Google Search</a></li>
</ul>

<div style="margin-left:20%; padding:0px 16px;height:500px;">
    <img src="neu.png" alt="Smiley face" width="95%" height="135">
<br>
```

```
<h3 align="center"><?php
echo '<a href="http://localhost/rdfapi-php/Project_20159228/index.php">Home</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/search1.php">Course Offered</a>
-
<a href="http://localhost/rdfapi-php/Project_20159228/course.php">Course Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/lecturer.php">Person (Lecturer)
Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/advisor.php">Advisor Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/hod.php">HOD Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/secretary.php">Secretary
Search</a>';
?></h3>
<br>
  <h3 align="center">SEARCH FOR INFORMATION ABOUT COURSE</h3>
<br><br>
<form action="show1.php" method="post" align="center">
  <div class="select-style">
  <select name="select">
    <option value="16">Course Search</option>

  </select>
  </div>
```

```
  <br><br>
  <input type="text" name="sparql" placeholder="Enter the course name you want to find e.g. Database System ...">

  <br><br><br><br>
  <input type="submit" value="Search" class="button">
</form>

  <br><br><br>
  <img src="bg1.png" alt="Smiley face" width="100%" height="100">
</div>

</body>
</html>
```

Code for Person Search

```
<!DOCTYPE html>
<html>
<head>
<style>
body {
    margin: 0;
}
```

```
ul {
    list-style-type: none;
    margin: 0;
    padding: 0;
    width: 15%;
    text-align: center;
    background-color: #f1f1f1;
    position: fixed;
    height: 100%;
    overflow: auto;
}

li a {
    display: block;
    color: #000;
    padding: 8px 16px;
    text-decoration: none;
}

li a.active {
    background-color: #000000;
    color: white;
```

```
}

li a:hover:not(.active) {
    background-color: #555;
    color: white;
}

textarea {
    width: 60%;
    height: 150px;
    padding: 12px 20px;
    box-sizing: border-box;
    border: 2px solid #ccc;
    border-radius: 4px;
    background-color: #f8f8f8;
    font-size: 16px;
    resize: none;
}

input[type=text] {
    width: 70%;
    height: 50px;
    box-sizing: border-box;
```

```
    border: 0px solid #ccc;
    border-radius: 4px;
    font-size: 16px;
    background-color: #f1f1f1;
    background-position: 10px 10px;
    background-repeat: no-repeat;
    padding: 12px 20px 12px 40px;
}

select {
    width: 50%;
    padding: 12px 20px;
    border: none;
    font-size:16px;
    border-radius: 4px;
    background-color: #f1f1f1;
}

.button {
    width: 20%;
    padding: 10px 20px;
    text-align: center;
    text-decoration: none;
```

```
    display: inline-block;
    font-size: 18px;
    margin: 4px 2px;
    -webkit-transition-duration: 0.4s; /* Safari */
    transition-duration: 0.4s;
    cursor: pointer;
    background-color: white;
    color: black;
    border-radius: 12px;
    border: 2px solid #555555;
}
.button:hover {background-color: #e7e7e7;}
</style>



</head>
<body>

<ul>
  <li><a href="http://localhost/rdfapi-php/Project_20159228/index.php">Home</a></li>
   <li><a class="active" href="https://neu.edu.tr/academic/faculties/faculty-of-engineering/departments/department-of-information-systems-engineering/">Home Page of NEU ISE Department</a></li>
```

```
  <li><a href="http://gmail.com">Send Message</a></li>
  <li><a class="active" href="http://google.com">Google Search</a></li>
</ul>

<div style="margin-left:20%; padding:0px 16px;height:500px;">
   <img src="neu.png" alt="Smiley face" width="95%" height="135">
<br>

<h3 align="center"> <?php
echo '<a href="http://localhost/rdfapi-php/Project_20159228/index.php">Home</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/search1.php">Course Offered</a>
-
<a href="http://localhost/rdfapi-php/Project_20159228/course.php">Course Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/lecturer.php">Person (Lecturer)
Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/advisor.php">Advisor Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/hod.php">HOD Search</a> -
<a href="http://localhost/rdfapi-php/Project_20159228/secretary.php">Secretary
Search</a>';
?></h3>

<br>

 <h3 align="center">SEARCH FOR INFORMATION ABOUT PERSON</h3>
```

```
<br><br>
<form action="show1.php" method="post" align="center">
  <div class="select-style">
  <select name="select">

    <option value="17">Person Search such as lecturers, Advisers e.t.c...</option>

  </select>
  </div>

  <br><br>
  <input type="text" name="sparql" placeholder="Enter the person's name you want to find e.g. Ameh...">

  <br><br><br><br>
  <input type="submit" value="Search" class="button">
</form>

  <br><br><br>
  <img src="bg1.png" alt="Smiley face" width="100%" height="100">
</div>
```

```
</body>

</html>
```

APPENDIX 6

SIMILARITY REPORT PAGE