YILDIRIM BEYAZIT UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

DOCUMENT TRACKING AND INSPECTOR ASSIGNMENT SYSTEM

by

Recep Sinan ARSLAN

June, 2015
ANKARA

DOCUMENT TRACKING AND INSPECTOR ASSIGNMENT SYSTEM

A Thesis Submitted to the
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M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"Document Tracking and Inspector Assignment System"** completed by **Recep Sinan ARSLAN** under supervision of **Yrd.Doç.Dr. Lami KAYA** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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“Everything that can be invented has been invented.”
Charles Holland Duell
The commissioner of the United States Patent
and Trademark Office

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Recep Sinan ARSLAN

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LIST OF ABBREVIATIONS

IT	:	Information Technologies
LIB	:	Labor Inspection Board
GPS	:	Global Positioning System
ERP	:	Enterprise Resource Planning
PHP	:	Personal Home Page
XML	:	Extensible Markup Language
API	:	Application Programming Interfaces
RPC	:	Remote Procedure Call
SOAP	:	Simple Object Access Protocol
GIS	:	Geographic Information Systems
GWT	:	Google Web Toolkit
TDD	:	Text Driven Development
EJB	:	Enterprise JavaBeans
JMS	:	Java Message Service
JDK	:	Java Development Kit
JVM	:	Java Virtual Machine
JRE	:	Java Runtime Environment
JIT	:	Just-in-time Compiler
MVC	:	Model-View- Controller
GUI	:	Graphical User Interface
JDBC	:	Java Database Connector
EIS	:	Enterprise Information Systems

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DOCUMENT TRACKING AND INSPECTOR ASSIGNMENT SYSTEM

SUMMARY

In this thesis work, we have designed and implemented an "inspector duty assignment and work flow" program in order to perform assignment of inspectors to inspection duties and management of these assignment documents system. The system has the multiple functions such as registration of documents within a standard that come to be given to inspectors as duty, their processing, their being filtered when necessary, showing the filtered documents on a map, compilation of statistical data and assignment of these documents.

The program has been designed and implemented step by step. Primarily, requirements of the program planned to be prepared have been determined, then design has been made according to the needs and coding has been carried out. In developing this system, software tools such as Ext Gwt, Gxt, Java2EE, database programming and management tools such as MySQL, Hibernate, EJB and web server tools such as JBoss and Apache have been used. All of these tools are compatible with Java infrastructure and are open-sourced software development technologies. The program has 3 parts as database, server and client. There are web pages prepared with Java2EE in the client side, data tables prepared with MySQL in the database side and JBoss application server in the server side.

In general, for this thesis work, we have formed a web site that aims to present a user friendly interface, to provide a secure access to assignment documents with user login screen and to compile necessary statistical data.

Keywords: Inspector Duty Assignment, Document Tracking, Java2EE, Ext Gwt Framework, Google Map API

EVRAK KAYIT VE MÜFETTİŞ GÖREVLENDİRME SİSTEMİ

ÖZET

Tez çalışmasında, müfettişlerin görevlendirilmesi ve görevlendirme evraklarının yönetimi işlemlerini yapmak üzere "evrak yönetimi ve müfettiş görevlendirme" programı tasarlanmaya ve gerçekleştirilmeye çalışılmıştır. Bu sistem, müfettişlere görev olarak verilmek üzere gelen evrakların belirli bir standart dâhilinde kaydının alınması, işlenmesi, gerekli hallerde filtrelenmesi, filtrelenen evrakların harita üzerinde gösterilmesi, ihtiyaç duyulan istatistiki verilerin derlenmesi ve bu evrakların görevlendirilmesi fonksiyonlarına sahiptir.

Hazırlanması planlanan programın, öncelikle gereksinimleri belirlenmiş, sonrasında ihtiyaçlar doğrultusunda tasarım yapılarak kodlaması gerçekleştirilmiştir. Bu sistemin oluşturulmasında, Ext Gwt, Gxt, Java2EE gibi yazılım araçları; MySQL, Hibernate, EJB gibi veritabanı programlama ve yönetim araçları ile JBoss ve Apache gibi web sunucu araçlarından yararlanılmıştır. Tüm bu araçlar Java altyapısı ile uyumlu ve açık kaynak kodlu yazılım geliştirme teknolojileridir. Programın veritabanı, sunucu ve istemci olmak üzere 3 kısmı bulunmaktadır. İstemci tarafında Java2EE ile hazırlanmış web sayfaları, veritabanı tarafında MySQL ile hazırlanmış veri tablolar vesunucu tarafından JBoss uygulama sunucusu bulunmaktadır.

Bu tez çalışması için, kullanıcı dostu bir arayüz sunmayı hedefleyen, görevlendirme evraklarına güvenli bir erişim sağlamayı amaçlayan, gerekli istatistiki verileri derleyen, bir web sitesi hazırlanılmaya çalışılmıştır. Ve bu sistem "Document Tracking and Inspection Assignment System" olarak adlandırılmıştır.

Anahtar Sözcükler: Müfettiş Görevlendirme, Evrak Kayıt, Java2EE, Ext Gwt Altyapısı, Google Map API

CHAPTER ONE - INTRODUCTION

This study is the results of a thesis work carried out at the Institute of Natural and Applied Sciences at Yildirim Beyazit University and serves as a fulfillment of a Master of Science degree in Computer Engineering.

1.1 Thesis Outline

The thesis is laid out as follows:

Chapter one, Introduction, provides the background, definitions, problem formulation, goal, limitations and related research, projects and applications for the thesis work.

Chapter two, Geocoding Systems, give information about the different web map services and comparison of them.

Chapter three, Technologies, give the details of software technologies and substructure of applications with their comparison.

Chapter four, Implementation, covers the implementation of Inspection Assignment Program; the application this thesis work revolves around.

