

A NEW SEARCH ENGINE ONTOLOGY FOR VISUALLY IMPAIRED USERS

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ABSTRACT

A NEW SEARCH ENGINE ONTOLOGY FOR VISUALLY IMPAIRED USERS

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In today's world, semantic technology is getting more and more important day by day. After Web 3.0, semantic infrastructure has become a must for internet based systems. In this thesis, we have focused on the semantic basis of search engines. Google, Yahoo, Yandex and Bing are the most popular search engines. All of them have a semantic structure, however the semantics have been developed according to the users who have not any visual impairment. In this study, search engine ontology has been developed according to the visually impaired users' needs. To this aim, two surveys have been conducted for analyzing requirements and ontology has been developed according to the survey results. A Google search engine interface has been developed according to this ontology by using Google API. Final ontology has been shared with visually impaired users and compared with classic search engine semantics. As a result, visually impaired users have reached needed information faster with new search engine interface. Protégé has been used as an ontology editor and OWL has been chosen as the ontology language. Hermit and Fact++ have been used as reasoners. Developed ontology may be used as a semantic structure of a search engine in the future.

Keywords: Search Engine, Semantic Web, Ontology, Requirements Analysis, Knowledge Engineering

ÖZ

GÖRME ENGELLİ KULLANICILAR İÇİN YENİ BİR ARAMA MOTORU ONTOLOJİSİ

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Günümüz dünyasında, anlamsal teknolojiler günden güne daha önemli olmaktadır. Web 3.0'dan sonra, anlamsal altyapı internet tabanlı sistemler için bir zorunluluk haline gelmiştir. Bu tez çalışmasında, arama motorlarının anlamsal altyapısı üzerine odaklanılmıştır. Günümüzün en popüler arama motorları Google, Yahoo, Yandex ve Bing'dir. Bu arama motorlarının hepsi anlamsal bir altyapı üzerinde çalışmaktadır. Fakat bütün bu anlamsal altyapılar, herhangi bir görme engeli olmayan kullanıcıların ihtiyaçları baz alınarak hazırlanmıştır. Bu çalışmada, görme engelli kullanıcıların arama ihtiyaçlarına uygun bir arama motoru ontolojisi hazırlanmıştır. İki ayrı anket çalışmasıyla kullanıcı gereksinimleri belirlenmiş ve anket sonuçlarına göre bir ontoloji oluşturulmuştur. Google API kullanılarak, bu ontolojiyi temel alan bir Google arama motoru arayüzü geliştirilmiştir. Görme engelli kullanıcılara, bu arayüzün sağladığı sonuçlarla klasik Google'ın sonuçları mukayese ettirilmiştir. Sonuç olarak kullanıcılar bu arayüzün getirdiği sonuçların daha iyi olduğunu söylemişlerdir. Ontoloji geliştirme aracı olarak Protégé ve ontoloji geliştirme dili olarak da OWL kullanılmıştır. Hermit ve Fact++ reasoner aracı olarak kullanılmıştır. Yaratılan bu ontoloji gelecekte görme engelli kullanıcılar için oluşturulacak uygulamalara da anlamsal bir altyapı sunabilir.

Anahtar Kelimeler: Arama Motoru, Anlamsal Web , Ontoloji, Gereksinim Analizi, Bilgi Mühendisliği

Dedicated to my dear father Yilmaz Akkaya and my dear mother Sevim Akkaya.

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LIST OF ABBREVIATIONS

SVD: Singular Value Decomposition

API: Application Development Interface

OWL: Web Ontology Language

RSS: Rich Site Summary

W3C: World Wide Web Consortium

SEO: Search Engine Optimization

URI: Uniform Resource Identifier

HTTP: Hyper Text Transfer Protocol

HTML: Hyper Text Markup Language

SSH: Secure Shell

TF/IDF: Term Frequency / Inverse Document Frequency

CHAPTER 1

INTRODUCTION

1.1 Introduction & Problem Description

Nowadays, Web is the most important way of reaching information. The easiest way of reaching information is Web surfing in all areas like education, health, commerce, communication, arts, etc. There are many tools for this purpose: smart phones, tablets, desktop computers, laptops, etc. Web plays a crucial role in our lives and it has a history like all the developing systems.

When we investigate Web history, we can see that World Wide Web has periods. Currently, we passed 1.0 and 2.0 periods. Web 1.0 is the first generation of the Web. According to Berners-Lee [1], Web 1.0 could be considered the read-only Web and also as a system of cognition. In other words, Web 1.0 is the primitive period of the Web history with weak user interactions. In this period, people mostly use Web for searching and reading. Web 2.0 period comes after Web 1.0. Tim O'Reilly defines Web 2.0 on his website as follows: "Web 2.0 is the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that new platform. Chief among those rules is this: Build applications that harness network effects to get better the more people use them." [2].

Today, we are living in Web 3.0 world. Web 3.0 is the synonym of semantic Web. According to W3C, "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries." [3]. According to Wikipedia definition, Web 3.0 might be called 'the intelligent Web' which emphasizes machine-facilitated understanding of information

in order to provide a more productive and intuitive user experience. Web 4.0 is coming soon.

Users want to reach information via Web by using some tools, but which websites do users mostly use? In the past, users type relevant website's address to the browser's address bar, press enter and reach the information. In today, there is an easier and popular way of reaching information: Search engines which have been integrated with Web browsers. Most browsers' address bar also works as a search engine. For example, users do not have to type the full address of a Website like "www.facebook.com", typing "facebook", pressing enter and clicking the first item of the result set is enough. Because of this, search engines are the most important part of reaching information.

Namely, search engines and semantic structures are very important for user satisfaction. What about the relationship between these two items? User satisfaction increases owing to semantic developments day by day, but when developing semantic structure of search engines, requirements are analyzed according to users who have no visual impairment. The main idea of this thesis is revealed in here. Search engine semantic structure has been created and optimized for general users but what about visually impaired users?

In this study, I have focused on improving semantic structure of a search engine according to visually impaired people's needs. A sample has been chosen from visually impaired computer users and two surveys have been conducted. Visually impaired users' requirements have been analyzed by these surveys. Ontology has been developed according to survey results. The purpose for developing this ontology is to reduce the difficulties for the visually impaired users when using the search engines, and to deliver better results to prevent their loss of time. Normally, most of the search engines already offer the best results to their users with an ontological infrastructure, but there is not any specific search engine ontology which is based on the needs of the visually impaired users. Results have been compared with classical search engine ontologies. This study will be able to guide future applications developed for visually impaired users.

1.2 Thesis Goals

The objectives that must be achieved are given as follows:

- Conducting a preliminary survey with the intent of determining actual survey's question list,
- Designing a second survey according to preliminary survey results with the intent of analyzing visually impaired users' requirements from the point of search engines,
- Building an information map which has been specified according to visually impaired users,
- To reveal classical search engines' relevancy according to visually impaired users,
- Developing an ontology which is specified and optimized according to survey results,
- Comparing new semantic search engine ontology's result set relevancy in comparison with a search engine such as Google,
- Guiding future applications by developed ontology which reveals search engine requirements of visually impaired users.

1.3 Contributions

This study has contributions to the literature in several points. Firstly, this study gives detailed explanation of ontology based search engines. Another contribution of this thesis is the requirement analysis which shows the visually impaired computer users' needs in details. This thesis has revealed that, for what purposes visually impaired people use search engines. And this is also an important contribution. This study gives an idea about the problems of visually impaired people while using a search engine. On the other hand, this study includes an analysis about Google trends reports' compatibility with visually impaired users. The most important contribution of this thesis is the developed search engine ontology according to visually impaired people's needs. This ontology has a complicated and categorized structure with many

classes, properties and instances. So, it can be used by different applications in future.

1.4 Approach

At the starting point of each development project, requirement analysis is at the first rank. In this study, I have a specific sample, which includes visually impaired computer users. For specifying requirements, I have divided survey study in two parts. First part is a preliminary study. Preliminary survey's aim is to analyze domain and determine actual survey's question list. Sample size was seven. Six participants were totally visually impaired and only one participant was partially visually impaired (70%). All participants use Windows as operating system and Jaws as screen reader. A survey has been conducted for analyzing their search engine requirements. This survey is presented in Appendix-A. The second part of the requirements analysis section is conducting actual survey. Actual survey includes 19 questions and all of these questions have been prepared according to preliminary survey results. The actual survey can be found in Appendix-B. Afterwards, ontology has been developed according to survey results and Google trends. Google Trends is a web service which serves most searched keywords for specific time periods and specific locations. Google trends have been used as a guide for finding most searched keywords. These keywords have been revised according to visually impaired users' requirement needs. For instance, "photo" is a popular keyword in Google trends, but "photo" keyword might not be so meaningful to visually impaired users.

In the development stage, classes, object properties, data type properties and instances have been created. Individuals have been generated according to survey results and Google trends report.

A Google search engine interface has been developed according to this ontology by using Google API. This interface has been shared with visually impaired users as a comparison with classic Google. Four tasks have been given to visually impaired participants and they have asked for using both interfaces for each task. Elapsed time has been collected for each task and each interface.

Hermit and Fact++ reasoners have been used as reasoning tools. Hermit and Fact++ modules have checked ontology's consistency. Protégé has been used as ontology editor and OWL has been used as an ontology language. Onto Graph tool has been used for visualization of the ontology.

1.5 Thesis Layout

Chapter 2: Background Work: In this chapter, I give a brief overview of the related technologies to this thesis. In particular, the history of web, semantic web, search engines, semantic search engines, Google trends, accessibility, ontology and reasoning engines.

Chapter 3: Related Work: This chapter includes a summary of the other related studies in literature. The contribution of this chapter is to reveal that there is no search engine ontology that has been specified according to visually impaired users.

Chapter 4: Proposed Methodology For Search Engine Ontology Development For Visually Impaired Users: This chapter includes all requirements analysis and ontology development steps: conducting preliminary survey, determining actual survey questions, quantifying requirements, conducting actual survey, implementing survey results, creating classes, creating properties, generating individuals, executing reasoning engine and checking consistency.

Chapter 5: Evaluation: In this chapter, visually impaired computer users have evaluated the ontology developed within the scope of this thesis. Final ontological interface – classic Google comparison is given in this chapter.

Chapter 6: Discussion: In this chapter, our findings, limitations and deficiencies are discussed. Future studies are also presented in here.

Chapter 7: Conclusion: This chapter presents the results obtained in this thesis.

CHAPTER 2

BACKGROUND WORK

The output of this thesis is search engine ontology especially for visually impaired people. In this development way, many technologies have been used. In this chapter, I give a brief overview of the related technologies.

2.1 Web History

The World Wide Web (commonly known as the web) is not synonymous with the Internet but is the most prominent part of the internet that can be defined as a techno-social system to interact humans based on technological networks [2]. As I mentioned in chapter 1.1, web is a developing system. So, the web has historical periods like other developing systems. I have introduced these development periods briefly in the introduction section, here, these periods will be examined in detail.

There are four development periods defined up to the present: PC era (1980-1990), Web 1.0 (1990-2000), Web 2.0 (2000-2010), Web 3.0 (2010-2020) and Web 4.0 (2020-2030). PC era period is not in our research area. Hence, we will start investigating with Web 1.0 period.

Web 1.0 can be defined as read-only web. In this period, websites had static HTML pages. Web content did not change until Web admin update the data. There was no dynamic content at Web pages. People generally use Web for reading and that is why Web 1.0 is defined as read-only Web. User interaction was so weak. Core protocols of Web 1.0 were HTTP, HTML and URI [2].

The second period of Web was Web 2.0. We have defined Web 1.0 as read-only Web and similarly we can define Web 2.0 as read-write Web. In Web 2.0 period,

dynamic Web pages increased human interaction. User participation had an important role with dynamic Web. Because of this, Web 2.0 has a user-centric design view. Blogs, RSS, wiki and social networking are the primary services came out in this period.

Blog service is a Web-based system, which users can make websites easily. Actually, blog system is the main Web page of small Web pages. In this way, users do not consume their time for designing, coding and optimizing processes. Blog system handles technical issues and blogger only creates his or her content with easy interfaces.

RSS (really simple syndication) is a family of Web feed formats used for syndicating content from blogs or Web pages. RSS is an XML file that summarizes information items and links to the information sources. Using RSS, users are informed of updates of the blogs or websites, which they're interested in [4].

Wiki can be defined as today's encyclopedia. In wiki project, anyone can write anything about any subject. This project aims to collect implicit information and serve it all over the world.

After Web 2.0 came out, social networking changed our lives deeply. "Social networking" term is a general term and it includes social media elements like facebook, twitter, foursquare, flicker, instagram, vine, etc. According to Boyd et al.: "We define social network sites as Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site." [5].

The third period of Web history is Web 3.0. As I mentioned before, "Web 3.0" is the synonym of "semantic Web". The Semantic Web brings structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users. The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation [6].

The last defined period of Web is Web 4.0. This period is also known as symbiotic Web. Symbiotic Web is interaction between humans and machines in symbiosis. It will be possible to build more powerful interfaces such as mind-controlled interfaces using Web 4.0. In simple words, machines would be clever on reading the contents of the Web, and react in the form of executing and deciding what to execute first to load the websites fast with superior quality and performance and build more commanding interfaces [2].

2.2 Search Engines

In 1990, the first search engine, Archie, was developed at McGill University, retrieving information from 300,000 Internet hosts back then. It was soon followed by rivals Veronica, Jughead, and Gopher. With the release of the Web to the public in 1991, a new generation of efficient search engines was developed that used “indexes” (the engine’s catalog of Web pages), “spiders” (programs that searched the Web to add pages to the index), and “relevancy software” that ranked retrieved pages for their match to the query [7]. Search engine has a very simple workflow. User inputs a keyword to search bar, press enter and attains search results. On the other side, search engine gets keyword, combs through websites, match these websites with keyword and lastly serves a result page. Search speed, generating relevant results, algorithm success and total number of indexed websites are the factors, which specifies engine’s success.