Chapter five, Discussion and Future work, discusses the outcome of the thesis and gives suggestions for future work and possible applications for assignment of inspectors with effective ways.

Chapter six, Conclusion, elaborates on the results and performance of the implementation described in chapter four.

1.2 Background

It is possible to handle the information concept in various perspectives and to define it. Generally, information refers to the totality of phenomenon, truth and principles that human mind is able to understand; knowledge; acquaintance; truth that can be obtained through research, learning or observation. When information is handled in respect of information terms, it is defined as the meaning that a person gives to data by benefiting from the consensual rules used in information processing.

As another definition, Barutçugil defines it as “personalized information that allows a person to grasp what is happening around him/her completely and accurately” and states that “information manifests itself in the forms of thoughts, predictions, intuitions, ideas, lessons learned, practices and experiences” [1].

The societies that understand the importance and the value of information have aimed to collect, evaluate, use, distribute and re-produce information. The societies that have grasped this value are called as information society. By means of this orientation, the information society has the primary key of development.

In our time, when the information is very valuable, information management becomes more and more important. Information management is to determine the value of information and to put it into practice for enterprises. Therefore, the information society can be defined as the society, which knows that there is information in the basis of social progress and development, and is based on learning, sharing and re-producing the information [2].

With the developing information and communication technologies, daily lives are also changing. This life is called as electronic life and internet network lies in the basis of this life. By means of internet, spatial boundaries are eliminated; all works and transactions done on the daily needs can be made electronically; it is made possible for people to communicate with each other through the internet. Commercial enterprises can conduct their business activities via internet network. And most importantly, government agencies can provide services to citizens on the internet. These all are the effects of the internet facilitating people's lives.

According to the traditional government model, “e-government” concept is used in order to express “a better government structure” that bases on a more developed and powerful Information Technology infrastructure and applications. In general, e-government system aims to provide a faster and more effective service to people.

One of the agencies, which need transformation in the e-government system, is the Labor Inspection Board of Ministry of Labor And Social Security. The Labor Inspection Board is an agency, which carry out labor inspection activities in the Republic of Turkey. This agency renders service to all employees and employers working under the umbrella of the government. The agency examines and evaluates

all kinds of data such as information, notifications, complaints that are reported to it. As a result of this evaluation, it performs inspection activities in the workplaces. The schema of these activities is shown in the Figure 1.1.

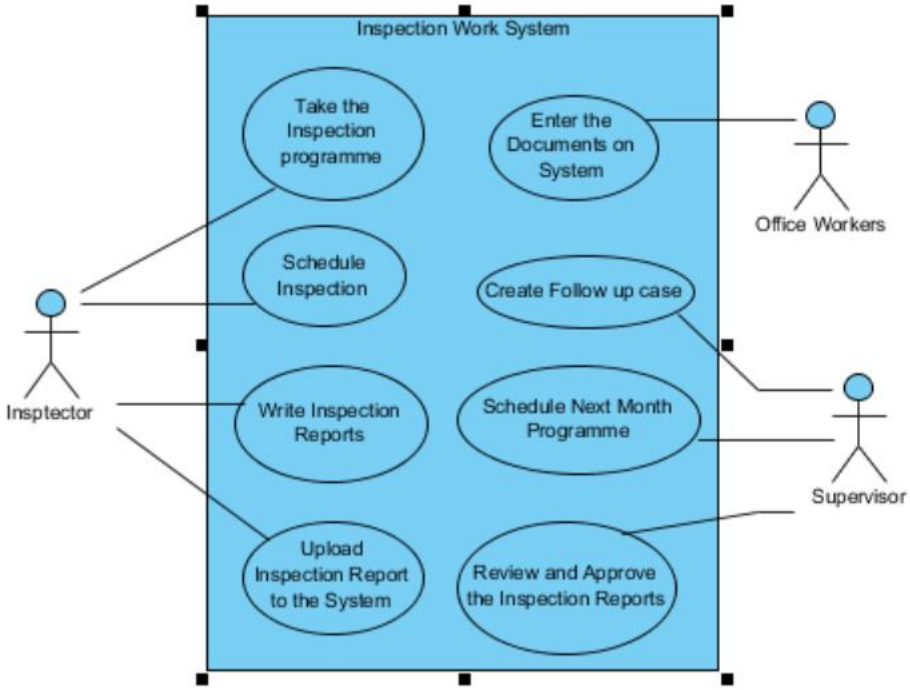


Figure 1.1 Labour inspection work flow [3]

The Inspection Board is founded in order to inspect, to manage and to carry out the implementation of the legislation relavant to issues of working life under the responsibility of the Ministry, to prepare plans and programs in this regard, to prepare legislation on labor inspection, to gather, assess and evaluate statistics, and to make investigations on the other relavant issues that will be regarded as necessary by the Ministry [4].

The Labor Inspection Board, by carrying out a risk assessment for each year, determines the priority sectors or fields to be inspected during the year. Working conditions and environment related problems or the intensity of complaints and applications from that field are the major risk criteria that are used to choose a sector or field primarily. Inspection programs are prepared, which include workplaces determined according to these criteria. All sorts of questions, suggestions, criticism, denunciation, complaints, applications and demands, which are related to the working life and social security, come via "ALO 170" line of the Labor and Social

Security Communication Center, applications under the Right to Information Act, and complaints, notifications and suggestions related to the working life under the Right to Petition Act via the channel of Prime Ministry Communications Center (BIMER).

Because it is an agency, which has an intensity of documents it receives from all these various channels, keeps the information security foreground, and for which access speed to information and information security are of great importance, the Labor Inspection Board has needed an advanced notification management systems and has put this master's thesis into practice as a solution. Therefore, it has been tried to gather documents in a central structure, to speed up their process, to follow them up from the beginning till the end, to report and manage them. Besides, a data standard has been created and all necessary data have been kept according to that standard; it has been tried to prepare a program, which will provide a fast and effective access to these information and also appointment of these documents to inspectors in order to be examined.