In this day and age, using Web technologies is the most popular and easy way of for reaching information. There are some other ways but the most useful one is surfing by search engines. People use search engines not only for reaching information but also for signing on other systems. In Web 1.0 times, people must type the full Web address to the Web browser’s address bar, click enter and join the aforementioned website. This workflow was time consuming. Developers realized that typing full address is not user friendly. Because of this, search engine developers created their own Web browser. These new browsers’ address bar also works as a search engine such as Chrome, Firefox, etc. After this evolution, other browsers also revised their address bar. Today, users prefer only typing relevant keywords to the website content

rather than typing full address into the address bar. This argument is supported by Google Trends reports. Users type “twitter” to the search bar, clicks on first result and join the twitter Web page. Generally, users do not type “twitter” word for getting information about twitter, they type it for signing on to the twitter.

Search engines have a complex and rule-based algorithm. When user simply inputs keywords to a search bar and starts search workflow, search engine match this query with an index that created before. This index includes the document’s keywords and pointers, which point document locations.

A search engine has four essential modules:

- A document processor,
- A query processor,
- A search and matching function,
- A ranking capability [8].

The first step of a search algorithm is the document processor. Document processor prepares, processes, and inputs the documents, pages, or sites that users search against. The document processor performs some or all of the following steps:

- Normalizes the document stream to a predefined format.
- Breaks the document stream into desired retrievable units.
- Isolates and metatags subdocument pieces.
- Identifies potential indexable elements in documents.
- Deletes stop words.
- Stems terms.
- Extracts index entries.
- Computes weights.

- Creates and updates the main inverted file against which the search engine searches in order to match queries to documents [8].

The second step is query processor. Document processing shares many steps with query processing. More steps and more documents make the process more expensive for processing in terms of computational resources and responsiveness [8].

The steps in query processing are as follows (with the option to stop processing and start matching indicated as "Matcher"):

- Tokenize query terms.
- Recognize query terms vs. special operators.
- Delete stop words.
- Stem words.
- Create query representation.
- Expand query terms.
- Compute weights [8].

Search and matching function comes after query processor. Searching the inverted file for documents meeting the query requirements, referred to simply as "matching," is typically a standard binary search, no matter whether the search ends after the first two, five, or all seven steps of query processing [8].

Having determined which subset of documents or pages matches the query requirements to some degree, a similarity score is computed between the query and each document/page based on the scoring algorithm used by the system [8].

The last step is rating. Scoring algorithms rankings are based on the presence/absence of query term(s), term frequency, tf/idf, boolean logic fulfillment, or query term weights.

After computing the similarity of each document in the subset of documents, the system presents an ordered list to the user. The sophistication of the ordering of the documents again depends on the model the system uses, as well as the richness of the document and query weighting mechanisms [8].

Furthermore, using search engine for spreading an idea is one of the most efficient marketing strategies. People spent most of their time in front of computers or smart phones. Electronic documents such as newspapers, books, articles, etc. take place of the paper-based sources. Therefore, paper based marketing strategies are not efficient for spreading in today's digital world. Publishing an advertisement by using search engine's result page is a very efficient and popular way of reaching customer.

Search engine optimization (SEO) is an algorithm, which determines result page ranking. SEO experts evaluate a website according to optimization rules and revises deficient parts of the system. For instance, describing Web page in meta tags can make a website more optimal for a search engine. Having an optimal Web page increases website's chance to have a first rank in result pages.

2.3 Semantic Search

Thus far, we have focused on search engine algorithm and functionalities. On the other hand, there is also one another important issue lying under search engine optimization. It is semantic structure. When using a search engine, user satisfaction depends on finding the expected results at the result page. Satisfying user expectation is possible if search engine estimations match with user expectations. For example, Google sets special search engine results according to user location. The "Ankara" keyword's search results from Turkey can be found in Figure 2.1 and Figure 2.2 shows the same keyword's results from United Kingdom. As seen in the figures, search results change according to user location.

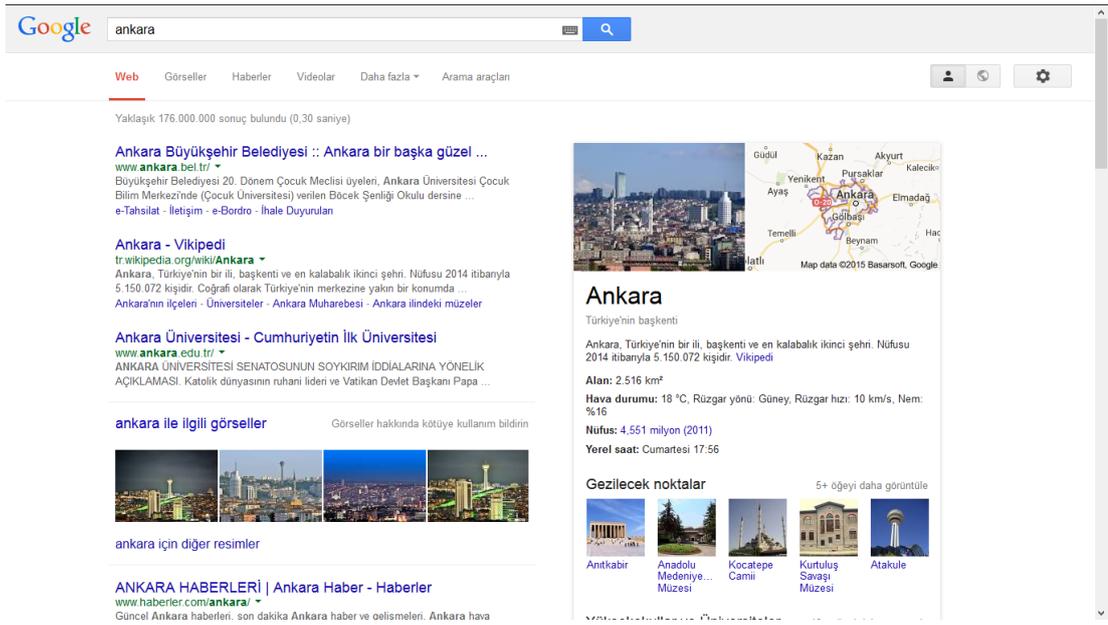


Figure 2.1 - Result Page from Turkey

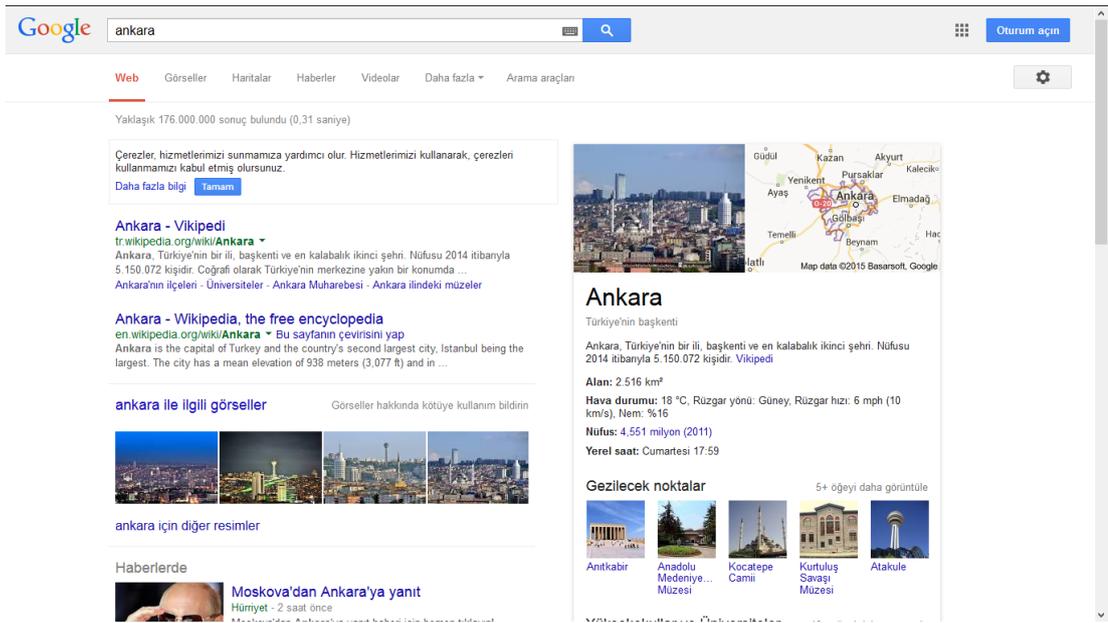


Figure 2.2 - Result Page from United Kingdom

Semantic search attempts to improve the results of research searches in two ways, a) traditional search results take form of a list of a document/Web pages and b) the search phrase in research searches typically denotes one (or occasionally two) real-world concepts [9].

According to search engine mechanism, presenting demands and a formula evaluating present related technology of that can solve and promote the efficiency of search engine, and formulating the demands of wisdom search engine. It uses Description Logic Inference System to integrate the digital library ontology to proceed with the inference of user requirement, and combines the content search mechanism and knowledge inference to accomplish the study of intelligent search engine [10].

As mentioned above, search result optimization is an important issue for user satisfaction. User starts searching with a result expectation. Query results must catch these results by semantic algorithms. A typical semantic search engine should consist of the following components: (1) Ontology development, (2) Ontology Crawler, (3) Ontology Annotator, (4) Web crawler, (5) Performing semantic search, (6) Query builder, and (7) Query pre-processor [11].

2.4 Google Trends

Google is the most popular and most used search engine all over the world. Google does not only develop search engine, but also serves some APIs and services for public use. One of these services is the Google Trends. Google collects all the user queries in its database, analyses them and serves as statistics grouped by geographic location and category. User search tendencies can be analyzed by using this service. Google trends also guide developers about user requirements. For instance, “horoscope” has been the most searched keyword and ranked first in trends report. This means, a popular website with many visitors can be designed by the help of SEO rules. Eventually, Google trends specify user requirements and market needs.

The search in Google Trends uses a query language that is different from that used in Google Search. One can enter a single term or phrase as a topic and combine terms using a vertical bar “|” or remove terms using a minus “-”. Furthermore, up to five terms (or phrases) can be compared in one result view by separating them with a comma [12]. This feature has been used while analyzing the keywords which include

more than one word in later chapters.

2.5 Accessibility

According to the World Wide Web Consortium (W3C) Web Accessibility Initiative: “Web accessibility means that people with disabilities can use the Web. More specifically, Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web.” [13]. W3C publishes Accessibility Guides for Web developers. Developers must develop websites according to these rules for accessibility.

In reality, it covers a much broader spectrum. It is about giving everyone unhindered access to a website regardless of the technology they use (e.g. Web-enabled television, mobile phone, screen reader, etc), and of their computer settings (e.g. screen resolution, browser, availability of plug-ins such as Flash). Therefore, a more useful and positive definition is: “Web accessibility is about providing unhindered access to the Web for everyone, regardless of disability and/or browsing technology”. [13].

Visually impaired people use screen readers like Jaws to interact with websites. Screen readers identify html tags and parse them into voice. For example, in Figure 2.3, screen reader identifies <title> tag and reads the content that has been written between title tags. User only hears a voice, which says “HTML example” and keeps reading. This is the basic algorithm of a screen reader.

```
<!DOCTYPE html>
<html>
<head>
  <title> HTML Example</title>
  <meta charset="UTF-8">
</head>
<body>

<p>The HTML head element contains meta data.</p>
<p>Meta data is data about the HTML document.</p>

</body>
</html>
```

Figure 2.3 - Basic HTML Example

Namely, screen readers cannot read contents, which were not created according to accessibility rules. In order to reaching visually impaired users, developers must obey accessibility rules.

2.6 Ontology

An ontology defines a common vocabulary for researchers who need to share information in a domain. It includes machine-interpretable definitions of basic concepts in the domain and relations among them [14]. In other words, ontology is an information map which includes some technical components like classes, properties and instances. Actually, ontology defines a domain by using some markup languages.

Why would someone want to develop an ontology? Some of the reasons are:

- To share common understanding of the structure of information among people or software agents,
- To enable reuse of domain knowledge,

- To make domain assumptions explicit,
- To separate domain knowledge from the operational knowledge,
- To analyze domain knowledge [14].

In this study, ontology is used for identifying search engine environment according to visually impaired users with the intent of search result optimization.

2.7 Reasoning Engines

A reasoner is a program that infers logical consequences from a set of explicitly asserted facts or axioms and typically provides automated support for reasoning tasks such as classification, debugging and querying [15]. By using a reasoner, (1) consistency can be checked , (2) relationships between classes can be identified. Briefly, a reasoning engine reveals the redundancy, inconsistency and uncertainty of an ontology. Some of the popular reasoners are: Pellet, Racer, Fact++, Hermit and JFact. In this study, Fact++ and Hermit have been used as reasoning engines.

CHAPTER 3

RELATED WORK

The aim of this study is to develop new search engine ontology especially for visually impaired people. Before analyzing requirements and developing ontology, it is necessary to review literature. The literature review has been presented in two chapters: Search engine result page improvement and ontology based search engines. Actually, there are more studies in literature about accessibility and search engine optimization but these studies are not about ontological optimization. They are all about user interface design according to visually impaired users. Because of this, the details of search engine design optimization studies have not be given in literature review.

Reaching information via inaccessible Web pages has always been challenging for visually impaired users. According to Leporini [16], in order to be truly satisfying and effective for users with disabilities, a Web service or page must not be well organized and appealing but also accessible and usable. In this respect, she has investigated the accessibility and usability of Google News which is an online service provided by Google. Her study has shown that, Google News service is accessible for “reading news”. On the other hand, the main difficulties have been related to usability issues. In spite of her study is about accessibility, I have not focused on this study’s details because its main issue is not about semantic search or ontology based search. Her study is about accessibility and usability of Web services.

Leporini’s [16] study about Google News is not only the study which is about the accessibility and usability of web pages. Leporini et al. [17] have designed a new Google interface which can be read more easily via screen readers. They have evaluated their study with 12 visually impaired users. In this study, Leporini et al.