1.3 Definitions

These words and terms are used frequently and in specific senses in this thesis.

- Documents: documents that come to be given to inspectors as duty.
- Inspection Board: Ministry of Labor And Social Security, Labor Inspection Board.
- Inspection Assignment: Assignment of documents to the inspectors.
- Inspector: Labour inspector.

1.4 Problem Formulation

The Labor Inspection Board needs an electronic management system for data management. Because it is an organized structure in more than one region, this system should be accessible from everywhere. Additionally, the system should make the documents' management comprehensible. This thesis study is basically divided into two sections:

1) Section One: As it is stated in the Section 1.2, it is to provide the documents, which attains to the Labor Inspection Board from various channels (ALO

170, BIMER, Ministry of Labor And Social Security), to be logged in the system within a certain policy and standard.

2) Section Two: It is to provide to produce utilizable data by processing these data and to ensure presentation of them.

The capabilities of the application to be prepared for this thesis will be as follows:

- Providing users to log in the system: By using program screen, users can log in the system with the user names and passwords. Besides, they can request a new password, if they forget their passwords, and new users can also register in the user's database by using the related screen.
- Providing the access of documents coming in different ways to the system: Thanks to the system, the entry of all kinds of requests to the system that attain to the Committee Board in different ways will be ensured via the interface, which is prepared. These operations and controls will be done over the developed page. The system will provide a simple interface for users.
- Visualizing of data, entries of which are provided into the system, on the map by processing them: Through the system, it will be provided that the data included in all petitions will be processed and they can be seen visually on the map. Therefore, it will be ensured that a summary of thousands of data can be displayed visually in order to determine a policy in the future. After documents' entry is completed, the system will do an update on the map simultaneously.
- Providing an easy access to all request's summary visualized on the map: Through the system, an easy access to the summary information related to the content of all the petitions visualized on the map will be provided by markers on the map. Besides, if requested, more detailed data of the relevant documents will be able to be seen.
- Providing the filtering requirements because of tremendous amount of data, which are displayed on the map: Filtering operation on the data will be able to be carried out by using the system. These operations will be supplied from the navigation panel on the map.

- Assigning the filtered or selected petitions to the relevant personnel: A new screen will be supplied for the fulfillment of necessary assignment procedure for examining of requests by inspectors. By means of this screen, personnel assignment can be done.
- The details of the task and petition will be sent to the personnel, whose assignment is completed: By using the system, the data related to the petitions desired to be assigned will be sent to the relevant personnel, other officers and administrative staff via e-mails and messages over the system.
- Export of the filtered data will be possible as files with xls or pdf extensions: By means of the program, if needed, export of filtered data will be possible in the form of excel or pdf file, and can be used, where necessary.
- Direct access to the digital data of all statistical-based data recorded into the system will be provided: Users, if they need, can access to the document type and digital statistical data on sectoral basis of all documents recorded into the system. In addition, they will be able to access to monthly and annual statistics for assignment of inspectors.
- System users will be able to convey their problems to the program administrator via e-mail, when they face any problem.
- Access to different parts of the system will be provided to personnel within their competence: The system will enable personnel with different competences to access to different degrees of system. It will manage this through logging window and controls.

To fulfill the requirements listed above, a website that will use Java infrastructure is being designed and planned to be written. Owing to this website, it will be possible to carry out the works and transactions mentioned above as web-based.

1.5 Goal

The goal of the thesis is to record all kinds of assignment documents attained to the Labor Inspection Board into a particular system and to visualize these recorded data. Filtering/classifying operation will be carried out on the data, and after this

classifying operation, assignment to the relevant persons will be done. Besides, detailed statistical data related to the relevant documents will be possible.

1.6 Limitations

During the preparation phase of the thesis, detailed and enough information about the agency could not be reached, before starting to develop the application. Thus, the application has been developed in the light of limited data and predictions. Besides, that the knowledge level of personnel is too various so, reveals the requirement to prepare the program in a detailed way and proper to different levels. In addition, that testing environment for software can not be provided hinders the verification of the application and correction of errors.

1.7 Related Works

Document management or spatial visualization applications are quite common due to the introduction of electronic government system. Although these applications are quite similar in name and structure, their goals are completely different from each other.

Some of these applications are given below with their brief details:

- Imaging in the web maps is done on the program papered for the thesis and in the thesis “Creation of a Search, Rescue and Monitoring System Based on Spatial Data in Web Maps” prepared by Bayram Giray Filiz, student in the Institute for Aviation and Space Technology, Air Force Academy, in 2013. This imaging operation is done by using actual spatial data reaching to the program from systems of Global Positioning System (GPS). It is worked on the telephones with GPS. When the telephone connects to the internet, it transfers the spatial coordinates of its location to the server. The users can also observe these transferred data over the website. For web mapping, Leaflet maps have been used [5].
- The thesis study “Electronic Document Management System as E-Government Application and an Application” prepared by Şahin Özgür Çeri, postgraduate student in Süleyman Demirel University, is a project of transferring all correspondence conducted in agencies into electronic

environment. The management, storage and coordination of correspondence being conducted inside and outside the agency are provided. Via this program, documents can be reached and reporting can be done with the necessary search through internet. It has been started to be used on January 26th, 2008. By means of this program, processing time of documents decreased from 2-10 minutes to seconds. It has contributed to the effective use of human capacity [2].

- The thesis study "New Location-Based Task Distribution Portal for Monitoring of Skills Training in Business" prepared by Mehmet Rüştü Mercan, student at Institute of Science and Technology in Sakarya University, is a location-based web application. It is a program, on which the training of vocational school students receiving skills training in business is monitored. Using this program, location-based task distribution is carried out. It is a system, which ensures a healthy communication between school and business. The details of all companies being in relationship have been kept in databases. It is a kind of Enterprise Resource Planning (ERP) software. It has been used Php for web programming, MySQL and Jquery for database. It has been utilized from Google Map API for mapping [6].
- The thesis study "Content Management System of Php, MySQL and Xml Based Turkish Dynamic Website: Dyna" prepared by İsmail Kirbaş, student at Institute of Science and Technology in Kocaeli University, is a content management website. It is a program, which is developed for user with no software skills to improve dynamic websites. Templates are used in the content management system of "DyNA" website. Thus, while providing visual integrity on the site easily, it becomes possible to produce and manage the site's content smoothly. By developing the program, Languages of Php, MySQL and Xml have been used [7].
- The thesis study "Internet-Based Student Registration System by Using Java Technology" prepared by Kürşat Kurt, student at Institute of Science and Technology in Muğla University, is a Java-based website for student registration. It is a website, which has been prepared to eliminate the failures

experienced during university students' registrations. It makes it possible for students to do operations they do in register's office such as re-registration and course registration over the internet. The technologies such as Java, Jsp have been used [8].

- Department of Science and Technology, Linkoping Institute of Technology student Eric Sjödin prepared an application which is the name of "An Application for Map-centric Management of Photographs with Embedded Spatial Metadata". In short Pixgis is an interactive environment in which photographs may be discovered, viewed and managed through maps. With Pixgis finding photographs from a specific location or of a particular structure is as easy as finding the location or structure on a map. As Pixgis simultaneously displays maps, photographs and spatial metadata it also enables users to analyze photographs in new manners. This thesis work illustrates the benefits of applications for map-centric management of photographs, exposes the problems one faces when implementing such applications and presents novel solutions to many of these problems. The thesis also elaborates on spatial metadata and methods for acquisition of photographs with embedded spatial metadata [9].

The articles written about similar subjects:

- An article "Internet-based Geographic Information Systems and Control and Management of Cartographic Production" has been written by Yusuf Bahri Ceyhan and Mehmet Yerci, personnel in the Department of Cartography of General Command of Cartography. A system has been designed for the control and management of cartographic production by internet-based geographic information systems [10].

- An article " Internet-Based Geographic Information Systems and Using Them For Forest Fires" written by Kemal Şahin and M. Ümit Gümüşay, the personnel in the General Command of Cartography, is a study of using geographic information systems for monitoring forest fires. The system is a network-centric program, which uses internet in order to achieve distributed data and analysis functions, to do analyses and visualization. By using

analyses and visualization methods of geographic information systems, it has been intended to facilitate the decision making process for fire managers. It is a web project, which is programmed by using Asp.net [11].

- In the article "Market-Based Task Distribution with Nearest Neighbor Heuristic Approach" prepared in Anadolu University, it is to distribute the tasks by means of market-based task distribution architecture. It has been aimed to build routes with no collisions during this distribution process. To find routes, the nearest neighbor heuristic approach and the shortest path algorithm of Dijkstra have been used. To prevent collision, a different method has been developed [12].

CHAPTER TWO - GEOCODING SYSTEMS

The development of web application that manipulates geocoding dataset is generally supported by Application Programming Interfaces (APIs) that leverage specialized component frameworks. These components enable rapid development situation for high quality applications [13][14]. An API is used by programmers, domain experts who are a programmer in the development process. When selecting an APIs, It is searched for APIs that improves the productivity of software engineers, through usability [15]. In this part, firstly two types of geocoding mechanism are explained. Then an academic test of all web mapping systems is shared [16].

2.1 Pc-based Applications

Centrus 2008 US Street Point Data, offers a commercial geocoding application that suited toward need of organizations required address-level geographic analysis. It provides various levels of details in its database. It integrates many different street networks. After searching a kind of address in the software, it gives us an output file. The output file contains matched or not and details on the positional accuracy, attributes of given data (e.g. Country, city, zip code), reference data feature, interpolation type and errors. Figure 2.1 shows the test results corresponding to reference datasets.

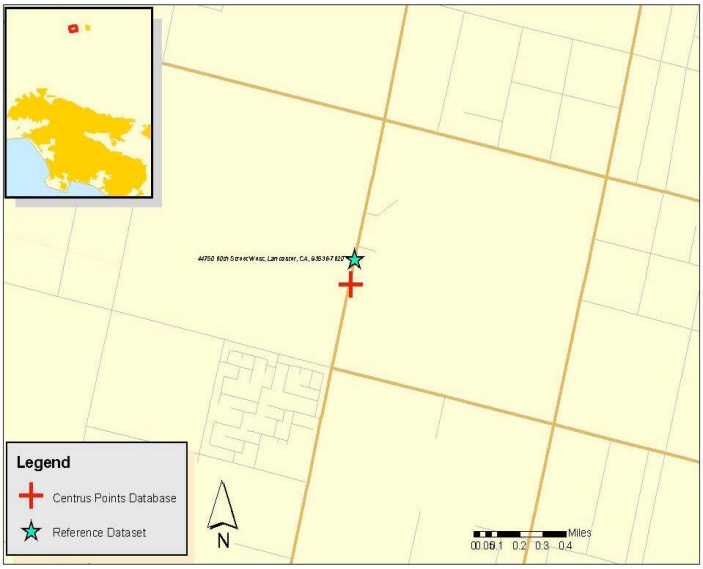


Figure 2.1 Partial view of centrus geocoding test result and corresponding reference dataset [16]

ESRI Geocoding functions coming from ArcGIS. It uses ArcCatalog, ArcMap and ArcToolbox. ESRI address locater uses more reference datasets. These datasets cover address attributes, indexes, and queries. In addition, it gives us an opinion about address standardization, searching methods. Figure 2.2 shows the test results corresponding to reference datasets.