[17] have aimed at improving the usability of web search tools for visually impaired users who interact via screen readers. Even though this study is also about accessibility and search engine optimization, it is not in my area of interest because they have optimized search tool by optimizing page design. Because of this, their study's details have not been given in this chapter.

3.1 Search Engine Result Page Improvement

Reaching needed result as soon as possible is important for user satisfaction. Search engines have simple work flows. User types a keyword into the search bar and gets the result page. King [18] defines each result set as a “collection” and he has a methodology which is reducing search costs like time, CPU, user effort, etc. while trying to reach the best collection. He is achieving this goal by,

- producing results using non cooperative collections that approaches the results of working with cooperative collections,
- taking a user query and automatically selecting the best search engines to search,
- producing a system which can work with multiple search engines and perform at levels close to a centralized system and
- providing a method of judging a relevance of a search engine to a query [18].

On the other hand, it is not easy to find out true keywords, which match true collections. Searches with improper keywords reveal irrelevant collections. King's study [18] also includes collection selection ontology. This ontology includes much more words than a standard dictionary. His system uses this dictionary for matching some outlier keywords that do not exist in standard dictionaries, with relevant collections. In short, this ontology has been used for collection optimization. There are some rules that help the system to choose the optimal collection. These rules are then used to classify each collection with using a system that finds clusters of high quality of information in the collections by sending groups of highly specific classification query terms. Hereupon system turns results into metadata. And lastly, system returns the best collection. The aim of my study is also returning optimum collection according to visually impaired people. In this respect, his study is parallel

with my study but he has a general target group as distinct from visually impaired users. His ontology development approach is similar to this study's ontology development approach.

Moreover, his system does not only choose the best collection but also choose the best search engine. This is the second main feature of his study. High level analysis method has been used for finding best search engine. On the other hand, Singular Value Decomposition was used to show how similar search engines are to each other. Singular Value Decomposition method showed that, Yahoo and Accoona search engines were the most similar to Google. At the moment, there is not any stable search engine especially designed for visually impaired people except some research studies. This singular value decomposition method can be used while comparing search engines especially developed for visually impaired people as a future study.

Finally, he has developed a large multi-domain ontology for Web Intelligence. Future applications will be able to use this ontology. On the other hand, this study finds out a method for mining classification terms from an ontology. This study is the first study that returns best collections by using ontology based approach. Another contribution of his study is a taxonomy based method for analyzing search engine content across multiple levels. As mentioned in introduction chapter, a large part of my study also includes requirement analysis. His taxonomy based method for analyzing search engine content has given opinion before starting requirement analysis.

In conclusion, King's study [18] has some similarities with my thesis in some parts. In my study, I have researched the information needs of visually impaired users, and he has also researched about information needs. We both developed an ontology after analyzing the dark side of Web intelligence environment. And we have both done this research for optimizing search engine results but John King especially focused on returning best result for users who has no visual impairment. My study's target group is visually impaired computer users. In spite of these two study's target groups are totally different; both have very similar analysis methodology. His study has leaded me about how to make content analysis before starting my study's analysis

which includes two surveys.

As it is known, it is not always easy to find the needed information in search engine result page. The first ranked result does not always include the needed information. On such an occasion, a user who has no visual impairment can easily scroll within the result page but this is not same for visually impaired people. They can only listen to the screen reader's voice until they find the needed information. According to Ivory, Yu and Gronemyer [19], there is a decision making difference between sighted and visually impaired users while using a search engine. In their study, they have focused on users' visual or cognitive abilities – affect their use of search result pages. As we know, sighted users scroll around the search results to achieve the needed information and they have revealed the difference between visually impaired and sighted users' efficiency in completing search tasks in their study [19].

They have composed nine search tasks. They have given these tasks to sixteen participants. Ten of these participants have been sighted and six of them have been visually impaired. Participants have used Google for each task. For each search task, they have served title, URL and summary features as usual and some new features different than classical Google like ads, words and quality by using a new interface in result page. Ads feature has shown how many ads a Web page includes and words feature has shown the total number of words on that Web page. Quality feature has had two levels: high quality and poor quality. High quality pages have been more accessible pages than poor quality pages. As a result, visual impairment has no effect on exploring results according to their study. On the other hand, without additional page features (ads, word count, quality level) users have wasted time to explore search pages which do not have needed information. Visually impaired users have preferred high quality pages during the decision process in their study. Before the review of their study, my evaluation methodology was not clear. Giving tasks to visually impaired users and calculating the elapsed time for each task have determined my evaluation methodology. I have also given some tasks to visually impaired participants and have calculated the elapsed time for each task.

According to Ivory et al. [19], visually impaired users spend twice as long as sighted participants to explore a search result. Moreover, visually impaired users spend about

three times as long as sighted users to find needed information on Web pages. This is an argument that supports my thesis scope. If visually impaired people spend more time than sighted users, then a special search engine design must be generated for them.

3.2 Ontology Based Search Engines

In today's technology, search engines have ontological structures and this semantic base develops day by day according to user needs. Various researchers study on this area. One of these researchers is Aghajani [20]. She has a study about semantic structure of Google. Moreover she studies about Google as a search engine in order to improve the usability and efficiency of semantic search by developing an ontology. Her ontology aims to enrich the user queries and gain user satisfaction in result pages. An ontology's logical objectives change according to chosen domain. Safety and security terms generated this ontology's domain. Aghajani's [20] study has been beneficial about serving an example search engine ontology model. In spite of domain differences, developing search engine ontologies have similar methodology.

Aghajani [20] has given "Semoogle" name to her search application. And this application has been developed according to safety and security domain. Furthermore, Semoogle has categorization feature. It has four categories: History, Mechanism, Prevention and Case Study. Semoogle uses ranking algorithms to categorize the Google search results in these four categories. In my study, I have not specified search categories, but categorization feature would be nice to have in future studies.

As mentioned above, she has developed a new semantic search engine which has an ontological structure by using Google API. She has chosen some keywords from the safety and security domain and searched these keywords by standard Google and Semoogle. Then she has compared the results. I have also evaluated my ontology by using standard and new Google interfaces. Her evaluation has showed that, the Semoogle increased the performance of search. Moreover, the evaluation has

demonstrated that this new application is somewhat better than the traditional Google search, and covers and satisfies the user requirements [22]. On the other hand, this application categorizes the search results in four categories and categorization increased the user satisfaction. I have seen once again that, building a semantic structure has positive effects on search engines. As a result of this, it can be deduced that, semantic structures increase user satisfaction. And that is why search engine developers attach importance to semantic structures.

I have mentioned about the importance of increasing user satisfaction by using semantic structures in previous paragraphs, but researchers generally develop semantic structures according to sighted people. What about visually impaired people? My study's main objective is to increase visually impaired users' satisfaction about search engines by using ontologies. As is known, visually impaired people read or listen to Web pages by the help of screen readers. Karthik et al. [21] have developed a voice enabled ontology based search engine for visually impaired people. Main objective of his study is to improve the usability and efficiency of semantic search using ontology in order to enrich the user queries and gain user satisfaction in resultant search with input and output as voice. In a few words, they have enabled user with using fewer number of words to gain best result set.

In their study, a new search engine application developed especially for visually impaired users. The input is got in form of voice and system converts voice into text. Converted text is searched through ontology and relevant results are returned in form of text. The application gets this text result set and converts into voice. Consequently, the result set is displayed in form of voice for visually impaired users. In this way, visually impaired users do not loose time with screen readers. They can directly interact with the system without any screen reader help. Eventually, this new application was tested on visually impaired people and the results were significant. The evaluation showed that, visually impaired user-voice enabled search engine application interaction is higher than classical text based search engine applications. This new method decreases time consuming and increases user satisfaction by returning best result set.

As a conclusion, search engines are important tools in an attempt to reach needed

information. And the user satisfaction is indirectly proportional to elapsed time while reaching information. Within this context, search engines must return the optimum result set for decreasing elapsed time. Developing a search engine supported by ontology is a significant methodology according to reviewed studies in this chapter. Another finding of this literature review is, there must be a difference between requirements analysis of sighted people and visually impaired people when the context is developing search engine. Because, search engine requirements change according to user's visual abilities.

CHAPTER 4

PROPOSED METHODOLOGY FOR SEARCH ENGINE ONTOLOGY DEVELOPMENT FOR VISUALLY IMPAIRED USERS

This chapter includes the detailed information about all steps of the applied methodology from preliminary survey to evaluation.

4.1 Methodology

As it is known, the main aim of this study is to develop a new search engine ontology for visually impaired people. The development steps can be seen as follows:

1. Conduct a preliminary survey with the aim of specifying actual survey questions
 - 1.1 Choose participants from a specific sample
 - 1.2 Collect the data with open questions
 - 1.3 Investigate problems with search engines
 - 1.4 Investigate offers for a better search engine
2. Analyze the preliminary survey's data
 - 2.1 Analyze the search engine usage purposes
 - 2.2 Analyze the problems about search engines
 - 2.3 Analyze the offers for a better search engine satisfaction
3. Design actual survey questions
 - 3.1 Create multiple choice and open questions which have been specified according to preliminary survey results on the purpose of evaluating search engine usage purposes
 - 3.2 Create questions which can evaluate the problems mentioned in preliminary survey
 - 3.3 Create questions which can evaluate the users' offers for a better search engine satisfaction

4. Conduct actual survey
 - 4.1 Choose participants from a specific sample
 - 4.2 Read survey questions and write down the answers
 - 4.3 Input survey data to local database
5. Analyze survey data
 - 5.1 Compute descriptive statistics like total, average and percent
 - 5.2 Interpret descriptive statistics
 - 5.3 Draw graphics which show the results more clearly
 - 5.4 Interpret the overall results
6. Develop ontology
 - 6.1 Create class structure according to survey results
 - 6.2 Create sub-class structure according to survey results
 - 6.3 Define properties between classes and sub-classes
 - 6.4 Input instances according to google trends reports and survey results
 - 6.5 Perform a consistency and conflict test by reasoning engines such as hermit and fact++
7. Develop a user interface
 - 7.1 Generate a search engine key from Google developers console
 - 7.2 Export the search engine code from Google developers console
 - 7.3 Deploy the exported code into server computer by using SSH
 - 7.4 Change the deployed html code according to interface design
 - 7.5 Revise the deployed code according to requirements (add or remove functions)
 - 7.6 Get promotions.xml file from Google developer's console
 - 7.7 Edit promotions.xml file according to developed ontology
 - 7.8 Import new promotions.xml file to Google's servers by using Google developer's console
8. Test new interface
 - 8.1 Prepare tasks which will be given to participants
 - 8.2 Install a program to the test computer which will help about calculating elapsed time to achieve a task
 - 8.3 Install or turn on a screen reader program on the test computer
 - 8.4 Open classic Google page by using Safari browser
 - 8.5 Read the each task to each participant

- 8.6 Calculate the elapsed time to achieve each task
- 8.7 If the task could not be completed in 5 minutes then cancel the task and collect the elapsed time “greater than 5 minutes”
- 8.8 Open the developed interface by using Safari browser
- 8.9 Read the each task to each participant
- 8.10 Calculate the elapsed time to achieve each task
- 8.11 If the task could not be completed in 5 minutes then cancel the task and collect the elapsed time “greater than 5 minutes”
- 8.12 Analyze the elapsed time for both interfaces
- 8.13 Compare two interfaces with regard to elapsed time

4.2 Conducting Preliminary Survey

As mentioned in previous chapters, the main aim of this study is to develop a new search engine ontology especially for visually impaired users. I have planned to study on a requirements analysis to specify ontology’s scope. Requirements engineering is concerned with the elicitation of the objectives to be achieved by the system envisioned, the operationalization of such objectives into specifications of services and constraints, the assignment of responsibilities for the resulting requirements to agents such as humans, devices and software, and the evolution of such requirements over time and across system families [22]. Requirement analysis is interchangeable with requirements engineering. For this purpose I have created a preliminary survey with 5 questions [Appendix-A]. The sample has been chosen according to thesis domain. There are only two high schools especially provide education for visually impaired students in Ankara. Mitat Enç is the biggest high school for visually impaired students that located in Ankara, Turkey. 7 participants have been chosen from this school who are high school students and able to use computer by screen reader. The four of these participants were female and the other three participants were male. All participants’ age was fourteen.

4.3 Preliminary Survey Results

The preliminary survey results showed that, all participants use Jaws as a screen reader. All participants prefer Jaws because Republic of Turkey Ministry of National Education supports this software. All participants also use Internet Explorer as a Web browser. The reason lying under Internet Explorer usage is Jaws compatibility with other browsers. According to participants, Jaws works best with Internet Explorer.

The most important component of this study is search engine. At the beginning of the study, I had to choose a search engine for analyzing, testing and comparing results, but I had to lean this choice on a scientific reason. That's why I have asked question 3 in preliminary questionnaire [Appendix-A]. The results have revealed that, Google is the mostly used search engine. Therefore, search engine ontology has been developed according to Google.

The first survey is only a preliminary study for designing the actual survey. Question 4 has been asked for analyzing in which purposes participants use search engines. Accordingly, this question is an open question. All answers have been collected and actual survey's question 6 has been prepared according to these answers [Appendix-B]. 11 different answers have been collected as follows:

- To find out how to go somewhere
- To find out timelines and stations of transportation options like bus, train, etc.
- Online shopping
- To buy social event tickets like cinema, theatre, etc.
- For researching or doing homework
- For sending e-mail
- To sign up or sign in social networks
- To listen to funny videos
- To listen to newspaper

- To listen to film or TV series
- For playing game

As is known, all the participants of this preliminary study are high school students. Because of this, participants use search engines mostly for doing their homework in school season. That is why they have mostly touched on difficulties of scanning search results while researching about a homework topic in question 5 [Appendix-A]. When a student type a topic into search bar, a result page occurs. A visually impaired user starts reading via screen reader from top to bottom. For example, the user typed “the life of Atatürk” and accessed result page via screen reader. The user chose first result (in general, the first results are Wikipedia pages), and starts reading. Screen reader reads each title, link, and images from top to bottom. After that, user achieves his/her goal and hears the needed information in the body part. This is something time consuming for students while doing homework. This matter will be analyzed in following chapters.