Figure 2.2 Partial view of ESRI geocoding test result and corresponding reference dataset [16]

The Geolytics is a commercial application which converts addresses into the latitude and longitude. It has no operation of address parsing and standardization. Reference datasets are based on TIGER and CensusCD that is given below. Figure 2.3 shows the test results corresponding to reference datasets.

Figure 2.3 Partial view of Geolytics geocoding test result and corresponding reference [16]

2.2 Web-based Applications

Geocoder.us is a widely used web based geocoding tool. It is supported by Locator Technologies. It based on Perl module which is free and open source. It takes address and returns parsed address based on reference dataset. If address can be parsed, single result is returned with latitude and longitude. Free online version does not include details of match type, standardization, processing methodology. Its functions can be accessed by XML, RPC, and SOAP etc. that are web-service oriented frameworks. Commercial version provides distance calculation and there is also lightweight service for mobile devices. Figure 2.4 shows the test results corresponding to reference datasets.

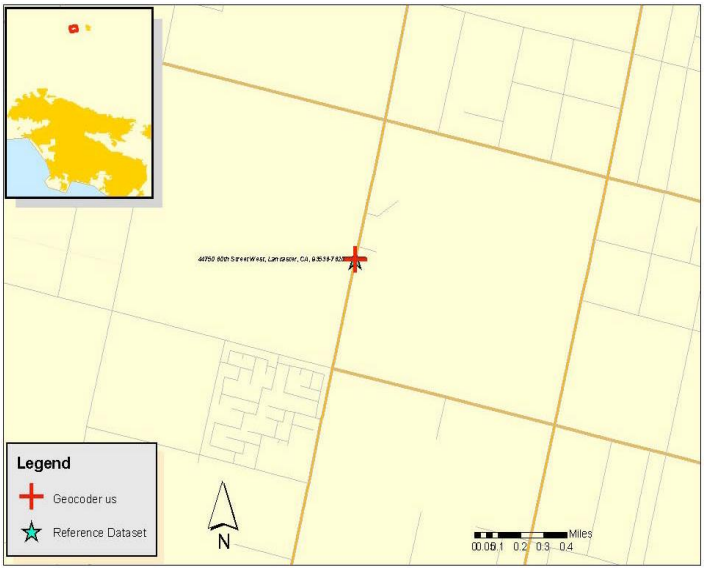


Figure 2.4 Partial view of Geocoder.us geocoding test result and corresponding reference [16]

Google Earth is a desktop version released by Google in 2005. It runs on all operating systems such as Microsoft, Mac OS X or Linux. Free version provides only one address coding. It offers 3-dimensional viewing with satellite images, aerial photography. It does not give metadata, details of match type, address standardization or other geocoding performing methodology. Figure 2.5 shows the test results corresponding to reference datasets.

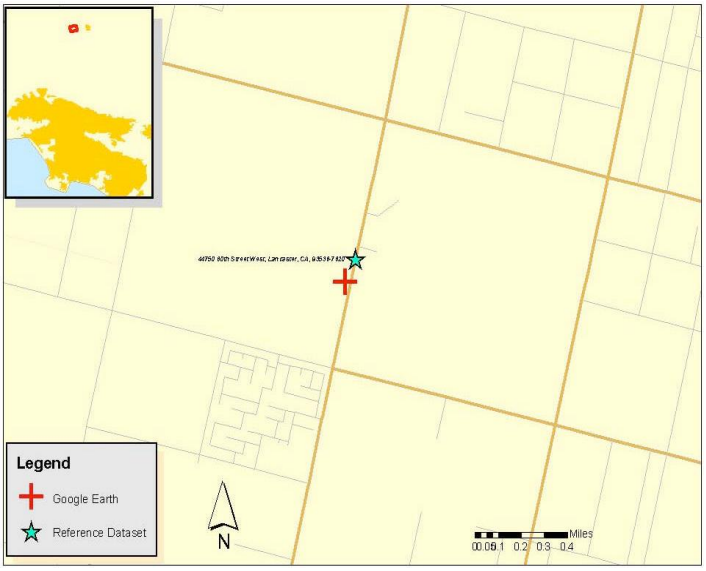


Figure 2.5 Partial view of Google Earth geocoding test result and corresponding reference [16]

Google Maps API is one of the most well-known web-based Geographic Information System (GIS) tool which is available. It provides web mapping services

and technologies for free in worldwide. It is used by many different map-based services on improved web-sites through the utilization of Google MAP API. Its functions are street maps, a route planner or address locator for many countries. Users can search by giving an address, intersection, business name so on. It also provides high-resolution imagery that is taken from airplanes instead of satellites. Reference data is coming from Tele Atlas and NAVTEQ. Figure 2.6 shows the test results corresponding to reference datasets.

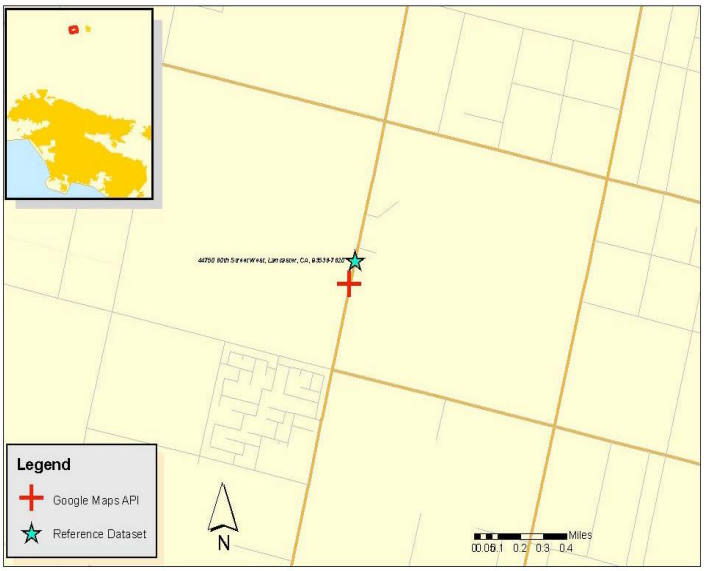


Figure 2.6 Partial view of Google Maps geocoding test result and corresponding reference [16]

Yahoo Maps API is another free and popular web based GIS tool. It includes geocoding functions. Online map version of it supports only single address geocoding. Yahoo Map API can be used by software developers to perform processing. It provides to find specific latitude and longitude in order to given address. Users can search by entering an address, intersection, business name or attraction such as Google Map API. Successful match returns location with street, zip code, city and country. Finally, it does not provide highly detailed metadata and accuracy whether address is not found. Figure 2.7 shows the test results corresponding to reference datasets.

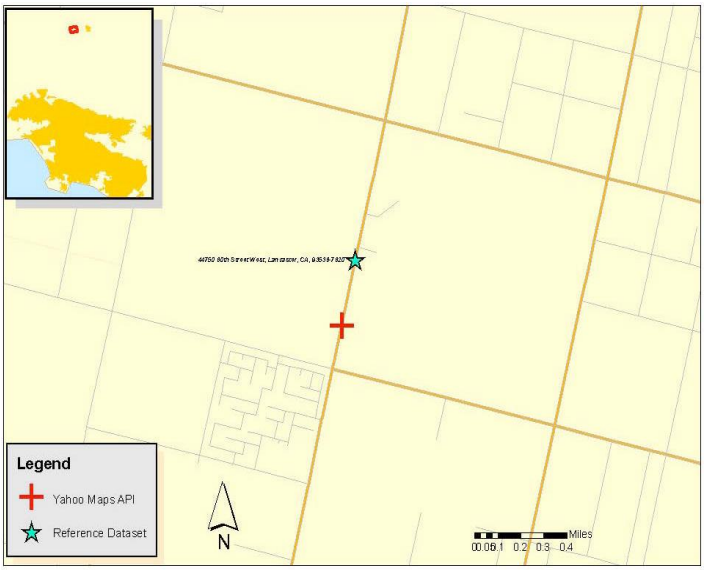


Figure 2.7 Partial view of Yahoo Maps geocoding test results and corresponding reference [16]

2.3 Licensing and Cost Comparison

Commercial products are better than free versions in some ways. These are reference data compilation, maintenance, updating, user-friendly interfaces and technical support. However, they are the high prices associated with setup, long-term maintenance and licensing. Price increases according to reference datasets, functionality etc.

Main advantage of open source geocoding applications is software that is available for free and complete code base. Because of that, no license fee is required, fully extensible. User can build new components, run on cross-platform and share on the internet. On the other hand, open source solutions do not have user friendly interfaces compare to commercial products. Therefore, they are more complicated to use if one wishes to run on their big organization instead of local.

2.4 Why Choose Google Map API

Geocoding platforms which is available and largely used is explained previous parts. They are evaluating in terms of cost, functionality, customization, reporting capabilities. Depending on the needs, requirements, technical ability, each of Pc-based or web-based geocoders can be chosen. Most importantly, price alone is not a good guide to geocode accuracy. Most expensive geocoder, Centrus, and free online web services, Google, Yahoo outputs almost the similar as you see below. Finally, it

is clear that each of these geocoding systems has some bad and good sides. Maybe, best solution for choosing application is composition of different Application Interfaces.

Google Map API is the most popular according to Programmableweb.com in 2010. It let you harness the impact of Google Maps to use in your personal applications to display your own dataset in an efficient and usable manner. So that, Google Map API was chosen in the software of me.

CHAPTER THREE - TECHNOLOGIES

3.1 Google Web Toolkit (GWT)

Figure 3.1 Google web toolkit symbol [17]

Developing web sites has become a harder task because of expectations are higher today. They must be modern, interactive and complex. Level of web sites compares with Gmail or Google Map application. Thus programmers want to work up to that level and produce such as powerful new web sites. Style, speed and interaction of these new websites are better than old desktop applications. So that users wish to new things not go back [18].

Firstly, solution for these new interactive web sites is usage of Ajax. But although usage of Ajax, the rest of developing web pages, tools, testing methods and the results are the same as before.

Google Web Toolkit (GWT) has been created in last few years. (see Figure 3.1) It is a powerful tool. It uses the power of Java, large programming environment, many new development tools. It has efficient developing and consistent output even though too many internet browsers that have many differences with each other. To start with GWT is not hard. Documentations are very well. Many well-known Java compilers can be used such as Eclipse to start working with GWT. Coding of GWT with Java is similar to old Java Swing coding. But if you want to create high quality, secure, complex web sites, you need to have high-level code [19].

3.1.1 Advantages of GWT

GWT has many advantages for both the user and the developer. GWT provides a great deal of help for developers in other areas. These advantages are :

3.1.1.1 HTML Ubiquity and Browser Differences

The first reason for GWT applications is the ubiquity of HTML. Although few years ago, there is no any cell phone that is as capable as browsers, todays you can easily access/buy a cell phone with all capabilities same as computer. So that, if you want to develop an application with any language/technology, it must run and look perfect in devices from cell-phone to computers.

Browsers (Mozilla, Firefox, and Chrome) are not created with same programming features. If Microsoft's Internet Explorer is used all users in the world, this is not a remarkable problem. But, statistics show that Mozilla Firefox, Safari, Internet Explorer share the market. So that you should pay attention to browser's creating features. In any case, GWT is adept at solving browser's problem and differences.

3.1.1.2 Javascript Deficiencies

Even assume that all browsers are fully standard, JavaScript is a big problem. Although, it is a powerful language, it is not a good language in terms of software engineering. Producing new large-sized applications is a bit complicated.

JavaScript is not suitable for developing big projects that are coded by large groups of people. And development tools are not well designed. So programmers must add extra line to bridge between object- oriented design and implementation of it.