4.4 Actual Survey Design

The actual survey has been created based on the findings from the preliminary survey explained in the previous section. The actual survey has 19 questions. First three questions have been prepared to determine demographic structure of the participants. Questions 4, 5, 6 and 7 have been prepared according to preliminary survey results.

The preliminary survey has revealed why visually impaired people use search engine [Appendix-A]. These eleven different search reasons have been listed in Chapter 4.3. Questions 8, 9, 10, 11, 12, 13, 14 and 15 have been prepared according to these eleven areas. For example, preliminary study showed that, visually impaired people use search engine for signing in social networks. Well then, which social networks do they use? On the other hand, preliminary study showed that visually impaired people use search engine for listening music. Which websites do they visit for listening music or which keywords do they type for reaching music websites?

Actual survey's question 18 is similar to preliminary survey's question 5 [Appendix-A]. The aim of these two questions is same: "to find out difficulties visually impaired people face while they are using a search engine".

The aim of question 19 is to analyze how to improve search engines for a better satisfaction. Participants are also asked to list their ideas. These ideas can be a starting point for future studies.

Question 17 is totally different than survey's other questions. In chapter 2.4, detailed information has been given about Google Trends. The aim of this question is to reveal the search tendency differences between visually impaired and sighted users. The given options of the question have been cited from Google Trends reports. The report has a specific date June 2015 and a specific location Turkey.

4.5 Conducting Actual Survey

The preliminary survey has been conducted with students. The demographic properties of each participant and their answers to each question were so similar. In consequence, I have changed the sample. The preliminary sample was a high school, which has similar participants, but actual survey has conducted in an association, which has members with different demographic properties. Thereby, survey results would show the expectations and problems of all visually impaired user types.

In this second survey study, thirty-four members have been chosen from association's member list randomly. All participants were visually impaired. The survey has been conducted by a special technique. In general, conductor gives the survey paper to participant and gets back a filled survey, but in my sample, participants cannot read themselves. So, I have read the questions, listened their answers and filled the survey forms. This was time consuming for me, but on the other hand, I could give detailed information when they have not understand the question. Each survey has taken 5-10 minutes.

4.6 Actual Survey Results

As mentioned in chapter 4, a survey has been conducted between visually impaired users. An association has been chosen as a sample. Thirty-four members have been chosen from association's member list randomly. Thirteen female and nineteen male computer users have participated in this study. Participants have been chosen from different age ranges to analyze all visually impaired users requirements from different ages. Participants have been divided into five groups according to their ages. There is only one participant in between 13-19 years. 20% of the participants have an age in between 19-30 years. 30% of the participants' age is between 30-40 years and 32% of the participants' age is between 40-50 years. Lastly, 15% of the participants have an age more than 50 years old.

The first section of the survey quantifies the demographic properties of the sample. Gender and age are first two demographic parameters. Thirdly, survey quantifies participants' education level. 15% of the participants are primary school graduate, 44% of the participants are high-school graduate and 35% of the participants are post graduate. There are only 2 participants who have a graduate level with 6% ratio overall.

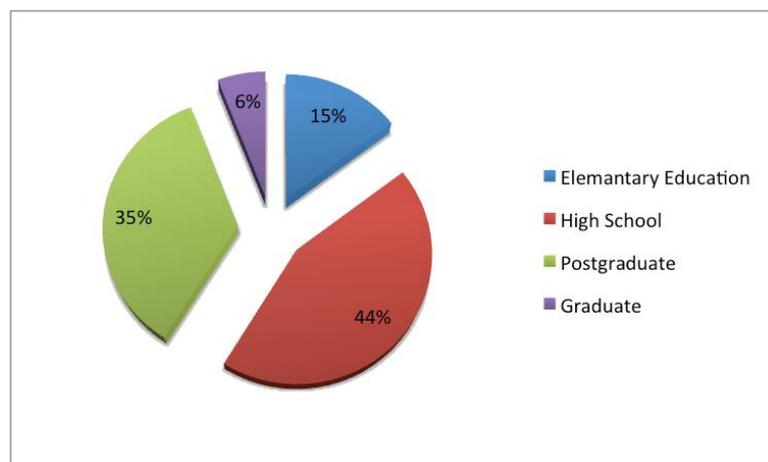


Figure 4.1 – Education Levels of Participants

This study is totally about visually impaired users. So, it is very important to conduct

this survey on visually impaired people. Visually impairment ratio has been asked as a fourth question to eliminate sighted users. According to World Health Organization, there are four types of visually impairment:

1. Normal vision,
2. Moderate visual impairment,
3. Severe visual impairment,
4. Blindness.

In my sample, minimum visually impairment ratio is 55%. This ratio can be classified as “severe visually impairment” according to some literature, but entire participants use computer by the help of a screen reader. So, I have not eliminated this participant as an outlier.

There are several Web browsers. I have chosen the most used browsers as asked options. These browsers are: Internet Explorer, Safari, Chrome, Yandex and Mozilla Firefox.

Only 2 participants do not use Internet Explorer as a Web browser. These 2 users only use chrome. 32 participants use Internet Explorer. 17 users prefer Chrome and Internet Explorer together. 7 users prefer Internet Explorer and Yandex interchangeable. Only 3 users use Mozilla Firefox interchangeable with Internet Explorer. None of the participants use Safari.

All participants use Google as a search engine, but 7 of them also use Yandex as a second choice. I have asked why Yandex as a second choice as an open question. The answers were very similar and can be summed up as trying new technologies tendency and Yandex’s search speed. Participants have stated that, after once they have got used to Yandex, it is much faster than Google, but it is not easy to get used to Yandex in the beginning.

33 participants use Jaws as a first choice, but one participant only uses Voice Over as a screen reader. This user only uses Voice Over because he does not have a computer

and Jaws only runs with computer. He uses Internet via mobile phone and Voice Over is the most used mobile screen reader according to survey results. 8 participants use Voice Over and Jaws interchangeable and 4 participants use NVDA interchangeable with Jaws and Voice over.

As mentioned above, most of the participants (94%) prefer Internet Explorer for surfing. Preliminary survey results have revealed that, visually impaired people mostly use Internet Explorer and Jaws couple. Preliminary survey's participants have remarked that, Jaws works best with Internet Explorer. I have mentioned this idea while conducting actual survey. I have asked why they prefer Internet Explorer and heard the same reason. Nearly all participants said that, Jaws is the best screen reader and this screen reader works best with Internet Explorer. Four participants have emphasized that, they try to use new technologies like Google and Yandex, but it is not easy to use Jaws with these browsers. As I mentioned in chapter 4.3, according to participants, Jaws and Internet Explorer work best together.

Table 4.1 Search Engine Usage Purposes

Purpose of Use	Number of Participants Answered Yes
To find out how to go somewhere	4
To find out timelines and stations of transportation options like bus, train, etc.	2
Online shopping	1
To buy social event tickets like cinema, theatre, etc.	2
For researching or doing homework	27
For sending e-mail	14
To sign up or sign in social networks	14

To listen to funny videos	9
To listen to newspaper	12
To listen to film or TV series	10
For playing game	1

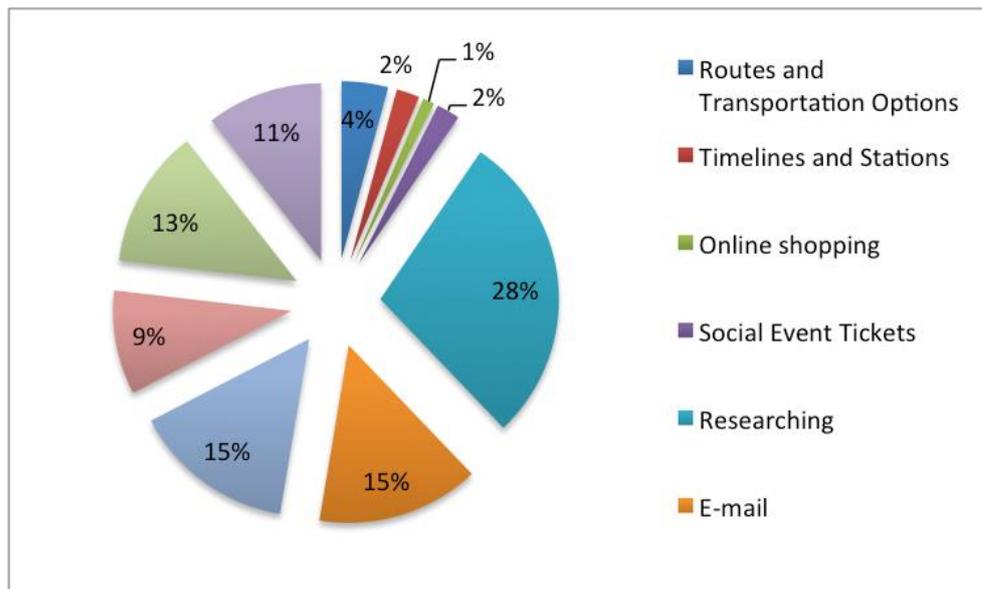


Figure 4.2 – Participants' Purpose of Search Engine Usage

As it is shown above in details, visually impaired people mostly use Internet on the purpose of researching or doing homework with 80% percentage. 41% of the participants use search engine for sending e-mail and to sign up or sign in social accounts. 35% of the participants use search engines to listen to newspaper. 29% of the participants' aim of use is listening to film or TV series.

As mentioned before, this survey study has been conducted in a special way. I have read the questions and written down the answers. While I was writing down the answers I always ask if they want to emphasize something. These open notes have showed that, participants have difficulty while they are shopping online. Shoppers investigate a product's photos before they buy it, but visually impaired users do not have any chance to investigate photos. So they need well-defined product

information to decide buying. Most of them have never shopped online.

77% of the participants use social media and all of them have an account in Facebook. Only 4 of them use Twitter together with Facebook. One participant has a Youtube account. Other social networks like Foursquare, LinkedIn, Swarm, Instagram are not used by visually impaired people according to survey results.

Swarm and Foursquare are location based social networks. The main aim of these two platforms is checking in a place. For checking in, user must see and accept which place the program's location service offers. It is impossible to check in for a visually impaired user. That's why none of the participants use these platforms.

On the other hand, Instagram is a very popular photograph-based social network. The main user task of this program is sharing and surfing photos. For visually impaired people, it is impossible to use Instagram. Because, Instagram only serves photos without any alt text and these photos are meaningless for a visually impaired user.

26% of the participants watch films and TV series online and all of these users type "watch" key word when they search for a film or TV series. Principally, "watching" is an action, which cannot be act by a visually impaired person. We can infer that, visually impaired users do not mean actually "watching" when they type it. They only want to reach desired video easily. We can say that "watch" key word is a stereotyped word and does not have its original meaning according to visually impaired people.

44% of the participants listen to audio book online with reference to survey results, but these participants do not type any related verb like "listen" to find wanted audio book. There are four popular audio libraries in Turkey: Getem, Türgök, Altınokta and Milli Kütüphane Konuşan Kitaplık. Participants type these libraries' names into search engines and reach the library websites. After that, they use these libraries' own search engines to find desired audio book.

21 participants have answered: "Yes, I visit youtube.com" to question 13 [Appendix-B]. These users also mentioned that, they type "YouTube" keyword rather than

“watch” keyword while searching for a video. This is not same for online films or TV series. They type “watch” keyword while they are trying to reach a film or TV series. For example, user type “YouTube sleeping cat” keywords for reaching sleeping cat video. The same user type “watch game of thrones season 1” for reaching Game of Thrones video.

47% of the participants listen to music online. 75% of these participants directly use YouTube for listening music online, but 25% of them type the song name and singer name into the search engine rather than visiting YouTube.

In chapter 1.4, there is brief information about Google Trends usage in this study. And in chapter 2.4, there is detailed information about Google Trends. The survey results about Google trends can be found in this chapter. While designing survey, a question has taken part with the purpose of analyzing if Google trends reports represent visually impaired people’s search trends or not. Therefore, Google Trends reports have been investigated for 14 June 2015. These 20 keywords have been mostly searched from Turkey on 14 June 2015:

1. Son dakika haberleri
2. Dolar
3. En son haber
4. Recep Tayyip Erdoğan
5. Sözcü
6. Hdp milletvekilleri
7. Tayyip Erdoğan
8. Akit
9. Dolar ne kadar
10. Deniz Baykal
11. TEOG Sonuçları
12. Abdullah Gül
13. İlçe seçim sonuçları
14. Oktay Vural
15. Mehmet Metiner
16. Bülent Arınç

17. Nagehan Alçı
18. Erdoğan
19. Son haberler
20. Erken seçim şartları

The Turkish general election of 2015 took place on 7 June 2015. And this survey has been conducted just a week after the election. That's why Google trends report includes political terms and politician names. Survey results show that, our participants have never searched these trending keywords, but there is an exception for the first and the nineteenth keywords. 14 of participants have searched “son dakika haberleri” which means, “breaking news” in English and “son haberler” which means “last news” in English. According to survey results, it can be inferred that Google Trends report does not represent visually impaired users' choices except breaking news and last news.

4.7 Developing Ontology According to Survey Results

There is no single way for developing ontology; there are many different ones in the literature. Generally, the most important common feature of these methodologies is being iterative. The ontology development process consists of requirements analysis, design and testing phases. In ontology, requirements analysis is the phase of examining the domain. In this study, requirements analysis has been the most time consuming and emphasized phase, in which the requirements are specified in two steps.

Within the scope of this study, two surveys have been conducted and analyzed to develop a search engine ontology especially for visually impaired users. First a preliminary survey has been conducted, and then a second survey has been carried out, based on the information obtained in the previous one [Appendix-A and Appendix-B]. The information about the requirements analysis can be found in Chapters 4.1, 4.2 and 4.3. After analysis, Protégé ontology development tool has been used for creating ontology. Protégé is a free, open-source ontology editor and framework for building intelligent systems.