One solution to solve this problem is the usage of different extra libraries that support to work with higher-level way of using languages. Second solution is using GWT. It solves this problem in a totally different way by enable to use of higher level Java. To do this, there are lots of modern developing, documentation and implementation tools.

3.1.2 Software Methodology to Apply

If you start to learn developing systems, you see the Waterfall Model that are shown below (Figure 3.2). All other methodologies are based on it.

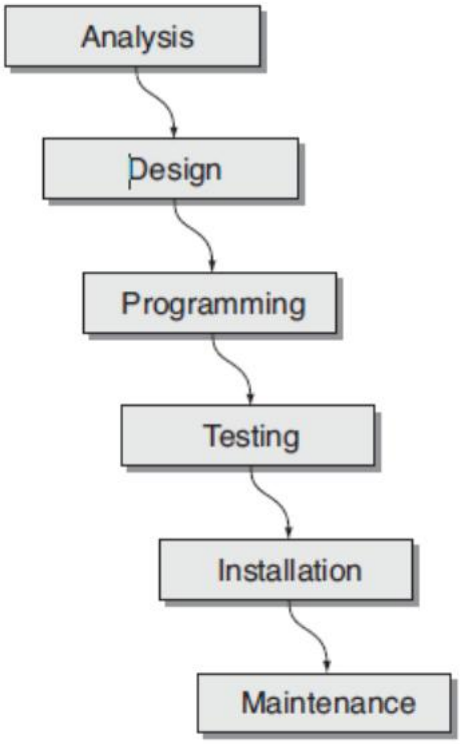


Figure 3.2 The classic Waterfall model[19]

Waterfall model is based on “measure twice, cut once”. But you usually do not apply this methodology’s steps. When requirements change along the developing time, what will happen? You need to go top of model. On the other side, Modern Agile model is going totally different way and that’s way you should use with GWT.

3.1.3 Agile Model

Nowadays, software development strategies are going to reduce the time. Requirement analysis and development parts must complete in shorter time. Using iterative method help us to access final application in short time. Prototype usually use to interconnection between programmer and user. Instead of designing whole system at the beginning, part by part developing strategy uses. All these systems have been defined as Agile software method until 2001. This method is collective of

development of systems, in highly iterative with often verification and adoption of code.

GWT is perfectly suitable to use this method. It suggests iterative development, rapid prototyping and automatic testing. GWT has utilized for unit testing and acceptance testing.

3.1.4 Why Use GWT

Since its present in May 2006, questions are asked: Why do you code with GWT, What is the differences between JavaScript, What advantages does have GWT? Etc.

GWT is a tool that enable to code client-side application with traditional Java. It compiles Java to JavaScript that is executed at browser. Web application has high level interactivity such as desktop application with minimal need of server side code. Compiling into JavaScript gives it to speed and optimized, better source code. Differences and quirks between browsers are not problem for GWT. Therefore it generates suitable code for each of these specific browsers such as Firefox, Chrome or IE.

3.1.5 Why Use Java

The usage of Java is common. At the beginning of programming web applications, if you are Java experienced programmer, learning of GWT is not hard same as other frameworks. Additionally, JavaScript developing IDEs are to basic debugging methods.

Java is also suitable for Agile Method such as XP. TDD (Text Driven Development) is supported Junit testing for client and server side.

Furthermore, developing web sites is easy with using Java Swing Objects. If you want to create better screen websites you can use widget, effective java libraries and so on [20].

3.1.6 Disadvantages of GWT

Although all we said before which are advantages and good thing for GWT, there are some negative points. GWT web pages are not indexable by search engines. As

web pages are created dynamically and search engines cannot access the content. Cloaking is a solution. But it is difficult to apply with GWT.

GWT applications have new features that are not supported by older browsers. So that, if client uses older version of any browsers, there can occur problems for GWT applications.

Security of GWT applications is the same as ordinary JavaScript applications. New security options coming up nowadays but same security tools are sharing between GWT applications to other web applications.

Deploying and compiling is slower and needs more computer skills. Solution for this problem is to use libraries like ExtJS or JQuery.

Finally, Java to JavaScript conversion can be poor and generated code will be long and slow. This is acceptable for GWT users. But working with JavaScript and implementing big project that will run all browsers is hard. You need to write more code and spend more time. To meet with success same result as with a few lines of Java code in GWT.

3.1.7 GWT RPC

The GWT RPC framework makes easy to exchange Java object over HTTP for client-server parts of your web site. Service is used for the server-client code that gets called from the client. The implementation of a GWT RPC is based on the Java servlet structure. To make calls to the service, you will use proxy class that is generated automatically by the client code. GWT will handle serialization of the Java objects passing back or forth with calling the methods. GWT RPC services are different from the web services base on SOAP or REST. They are simply version for transferring data from server to GWT application. (Figure 3.3) shows the definition of GWT RPC [21].

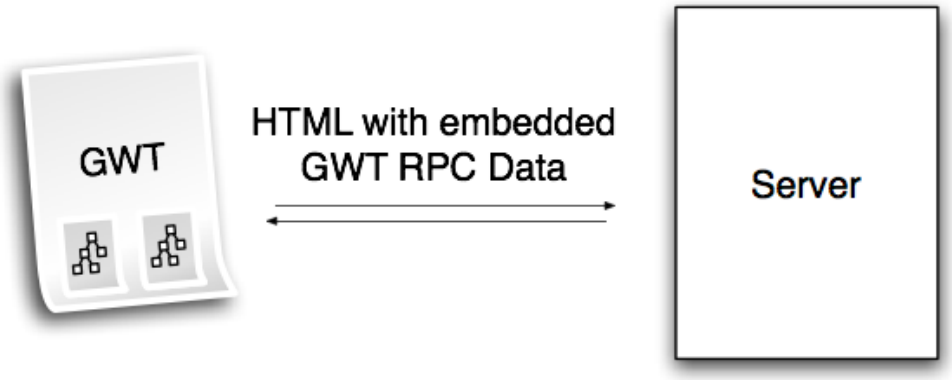


Figure 3.3 Definition of GWT RPC [22]

3.2 Application Server

The application servers use to separate business logic from presentation logic. This is good for developing web sites in short time. When you start to develop new web application, you only write new modules. You don't need to write from the beginning. You can use old written modules. So that, application servers are good choice for developing complex and big web sites.