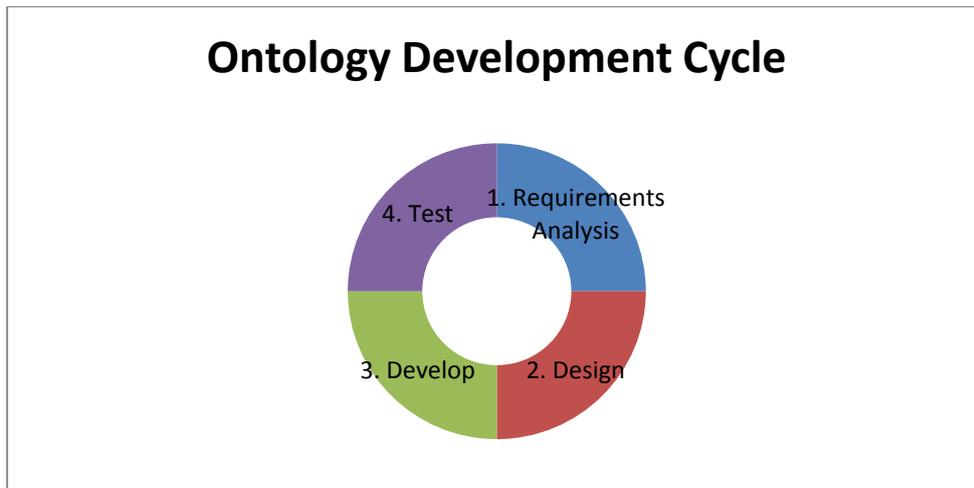


Figure 4.3 – Ontology Development Cycle

The second stage of ontology development process is the design phase. In this stage, a design is made on how to use the information acquired from the requirements analysis phase in ontology. The third stage is the development phase. In this phase, classes, properties and instances are created, which are the basic elements of ontology. The testing phase comes after the third stage. The developed ontology should be consistent. In this context, consistency test of the ontology is applied through reasoning engines. If any problem is detected during the test phase, it can be turned back to any appropriate stage. For this reason, owing to the fact that the development model used in this study has an iterative and spiral structure, it resembles the spiral software development model, which is one of the software development methodologies. The spiral development model is a risk-driven process model generator that is used to guide multi-stakeholder concurrent engineering of software intensive systems. It has two main distinguishing features. The first one is a cyclic approach for incrementally increasing a system's degree of definition and implementation, while decreasing its degree of risk. The second feature is a set of anchor point milestones for ensuring commitment to the stakeholders for feasible and mutually satisfactory system solutions [23].

The first step of developing the ontology is to determine the domain. In this study, the domain is the content offered by the search engines. The target audience of this

ontology is the visually impaired users. In this context, during the requirements analysis, the sample is selected from the visually impaired users.

An ontology basically has classes, properties and instances. An ontology development process' starting point is defining the class hierarchy. While creating the class hierarchy, question 4 in preliminary survey and question 6 in actual survey have been used, since the aim of this ontology is to serve a better search experience for visually impaired users by analyzing their expectations from a search engine.

The ontology has three main classes: Categories, Query and Visual Elements. Categories, the first main class of the ontology, is the categorization of the searches of the visually impaired users and their purposes of using the search engines.

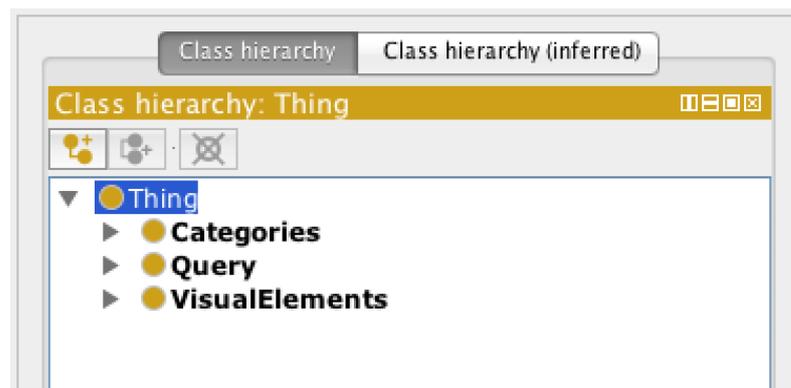


Figure 4.4 - Main Three Classes

Categories class represents the results of question 4 in Appendix-A and question 6 in Appendix-B as mentioned above. In more detail, categories class includes the basic search engine usage purposes.

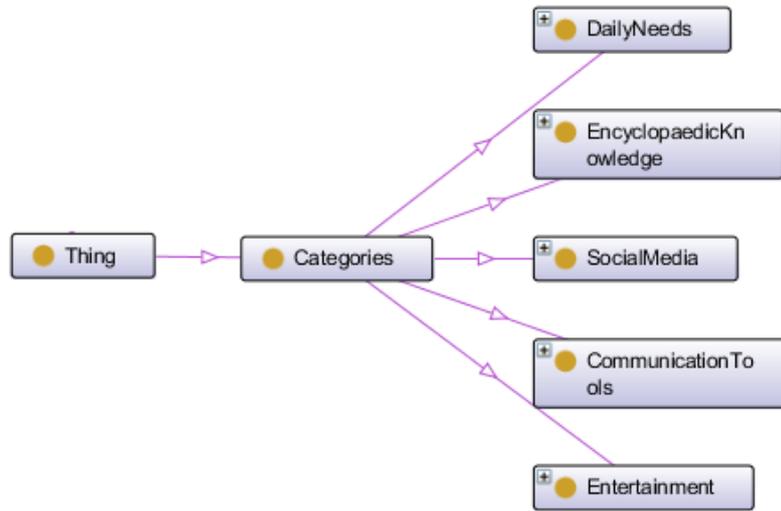


Figure 4.5 - Four Subclasses of Categories Class

Subclasses represent concepts that are more specific than a superclass . Subclasses of a class usually (1) have additional properties that the superclass does not have, or (2) they have restrictions different from those of the superclass, or (3) they participate in different relationships than the superclasses [14].

Categories class has five subclasses: Communication Tools, Daily Needs, Encyclopedic Knowledge, Entertainment and Social Media. These classes have been created as a result of survey data. Survey categories and ontology classes matching can be found in Table 4.2.

Table 4.2 Survey Categories- Ontology Classes Matching

Survey Categories	Equivalent Class in Ontology
To find out how to go somewhere	Daily Needs
To find out timelines and stations of transportation options like bus, train, etc.	Daily Needs
Online shopping	Daily Needs
To buy social event tickets like cinema, theatre, etc.	Daily Needs
For researching or doing homework	Encyclopedic Knowledge
For sending e-mail	Communication Tools
To sign up or sign in social networks	Social Media
To listen to funny videos	Entertainment
To listen to newspaper	Entertainment
To listen to film or TV series	Entertainment
For playing game	Entertainment

Daily Needs subclass summarizes the information reached by the visually impaired users for their daily activities by using the search engines.

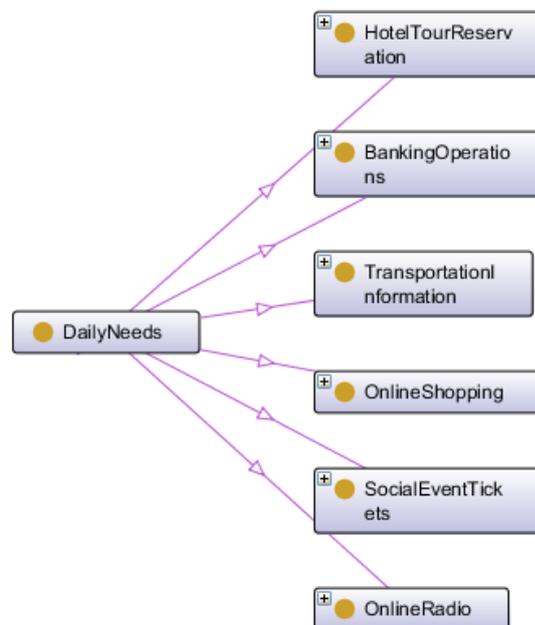


Figure 4.6 – Subclasses of Daily Needs

Encyclopedic Knowledge class fundamentally represents the information tried to be reached by the participants for their homework or researches. At the first stages of the study, this class has been planned to have a larger scope, but due to the results of the survey, it has been observed that the visually impaired participants only use the first coming results for their homework and researches, as they cannot explore among the other pages easily. As I mentioned in previous chapters, preliminary survey has been conducted in Mitat Enç High School. I have observed that, these high school students only use Wikipedia sites while they are preparing their homework. Herewith, encyclopedic knowledge class has only one instance: Wikipedia.

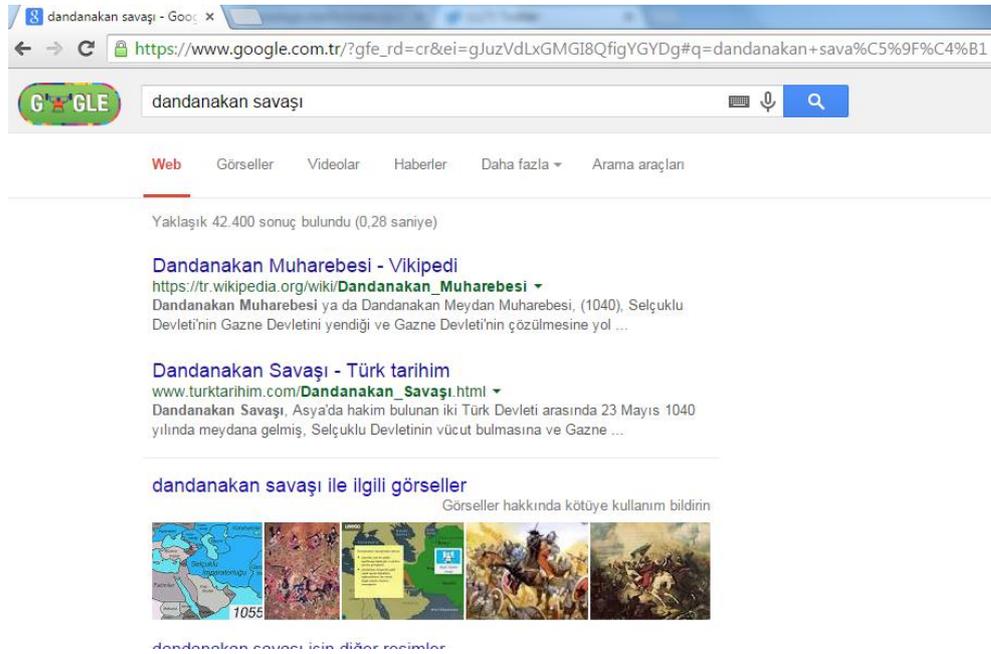


Figure 4.7 - Google Search Result for “Dandanakan Savaşı”

As seen in Figure 4.7, when a visually impaired user search for a homework assignment, Google returns Wikipedia pages at the top in general. For this reason, students always use Wikipedia pages for doing homework and that’s why encyclopedic knowledge class has only one instance.

The communication tools and methods used by the participants are summarized in the communication tools subclass. While a sighted user uses many tools such as Skype, Viber, and video conference for communication through the Internet, it is observed that the visually impaired users communicate over the Internet by only sending e-mails.

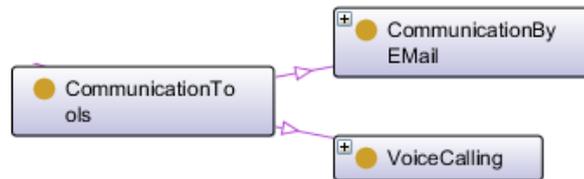


Figure 4.8 - Communication Tools Subclasses

Social Media class includes some websites which are defined as social network.

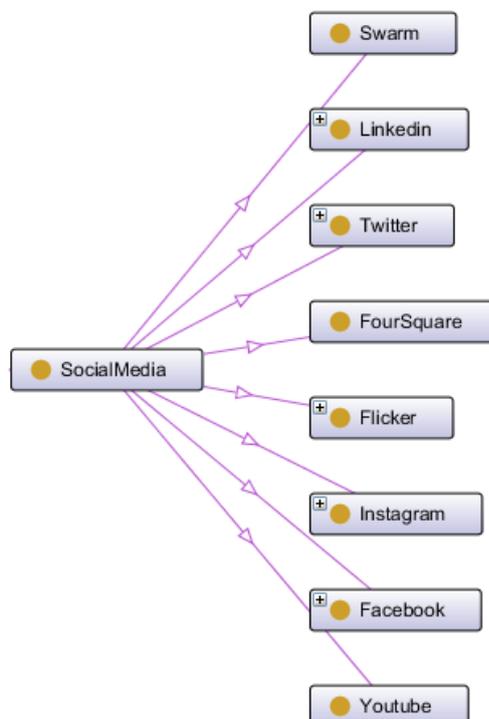


Figure 4.9 - Social Media Subclasses

Entertainment class represents the entertainment actions which participants access via search engines.

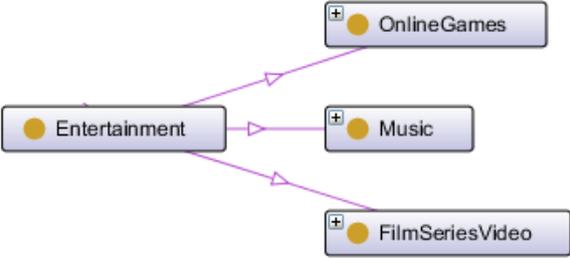


Figure 4.10 - Entertainment Subclasses

Query class includes twelve subclasses: Connect, read, play, learn, watch, sign in, buy, call, download, sign on, account and listen. These class names have been derived from survey results and Google trends reports.

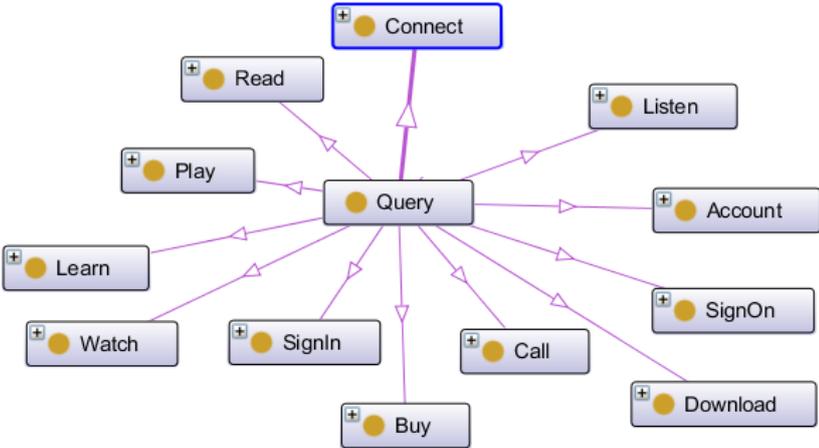


Figure 4.11 - Query Subclasses

Visual elements class has only two subclasses: Video and image. This class has been created on the purpose of designating relationships between other classes. Some classes like instagram include visual elements. This relation must be established.

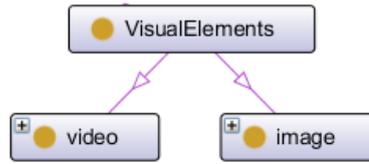


Figure 4.12 - Visual Elements Subclass

The ontology has fifteen object properties such as: correlatedWith, directs, equivalentTo, forwardTo, has, includes, isAbout, isPartOf, linksTo, needs, onlyServes, partiallyIncludes, provide, queries and return. Each property is related to one or several classes.

The ontology’s individuals have been created according to Google results. Each term has been searched by Google and results constituted individuals set. For example, hotel reservation is a class in the ontology. When I searched for “hotel reservation” keyword “www.booking.com “ result is returned. So booking.com is an individual which is related by “HotelTourReservation” class.

CommunicationByEmail class has four individuals: gMail, hotMail, outlookMail and yahooMail. VoiceCalling class has only one individual and it is skype.

The “Banking Operations” class has 27 individuals as follows:

Table 4.3 Banking Operations Individuals

A&t Bank	denizBank	odeaBank
aBank	fibaBank	sekerBank
akBank	finansBank	tBank
aktifBank	garantiBank	tekstilBank
alBarakaBank	halkBank	turkishBank
anadoluBank	hsbcBank	turkiyeFinansBank
bankAsya	ingBank	vakifBank
burganBank	isBankasi	yapiKrediBank
citiBank	kuveytTurkBank	ziraatBank

Eleven individuals have been specified for “HotelTourReservation” class: booking.com, etsTur, hotels.com, jollyTur, mngTurizm, setur, tatil.com, tatilBudur.com, touristica, tripAdvisor and trivago.

Online radio class has only two individuals: jango and karnaval. Twenty three individuals have been created for “online Shopping” class.

Table 4.4 Shopping Individuals

amazon	gittiGidiyor	modagram
arcelik	hepsiBurada	morhipo
batik	hizliAl	mudo
beymen	ikea	n11
boyner	lidyana	trendyol
ebay	limango	vatanComputer
forevernew	mango	zizigo
gap	markafoni	

SocialEventTickets have three individuals: biletiva, biletix and myBilet. Transportation information class has thirteen individuals as follows:

Table 4.5 Transportation Individuals

airTickets	nilufer	tripsta
atlasJet	onurAir	Ulusoy
borajet	pegasus	varan
geziko	skyScanner	
kamilKoc	thy	

Domino and Minecraft individuals have been generated for online games class. Image class has five individuals: bmp, exif, gif, jpeg and png. Video class also has five individuals: avi, flv, mov, mp4 and wmv. These individuals actually represent file types.

Figure 4.11 shows the overall picture of the ontology with classes, properties and individuals. The rdf file can be found in Appendix-C.

CHAPTER 5

EVALUATION

In preceding chapters, I have described my search engine ontology approach especially for visually impaired users. In order to validate my approach, I have conducted an evaluation. This chapter includes participants, evaluation methodology and results.

In conducted surveys, I have chosen participants randomly from “Altı Nokta Körler Derneği” member list, but in evaluation chapter, I have not chosen participants randomly because of the testing environment limitations. My test computer was a MacBook¹ with OS X² operating system. Visually impaired users generally prefer Jaws as a screen reader, but Jaws is not open source. I could not buy this software because of financial limitations, but OS X has its own screen reader: Voice Over. Voice over is very similar with other screen readers like Jaws. For this reason, I have chosen five participants who have mac OS X and Voice Over experience. All participants were totally visually impaired and have bachelor’s degree. Two participants were female and three participants were male.

The main aim of this study is serving better search results to visually impaired users while they are using a search engine. For this purpose, requirement analysis and ontology development stages have been performed. The created ontology is the output of this study, but it is impossible to evaluate this ontological approach without user interface. Therefore, a search interface has been created according to ontology. The user interface can be found in <http://users.metu.edu.tr/aezgi/>.

¹ The MacBook is a line of Macintosh portable computers introduced in January 2006 by Apple Inc.

² OS X is a series of Unix-based graphical interface operating systems developed and marketed by Apple Inc.

Google search API has been used for redesigning search results. Google Search API allows developers to customize result set for specific keywords. Developers can add or remove websites from result set via API. For example, the result set can be specified when a user type “Facebook” keyword. Normally, “facebook” keyword returns “www.facebook.com” in the first place, but the ranking can be changed by using Google API. www.twitter.com can be placed on the top of result set.

In Google API developer console, some keyword-website matching rules have been created for the purpose of rearranging result set. These keywords have been chosen from the survey results. For example, it is shown that, survey participants use youtube website to listen to their favorite singer’s songs. Some popular singer names have been added to keywords list and that singer’s youtube page link has been ranked as first. Moreover, some other keywords and website matching rules have been created according to survey results and ontology.

```
<?xml version="1.0" encoding="UTF-8"?>
<Promotions start="0" num="14" total="14">

  <Promotion id="281efe03" queries="sosyal medya" title="Twitter"
url="https://twitter.com/" image_url="" start_date="" end_date="" is_regex="false"
enabled="true" description=""/>

  <Promotion id="b6a2af51" queries="sosyal medya" title="Facebook"
url="https://www.facebook.com/?_rdr=p" image_url="" start_date="" end_date=""
is_regex="false" enabled="true" description=""/>

  <Promotion id="4686ff12" queries="sibel can" title="Youtube Sibel Can"
url="https://www.youtube.com/results?search_query=sibel+can" image_url=""
start_date="" end_date="" is_regex="false" enabled="true" description=""/>

  <Promotion id="75d714c5" queries="ibrahim tatlıses" title="Youtube İbrahim
Tatlıses"
url="https://www.youtube.com/results?search_query=ibrahim+tatlı%C4%B1ses"
image_url="" start_date="" end_date="" is_regex="false" enabled="true"
description=""/>

  <Promotion id="a9fd70a1" queries="izle,dinle" title="Youtube"
```

```
url="https://www.youtube.com/" image_url="" start_date="" end_date=""  
is_regex="false" enabled="true" description=""/>  
<Promotion id="d79c3af3" queries="online oyun" title="Online Oyun"  
url="http://www.pcsgames.net/" image_url="" start_date="" end_date=""  
is_regex="false" enabled="true" description=""/>
```

Figure 5.1 Promotions.xml Sample Code

Actually, if I would have developed a search engine which bases on developed ontology, re-ranking by promotions.xml step would not be necessary anymore. However, this thesis main purpose is not about developing an ontology based search engine. The main purpose of this study is developing search engine ontology according to visually impaired users' needs. Therefore, a simulation interface has been developed by the help of Google API.

The test interface has a very basic design, which only includes a search box. The Web design does not include any images because images make difficult to reach search box while listening by a screen reader. The server computer is Middle East Technical University's server, which is only used for academic studies.

Four tasks have been given to each user. These tasks are:

1. Listen one of your favorite singer's song by using this interface.
2. Listen to an audio book.
3. Assume that you have homework about "Çalığışu" novel. Just read one paragraph about "Çalığışu".
4. Play an online game.

Each task has been read to each participant with the same order. Firstly, each participant has been asked to complete tasks with classic Google interface via screen reader. Secondly they have been asked to do same tasks with new interface via screen reader again. Screen reader programs start reading a page from top to bottom with all links, buttons and images. Classic Google interface and new interface have different page layouts. In order to exclude elapsed time based on design difference, elapsed time data has been calculated after user reaches the search bar in each

interface.

The table below shows the elapsed time while achieving each task. The first two digits of the each data represent the minutes and the last two digits represent seconds. Some tasks have been lasted longer than five minutes or never achieved. This kind of tasks are cancelled after 5 minutes and shown as >5:00 in following table.

Table 5.1 Elapsed Time in Each Task

	TASK 1		TASK 2		TASK 3		TASK 4	
	Classic	New	Classic	New	Classic	New	Classic	New
Participant 1	0:21	0:28	1:13	0:42	5:12	3:13	>5:00	1:14
Participant 2	3:09	2:51	2:01	1:30	8:10	4:46	>5:00	1:22
Participant 3	1:20	0:52	1:41	1:02	4:48	2:27	>5:00	1:02
Participant 4	2:12	1:30	2:55	1:11	5:54	4:02	>5:00	0:39
Average Elapsed Time	1:45	1:25	1:57	1:06	6:01	3:37	>5:00	1:04

Table 5.1 represents the elapsed time during tasks in terms of minutes and seconds. Classic column represents classical Google and new column represents new search engine. As seen in Table 5.1, elapsed time has been decreased in each task.

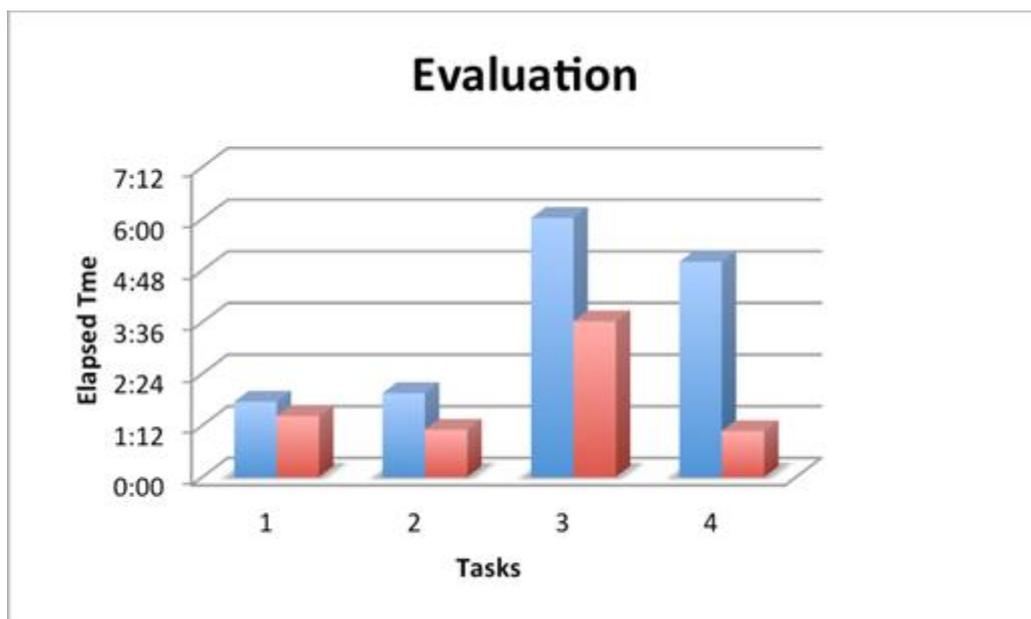


Figure 5.2 - Elapsed Time Decrease Graph

Figure 5.2 shows that, there is a significant elapsed time decrease between classic and new Google. This means that, users reach the needed information more easily with new Google. So, the main aim of the study has been achieved. The search duration has been decreased. On the other hand, new Google design has no images. Users remarked that, it is easier without unnecessary images. Moreover I would like to state that; users had no new Google interface experience before test. So, if they use this website once again, they will achieve the tasks easier.

CHAPTER 6

DISCUSSION

This chapter gives a description of advantages and limitations of this study as a discussion.

6.1 Advantages

It is not easy to reach visually impaired computer users and perform tests with them. The number of visually impaired users is less than the number of sighted users. Totally 46 (7 users for preliminary survey, 34 users for actual survey and 5 users for testing) visually impaired computer users have been participated in survey and test studies of this thesis. These participants have chosen from different age groups and different education levels. Because of this, the requirement analysis part of this study represents a large group of people's needs with important details.

Compared to classic Google, the new search engine ontology which has been developed in this study has a number of proven advantages in different aspects. First of all, this ontology has been developed according to visually impaired people's needs. Because of this, visually impaired computer users complete search tasks faster with this new ontology. There is an indirect proportion between elapsed time to achieve a task and user satisfaction. Namely, when elapsed time to achieve a task decreases, user satisfaction increases. Increasing user satisfaction is the most important advantage of this thesis.

Another advantage of this thesis is the created interface's usability according to visually impaired computer users. As I mentioned before, a search engine interface has been created according to ontology by Google API. This interface has a very simple design. It only includes a search bar and a search button. On the other hand, the classic Google interface has many images and links before search bar. Screen reader programs start reading a page from top to bottom with all links, buttons and images. In classic Google, users hear many things before reaching search bar and this is time consuming for visually impaired people. My new design's simplicity also decreased the elapsed time to achieve a search task and user satisfaction increased.

The ontology's main class structure has been created according to visually impaired users' purpose of search engine usage. In this context, search result page has been revised according to their needs. So, the new result page has satisfied visually impaired user needs more than classic Google.

6.2 Limitations

The most important limitation of this study is testing environment. Voice Over tool has been chosen because of test computer's limitation. However, Voice Over is not commonly used screen reader. According to survey results which have been given in chapter 4.5 in details, visually impaired users mostly prefer Jaws as a screen reader. If Jaws could be used instead of Voice Over, the sample size of testing would be more than actual sample size. Namely, larger sample size represents a larger number of people's needs.

Another limitation of this thesis is the overall sample size. Actually, overall sample size of this study is 46 and it is not a small sample size. On the other hand, if I could perform survey and test studies on a bigger sample size then the results would represent large mass's needs. This study can be repeated with a bigger sample size as a future study.

In test phase, it has been the first time participants use the new search engine

interface, but they have used classic Google interface many times before testing. So, they have a familiarity with classic Google design. In other words, if participants have a chance to use my new interface before testing, they would be used to new interface design and elapsed time to achieve a task would be less.

The last limitation of this study is about elapsed time while conducting surveys. Visually impaired participants could not fill in questionnaires without any help. Because of this, I have read each question to each participant and written down the answers. It has been a time consuming phase. Actually, I have designed a web page instead of paper based survey, but visually impaired participants could not reach this web page because of some reasons. Because of this, I have chosen paper based survey method.

In spite of choosing this study's participants from different education levels, genders and age groups, all of them are Turkish and all of them live in Ankara. In this respect, results represent the requirements of visually impaired people who live in a specific area. This is another limitation of this study.

6.3 Future Studies

The main output of this study is the developed ontology. A complicated requirements analysis has been performed before developing this ontology. Even though this analysis aims to guide ontology development, it has also revealed what kind of information visually impaired people need to reach by using Web tools. In this respect, the requirement analysis part of this study would be used in content based applications for visually impaired people in the future.

A prototype interface which returns search results according to ontology has been developed with the aim of evaluation. The ontology has only used for re-ranking search results in this prototype. Therefore, this interface is not ontology based. This interface only simulates ontology's results. Evaluation results have revealed that, visually impaired users will spend less time while reaching the needed information

by using this new interface. So, a search engine which bases this ontology would be developed as a future study.

On the other hand, the ontology's class structure has only used with the aim of re-ranking results. However, ontology's class structure can be used on the purpose of categorizing search result like Aghajani's [20] study. If the similar to Aghajani's [20] results could be obtained, categorization will also decrease the elapsed time while reaching information. So, this ontology would be used with the intention of dividing results into categories in the future.

The ontology has been developed according to survey results which reflect today's visually impaired users' needs. The requirements of visually impaired users will be changed year after year. Because of this, the developed ontology will not cover all visually impaired users' requirements. So, this ontology must be revised according to new requirements in the future. If requirements will not change but increase, this ontology would be extended according to new requirements. This ontology can be integrated with future interfaces or applications easily.

The sample size is an advantage of this study. On the other hand, one way to augment the credibility of an experiment's results is to perform it with a large sample size to make the results more representative of an entire population. This study can be repeated with a bigger sample size as a future study.

Moreover, this study has revealed that, Google Trends reports do not represent the visually impaired users' search tendencies according to survey results. Therefore, another Google Trends application which represents the visually impaired computer users' tendencies can be also developed as a future study.

CHAPTER 7

CONCLUSION

The aim of this study is developing new search engine ontology especially for visually impaired people. In this context, requirement analysis has been done before developing ontology. The original idea of conducting requirement analysis is creating resource for the ontology. Survey methodology has been chosen for conducting requirement analysis. Survey questions have been chosen very carefully because the survey has been the only resource for ontology. For this reason, a preliminary survey has been conducted in an attempt to specify actual survey's questions. All participants have been chosen from visually impaired computer users for both surveys. The preliminary survey's sample size has been 7. The output of this preliminary survey has created the actual survey's questions. The actual survey's sample size has been 34. These participants have been chosen from different age groups and different education levels. The survey results have been investigated in detail.

After the results have been analyzed, ontology development studies have been started. Firstly, survey results have been used for specifying ontology's general class structure. After, subclasses have also been specified according to survey results. Ontology's some instances have been generated according to survey results, but some of them have been generated according to Google reports. Ontology's relationships have also been created according to survey results.

The ontology's consistency has been checked by using Hermit and Fact++ reasoning engines. The reasoning results have shown that, there are no conflicts or inconsistency in the ontology.

The main aim of this study is increasing visually impaired computer users' search engine satisfaction. In this respect, ontology has been developed according to visually impaired users' needs, but it is impossible to conduct a user test for the ontology without an interface. For this reason, a simple interface which only includes a search bar and search button has been created by Google API. This interface has been used in testing. Test computer has been a MacBook with OS X operating system. So, test screen reader has been chosen as MacBook's default screen reader program: Voice-over.

Four tasks have been created for testing. The participants of the test have been chosen from visually impaired users who have voice-over experience. The participants have been asked for doing same task firstly with classic Google and then new created interface. The elapsed time while achieving tasks have been collected for each task and for each interface. The results have showed that, participants have completed tasks faster with new interface which includes new search engine. This means that, a search engine which has been developed based on my ontology will increase visually impaired computer users' search engine satisfaction.

This study includes an interface which shows the ontological results, but this interface has been created only for testing. Because of this, the search engine includes just a small part of the ontology. However, the evaluation results have been showed that, developing a search engine based on this ontology increase visually impaired users' satisfaction. In this context, a search engine which totally includes the developed ontology would be significant as a future study.

The main output of this study is the ontology, but it also includes a detailed requirement analysis additionally. The result of this analysis reveals the internet usage purposes of visually impaired people. Because of this, the requirement analysis part of this study can be used not only in search engine applications, but also in all content-based applications for visually impaired people in future studies.

Moreover, this study has revealed that, Google Trends reports do not represent the visually impaired users' search tendencies according to survey results. Therefore,

another Google Trends application which represents the visually impaired computer users' tendencies can be developed as a future study.

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APPENDIX-A

PRELIMINARY SURVEY

Question 1: Which screen reader do you use?

- Jaws
- NVDA
- Window-eyes
- Voice over

Question 2: Which web browser do you use for Internet surfing?

- Internet explorer
- Chrome
- Mozilla Firefox
- Safari
- Opera

Question 3: Which search engine do you use?

- Google
- Bing
- Yahoo
- Yandex

Question 4: What are the basic aims of your computer usage?

Question 5: What are your problems about using search engine as a visually impaired user?

APPENDIX-B
SURVEY

Question 1: Your age:

- 13-19
- 19-30
- 30-50
- 50+

Question 2: Your education level:

- Elementary education
- High school
- Postgraduate
- Graduate
- Doctorate

Question 3: Your visually impairment ratio:

Question 4: Which web browsers do you use?

- Internet Explorer
- Chrome
- Mozilla Firefox

- Safari
- Other

Question 5: Which search engines do you use?

- Google
- Yandex
- Yahoo
- Bing
- Other

Question 6: For which purposes do you use search engine?

- To find out how to go somewhere
- To find out timelines and stations of transportation options like bus, train, etc.
- Online shopping
- To buy social event tickets like cinema, theatre, etc.
- For researching or doing homework
- For sending e-mail
- To sign up or sign in social networks
- To listen to funny videos
- To listen to newspaper
- To listen to film or TV series
- For playing game

Question 7: Which screen readers do you use?

- Jaws
- NVDA
- Window-eyes
- Voice over

Question 8: In which social networks do you have an account?

- Facebook
- Twitter
- Foursquare
- LinkedIn
- Swarm
- Instagram
- Google +
- Youtube

Question 9: Do you listen to TV series online by using websites?

- Yes
- No

Question 10: (If you answered question 9 as “No” skip this question.) Which TV series do you watch online and which key words do you use while searching these series? For example, do you use “watch” keyword while searching?

Question 11: Do you listen audio book by using websites?

- Yes
- No

Question 12: (If you answered question 11 as “No” skip this question.) Which key words do you use while searching audio book?

Question 13. Do you visit websites which publish videos such as Youtube, izlesene.com ?

- Yes
- No

Question 14: (If you answered question 13 as “No” skip this question.) Which key words do you use while searching a video?

Question 15. Do you listen to music bu using websites?

- Yes
- No

Question 16: (If you answered question 15 as “No” skip this question.) Which key words do you use while searching for music?

Question 17. Which keywords have you searched recently?

- Son dakika haberleri
- Dolar
- En son haber
- Recep Tayyip Erdoğan
- Sözcü
- Hdp milletvekilleri
- Tayyip Erdoğan
- Akit
- Dolar ne kadar
- Deniz Baykal
- TEOG Sonuçları
- Abdullah Gül
- İlçe seçim sonuçları
- Oktay Vural
- Mehmet Metiner
- Bülent Arınç
- Nagehan Alçı

- Erdoğan
- Son haberler
- Erken seçim şartları

Question 18. What kind of problems do you have with search engines as a visually impaired user?

Question 19. How can search engine be better according to visually impaired users? Do you have any improving idea? Please list your ideas.

APPENDIX-C
SEARCH ENGINE ONTOLOGY'S RDF CODE

```
<?xml version="1.0"?>

<!DOCTYPE rdf:RDF [
  <!ENTITY owl "http://www.w3.org/2002/07/owl#" >
  <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
  <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
]>

<rdf:RDF xmlns="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#"
  xml:base="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <owl:Ontology rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi"/>

  <!--
  //////////////////////////////////////
  //
  // Object Properties
  //
  //////////////////////////////////////
  -->

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#correlatedWith -->
```

```

    <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#correlatedWith">
      <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Buy"/>
      <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
      <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialEventTickets"/>
    </owl:ObjectProperty>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#directs
-->

    <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#directs">
      <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Listen"/>
      <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Music"/>
      <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineRadio"/>
    </owl:ObjectProperty>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#equivalentTo -->

    <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#equivalentTo">
      <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Read"/>
      <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Watch"/>

```

```
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#forwardTo -->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#forwardTo">
  <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineGames"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Play"/>
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#has -->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#has">
  <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Account"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Facebook"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Flicker"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#FourSquare"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Instagram"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Linkedin"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Swarm"/>
```

```

    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Twitter"/>
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Youtube"/>
    </owl:ObjectProperty>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#includes -->

    <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#includes">
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Flicker"/>
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Instagram"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#image"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#video"/>
    </owl:ObjectProperty>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#isAbout -->

    <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#isAbout">
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Call"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#VoiceCalling"/>
    </owl:ObjectProperty>

    <!-- http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlelevi#isPartOf -->

  <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#isPartOf">
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Account"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#BankingOperations"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#CommunicationByEmail"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#OnlineGames"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#OnlineShopping"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#VoiceCalling"/>
  </owl:ObjectProperty>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#linksTo -->

  <owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#linksTo">
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#CommunicationByEmail"/>
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#SignIn"/>
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#SignOn"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#VoiceCalling"/>
  </owl:ObjectProperty>

```

```

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#needs -
->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#needs">
  <owl:inverseOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#linksTo"/>
  <rdfs:subPropertyOf rdf:resource="&owl;topObjectProperty"/>
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#onlyServes -->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#onlyServes">
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Youtube"/>
  <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#video"/>
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#partiallyIncludes -->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#partiallyIncludes">
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Facebook"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Linkedin"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#Twitter"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#image"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#video"/>
    <rdfs:subPropertyOf rdf:resource="&owl;topObjectProperty"/>
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#provide -->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#provide">
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Download"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#FilmSeriesVideo"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Music"/>
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#queries
-->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#queries">
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationTools"/>
    <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Connect"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineRadio"/>
    <rdfs:range rdf:resource="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#SocialMedia"/>
  <rdfs:subPropertyOf rdf:resource="&owl;topObjectProperty"/>
</owl:ObjectProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#return -
->

<owl:ObjectProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#return">
  <rdfs:range rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#EncyclopaedicKnowledge"/>
  <rdfs:domain rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Learn"/>
</owl:ObjectProperty>

<!--
////////////////////////////////////
//
// Data properties
//
////////////////////////////////////
-->

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#audioType -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#audioType">
  <rdfs:range>
    <rdfs:Datatype>
      <owl:oneOf>
        <rdf:Description>

```

```

<rdf:type rdf:resource="&rdf;List"/>
<rdf:first>mp3</rdf:first>
<rdf:rest>
  <rdf:Description>
    <rdf:type rdf:resource="&rdf;List"/>
    <rdf:first>mpc</rdf:first>
    <rdf:rest>
      <rdf:Description>
        <rdf:type rdf:resource="&rdf;List"/>
        <rdf:first>ogg</rdf:first>
        <rdf:rest>
          <rdf:Description>
            <rdf:type rdf:resource="&rdf;List"/>
            <rdf:first>raw</rdf:first>
            <rdf:rest rdf:resource="&rdf:nil"/>
          </rdf:Description>
        </rdf:rest>
      </rdf:Description>
    </rdf:rest>
  </rdf:Description>
</rdf:rest>
</owl:oneOf>
</rdfs:Datatype>
</rdfs:range>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#cardNo
-->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#cardNo">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#creditCardInformation"/>
  </owl:DatatypeProperty>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#comment -->

  <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#comment"/>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#creditCardInformation -->

  <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#creditCardInformation"/>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#cvc -->

  <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#cvc">
    <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#creditCardInformation"/>
  </owl:DatatypeProperty>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#date --
>

  <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#date">
    <rdfs:subPropertyOf rdf:resource="&owl;topDataProperty"/>
  </owl:DatatypeProperty>

  <!-- http://www.semanticweb.org/cc-

```

```
bbs_user/ontologies/2015/1/googlevi#dateOfExpiry -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#dateOfExpiry">
```

```
<rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#creditCardInformation"/>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-
```

```
bbs_user/ontologies/2015/1/googlevi#departure -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#departure">
```

```
<rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-
```

```
bbs_user/ontologies/2015/1/googlevi#destination -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#destination">
```

```
<rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-
```

```
bbs_user/ontologies/2015/1/googlevi#eMailAdress -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#eMailAdress"/>
```

```

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#eventName -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#eventName">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#imageType -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#imageType">
  <rdfs:range>
    <rdfs:Datatype>
      <owl:oneOf>
        <rdf:Description>
          <rdf:type rdf:resource="&rdf;List"/>
          <rdf:first>gif</rdf:first>
          <rdf:rest>
            <rdf:Description>
              <rdf:type rdf:resource="&rdf;List"/>
              <rdf:first>jpeg</rdf:first>
              <rdf:rest rdf:resource="&rdf;nil"/>
            </rdf:Description>
          </rdf:rest>
        </rdf:Description>
      </owl:oneOf>

```

```

        </rdfs:Datatype>
    </rdfs:range>
</owl:DatatypeProperty>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#location -->

    <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#location"/>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#mailBody -->

    <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#mailBody"/>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlelevi#name -
->

    <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#name">
        <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#userInformation"/>
    </owl:DatatypeProperty>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#notification -->

    <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#notification"/>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlelevi#place -
->

```

```

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#place">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#price --
>

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#price">
  <rdfs:subPropertyOf rdf:resource="&owl;topDataProperty"/>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#radioStationUrl -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#radioStationUrl">
  <rdfs:subPropertyOf rdf:resource="&owl;topDataProperty"/>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#row --
>

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#row">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#seatInformation"/>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-

```

```
bbs_user/ontologies/2015/1/googlevi#runtime -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#runtime">
```

```
<rdfs:comment>video or film&apos;s duration</rdfs:comment>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-
```

```
bbs_user/ontologies/2015/1/googlevi#seatInformation -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#seatInformation">
```

```
<rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-
```

```
bbs_user/ontologies/2015/1/googlevi#seatNumber -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#seatNumber">
```

```
<rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#seatInformation"/>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-
```

```
bbs_user/ontologies/2015/1/googlevi#shoppedItems -->
```

```
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#shoppedItems">
```

```
<rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#shoppingBasket"/>
```

```
</owl:DatatypeProperty>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#shoppingBasket -->  
  
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#shoppingBasket"/>  
  
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#smtpServer -->  
  
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#smtpServer"/>  
  
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#subject  
-->  
  
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#subject"/>  
  
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#surname -->  
  
<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#surname">  
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#userInformation"/>  
</owl:DatatypeProperty>  
  
<!-- http://www.semanticweb.org/cc-
```

```

bbs_user/ontologies/2015/1/googlevi#ticketInformation -->

  <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ticketInformation">
    <rdfs:range>
      <rdfs:Datatype>
        <owl:oneOf>
          <rdf:Description>
            <rdf:type rdf:resource="&rdf;List"/>
            <rdf:first>eventTicket</rdf:first>
            <rdf:rest>
              <rdf:Description>
                <rdf:type rdf:resource="&rdf;List"/>
                <rdf:first>transportationTicket</rdf:first>
                <rdf:rest rdf:resource="&rdf:nil"/>
              </rdf:Description>
            </rdf:rest>
          </rdf:Description>
        </owl:oneOf>
      </rdfs:Datatype>
    </rdfs:range>
  </owl:DatatypeProperty>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#totalAccessibilityError -->

  <owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#totalAccessibilityError"/>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#transportationType -->

```

```

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#transportationType">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
  <rdfs:range>
    <rdfs:Datatype>
      <owl:oneOf>
        <rdf:Description>
          <rdf:type rdf:resource="&rdf;List"/>
          <rdf:first>bus</rdf:first>
          <rdf:rest>
            <rdf:Description>
              <rdf:type rdf:resource="&rdf;List"/>
              <rdf:first>car</rdf:first>
              <rdf:rest>
                <rdf:Description>
                  <rdf:type rdf:resource="&rdf;List"/>
                  <rdf:first>flight</rdf:first>
                  <rdf:rest>
                    <rdf:Description>
                      <rdf:type rdf:resource="&rdf;List"/>
                      <rdf:first>train</rdf:first>
                      <rdf:rest rdf:resource="&rdf:nil"/>
                    </rdf:Description>
                  </rdf:rest>
                </rdf:Description>
              </rdf:rest>
            </rdf:Description>
          </rdf:rest>
        </rdf:Description>
      </owl:oneOf>
    </rdfs:Datatype>
  </rdfs:range>

```

```
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#travelDuration -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#travelDuration">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ticketInformation"/>
</owl:DatatypeProperty>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#url -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#url"/>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#userInformation -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#userInformation"/>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#userName -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#userName">
  <rdfs:subPropertyOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#userInformation"/>
</owl:DatatypeProperty>
```

```

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#videoType -->

<owl:DatatypeProperty rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#videoType">
  <rdfs:range>
    <rdfs:Datatype>
      <owl:oneOf>
        <rdf:Description>
          <rdf:type rdf:resource="&rdf;List"/>
          <rdf:first>avi</rdf:first>
          <rdf:rest>
            <rdf:Description>
              <rdf:type rdf:resource="&rdf;List"/>
              <rdf:first>mkv</rdf:first>
              <rdf:rest>
                <rdf:Description>
                  <rdf:type rdf:resource="&rdf;List"/>
                  <rdf:first>mov</rdf:first>
                  <rdf:rest>
                    <rdf:Description>
                      <rdf:type rdf:resource="&rdf;List"/>
                      <rdf:first>mp4</rdf:first>
                      <rdf:rest rdf:resource="&rdf:nil"/>
                    </rdf:Description>
                  </rdf:rest>
                </rdf:Description>
              </rdf:rest>
            </rdf:Description>
          </rdf:rest>
        </rdf:Description>
      </rdf:rest>
    </rdf:rest>
  </rdf:rest>
</owl:oneOf>
</rdfs:Datatype>
</rdfs:range>
</owl:DatatypeProperty>

```

```

        </rdf:Description>
        </owl:oneOf>
    </rdfs:Datatype>
    </rdfs:range>
</owl:DatatypeProperty>

<!--
////////////////////////////////////
//
// Classes
//
////////////////////////////////////
-->

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Account -->

    <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Account">
        <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Query"/>
    </owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#BankingOperations -->

    <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#BankingOperations">
        <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#DailyNeeds"/>
    </owl:Class>

```

```

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Buy --
>

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Buy">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Call --
>

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Call">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories"/>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationByEmail -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationByEmail">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#CommunicationTools"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationTools -->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationTools">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Connect -->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Connect">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#DailyNeeds -->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#DailyNeeds">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Download -->

```

```
<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Download">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>
```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#EncyclopaedicKnowledge -->
```

```
<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#EncyclopaedicKnowledge">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories"/>
</owl:Class>
```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Entertainment -->
```

```
<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Entertainment">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories"/>
</owl:Class>
```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Facebook -->
```

```
<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Facebook">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialMedia"/>
</owl:Class>
```

```

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#FilmSeriesVideo -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#FilmSeriesVideo">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Entertainment"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Flicker
-->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Flicker">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialMedia"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#FourSquare -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#FourSquare">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialMedia"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation -->

```

```

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#HotelTourReservation">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#DailyNeeds"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Instagram -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Instagram">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#SocialMedia"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlelevi#Learn -
->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Learn">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Linkedin -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Linkedin">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#SocialMedia"/>
</owl:Class>

```

```

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Listen
-->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Listen">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Music
-->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Music">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Entertainment"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineGames -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineGames">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Entertainment"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineRadio -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#OnlineRadio">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#DailyNeeds"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#DailyNeeds"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Play --
>

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Play">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Query
-->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Read --
>

<owl:Class rdf:about="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#Read">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#SignIn
-->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SignIn">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SignIn -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SignIn">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Query"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialEventTickets -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialEventTickets">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#DailyNeeds"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#SocialMedia -->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialMedia">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Categories"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Swarm
-->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Swarm">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialMedia"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation -->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#DailyNeeds"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Twitter
-->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Twitter">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialMedia"/>

```

```
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Vikipedia -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Vikipedia">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#EncyclopaedicKnowledge"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#VisualElements -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#VisualElements"/>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#VoiceCalling -->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#VoiceCalling">
  <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationTools"/>
</owl:Class>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#Watch
-->

<owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#Watch">
```

```

    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Query"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Youtube -->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#Youtube">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#SocialMedia"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlelevi#image
-->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#image">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#VisualElements"/>
  </owl:Class>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlelevi#video -
->

  <owl:Class rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#video">
    <rdfs:subClassOf rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#VisualElements"/>
  </owl:Class>

```

```
<!--  
////////////////////////////////////  
//  
// Individuals  
//  
////////////////////////////////////  
-->  
  
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#a&#amp;tBank -->  
  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#a&#amp;tBank">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>  
</owl:NamedIndividual>  
  
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#aBank  
-->  
  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#aBank">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>  
</owl:NamedIndividual>  
  
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#airTickets -->
```

```

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#airTickets">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#akBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#akBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#aktifBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#aktifBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#alBarakaBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#alBarakaBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlelevi#BankingOperations"/>
</owl:NamedIndividual>

```

```

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#amazon -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#amazon">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#anadoluBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#anadoluBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#arcelik
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#arcelik">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#atlasJet
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-

```

```

bbs_user/ontologies/2015/1/googlevi#atlasJet">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
  </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#avi -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#avi">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#video"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#bankAsya -->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#bankAsya">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
      </owl:NamedIndividual>

      <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#batik --
>

      <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#batik">
        <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
        </owl:NamedIndividual>

        <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#beymen -->

```

```

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#beymen">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#biletiva -->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#biletiva">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialEventTickets"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#biletix
-->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#biletix">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialEventTickets"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#bmp --
>

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#bmp">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#image"/>
    </owl:NamedIndividual>

```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#booking.com -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#booking.com">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#boraJet
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#boraJet">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#boyner
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#boyner">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#burganBank -->
```

```

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#burganBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#citiBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#citiBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#denizBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#denizBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#domino -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#domino">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineGames"/>

```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#ebay -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#ebay">
```

```
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#etsTur -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#etsTur">
```

```
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#exif -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#exif">
```

```
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#image"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#fibaBank -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#fibaBank">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>  
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#finansBank -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#finansBank">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>  
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#flv -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#flv">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#video"/>  
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#foreverNew -->
```

```

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#foreverNew">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#gMail -
->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#gMail">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationByEmail"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#gap -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#gap">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#garantiBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#garantiBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#geziko

```

```
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#geziko">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#gif -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#gif">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#image"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#gittigidiyor -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#gittigidiyor">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#halkBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#halkBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hepsiBurada -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hepsiBurada">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#hizliAl
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hizliAl">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hotMail -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hotMail">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationByEmail"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hotels.com -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hotels.com">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hsbcBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#hsbcBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#ikea --
>

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ikea">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ingBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ingBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#isBankasi -->  
  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#isBankasi">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>  
</owl:NamedIndividual>  
  
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#jango -  
->  
  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#jango">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#OnlineRadio"/>  
</owl:NamedIndividual>  
  
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#jollyTur -->  
  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#jollyTur">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>  
</owl:NamedIndividual>  
  
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#jpeg --  
>
```

```

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#jpeg">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#image"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#kamilKoc -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#kamilKoc">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#karnaval -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#karnaval">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineRadio"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#kuveytTurkBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#kuveytTurkBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#lidyana
-->
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#lidyana">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#limango -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#limango">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#mango
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mango">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#markafoni -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#markafoni">
```

```

    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
  </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mineCraft -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mineCraft">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineGames"/>
  </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mngTurizm -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mngTurizm">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
  </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#modagram -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#modagram">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
  </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#morhipo -->

```

```

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#morhipo">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#mov --
>

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mov">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#video"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#mp4 --
>

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mp4">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#video"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#mudo -
->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#mudo">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
    </owl:NamedIndividual>

```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#myBilet -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#myBilet">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#SocialEventTickets"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#n11 -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#n11">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#nilufer
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#nilufer">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#odeaBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
```

```

bbs_user/ontologies/2015/1/googlevi#odeaBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
  </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#onurAir -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#onurAir">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
    </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#outlookMail -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#outlookMail">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationByEmail"/>
    </owl:NamedIndividual>

  <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#pegasus -->

  <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#pegasus">
    <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
    </owl:NamedIndividual>

```

```

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#png -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#png">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#image"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#sekerBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#sekerBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#setur --
>

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#setur">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#skyScanner -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#skyScanner">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>

```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#skype -
->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#skype">
```

```
<rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#VoiceCalling"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#tBank -
->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tBank">
```

```
<rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tatil.com -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tatil.com">
```

```
<rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tatilBudur.com -->
```

```

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tatilBudur.com">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#teb -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#teb">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
  <rdfs:comment>&quot;teb&quot; is a short name of Turkiye Ekonomi Bankasi.
&quot;Teb&quot; has been chosen because this bank is known with its short name
by users.</rdfs:comment>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tekstilBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tekstilBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#thy -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#thy">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>

```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#touristica -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#touristica">
```

```
<rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#HotelTourReservation"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#trendyol -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#trendyol">
```

```
<rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#OnlineShopping"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#tripAdvisor -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#tripAdvisor">
```

```
<rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlelevi#HotelTourReservation"/>
```

```
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlelevi#tripsta  
-->
```

```

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#tripsta">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#trivago
-->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#trivago">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#HotelTourReservation"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#turkishBank -->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#turkishBank">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
    </owl:NamedIndividual>

    <!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#turkiyeFinansBank -->

    <owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#turkiyeFinansBank">
      <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
    </owl:NamedIndividual>

```

```
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#ulusoy
-->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#ulusoy">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#vakifBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#vakifBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#varan -
->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#varan">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#TransportationInformation"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#vatanComputer -->
```

```
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#vatanComputer">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#wmv --
>

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#wmv">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#video"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#yahooMail -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#yahooMail">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#CommunicationByEmail"/>
</owl:NamedIndividual>

<!-- http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#yapiKrediBank -->

<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#yapiKrediBank">
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>
</owl:NamedIndividual>
```

```
<!-- http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#ziraatBank -->  
  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#ziraatBank">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#BankingOperations"/>  
</owl:NamedIndividual>  
  
<!-- http://www.semanticweb.org/cc-bbs_user/ontologies/2015/1/googlevi#zizigo  
-->  
<owl:NamedIndividual rdf:about="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#zizigo">  
  <rdf:type rdf:resource="http://www.semanticweb.org/cc-  
bbs_user/ontologies/2015/1/googlevi#OnlineShopping"/>  
</owl:NamedIndividual>  
</rdf:RDF>  
<!-- Generated by the OWL API (version 3.4.2) http://owlapi.sourceforge.net -->
```