EJB (Enterprise JavaBeans) is the most common object framework. It has three parts: session bean which runs in browsing session with business logic; Entity bean which stores date on database table; Message Driven bean uses JMS (Java Message Service).

Application servers are trustable and scalable. Application server clustering is one way to provide reliability. One server is out of service, processing must be continuing without any data loss.

Application servers provide connection pooling and state management. And it also provides connectivity to database, enterprise resource, mainframes and message queuing.

There are many application servers. These servers are created by BEA, Borland or JBoss (open source) and Sun. Comparison of the application servers was done on Java Platforms ans why JBoss is chosen showed [23].

3.2.1 Features of Application Servers

Although all application servers support Java2EE, there are some differences which are depending on EJB, servlet, database, operating systems, user interface, tools etc. Table 4.1 shows these features.

Table 3.1 Basic features of the application servers [23]

Features / Application Servers	Inprise Application Server 4.1	BEA WebLogic 6.0	J2EE RI 1.3beta	JBoss 2.0
Supported OS	Windows 9x, Windows NT, 2000 Solaris HP-UX 11.00 Redhat Linux 6.2 AIX 4.3	Windows NT 4.0 Windows 2000 Solaris HP-UX 11.0 Redhat Linux 6.2	Windows NT 4.0 Windows 2000 Solaris 7,8 Redhat Linux 6.2	Any OS with JVM
EJB Version	EJB 1.1	EJB 2.0	0 EJB 2.0	EJB 1.1
JDK Version	Jdk 1.3.0	Jdk 1.3.0	Jdk 1.3.0	Jdk 1.3.0
J2EE licensed/certified	Yes/Yes	Yes/Yes	Yes	No/No
Servlet version/JSP Version	Servlet 2.2/ JSP 1.1	Servlet 2.2/ JSP 1.1	Servlet 2.3/ JSP 1.2	Servlet 2.2/ JSP 1.1 (with Tomcat integration)
Wizards	Yes	No	Yes	No
Supplied database access	JDataStore	Cloudscape v3.6	Cloudscape v3.6	Hypersonic
Remote console/Full command line	Yes/Yes	Yes/Yes	No/Yes	No/Yes
Monitoring tools	Yes	Yes	No	No
Automatic deployment	No		No	No
Hot deployment of EJBs	No	No	No	Yes

3.2.2 JBoss (Open Source)

JBoss is an implementation of the EJB 1.1 specification. These specifications are server and container. JBoss provides only EJB Server. It does not involve supporting for JSP, SSL and other protocols that are Sun Products. So, it occupies smaller memory and needs smaller disk space. JBoss runs very effective on local computer with only 64 MB of RAM and some MBs of disk.

Because of its smaller requirements, it starts faster than other servers. JBoss starts with SQL database server. Another feature of JBoss is hot deployment. Deploying a bean is very simple like copying JAR file into deployment file. If this is done before, JBoss automatically changes the loaded version and loads new version. JBoss provides GUI XML editor to configure deployment descriptor. JBoss is distributed with GNU License that means free.

3.2.3 Performance Test of Application Servers

To see Java application server's limits and found signification differences, performance test is rendered. Servers have been tested on Dell computer with Intel Pentium, 128 MB RAM, 20 GB Hard disk and Linux operating system. Test results are given below. (see Table 3.2)

Table 3.2 Test results for application servers under stress conditions [23]

Number of Call/Server	5	10	50	100	500	1000	5000
Inprise Application Server	4.6	3.2	2.56	2.05	2.128	2.083	1.837
WebLogic Application Server	2.0	1.9	2.02	1.93	1.956	1.91	1.584
J2EE RI	4.4	4.7	6.72	5.85	5.652	5.562	4.561
JBoss	5.4	5.1	4.02	4.00	3.674	3.477	2.852

3.2.4 Results and Why JBoss Application Server Is Chosen

The companies want to develop efficient application for using local and internet. This application will be good option to gain money. Timing and more features are

the key factor to choose new technologies. Choosing right application server depends on your expectations.

For beginners in J2EE, the best choice is Reference Implementation from Sun. It does not need complex servers. It is easy and free.

WebLogic server is reliable and complex. It offers best support and it needs higher level understanding Java2EE. It is very expensive and it is best choice for security. For better performance and not extremely complex applications, JBoss is optimal choice. It is also free. It needs knowledge about J2EE. You have to manually create deployment packages.

As you see the results, my thesis application is not extremely complex. I need to better performance with low level hardware. So, I choose JBoss instead of others.

3.3 Jdk, Jre, Jvm, Jit

The Java Development Kit (JDK) is an implementation of Java SE, Java EE or Java ME platforms [24]. It is created by Oracle Company in the form of a binary file. Java programmers on Solaris, Mac OS X, Linux or Windows can use it. The JDK includes a private Java Virtual Machine (JVM) which is an abstract computing machine [25][26].

Java Runtime Environment (JRE) is an implementation of the JVM. JDK that includes several development tools such as Java libraries, Java source compilers, Java debuggers, bundling and deployment tools [27].

JVM becomes an example of JRE that is used at runtime of the java code. It is also known as a runtime interpreter. The JVM is a structure that is any of Java technology built upon. It is responsible for hardware and platform independence. JVM helps the Java programmers who use the libraries for their programs from JDK in due to the abstraction of inner implementation. Figure 3.4 shows the structure of JVM.

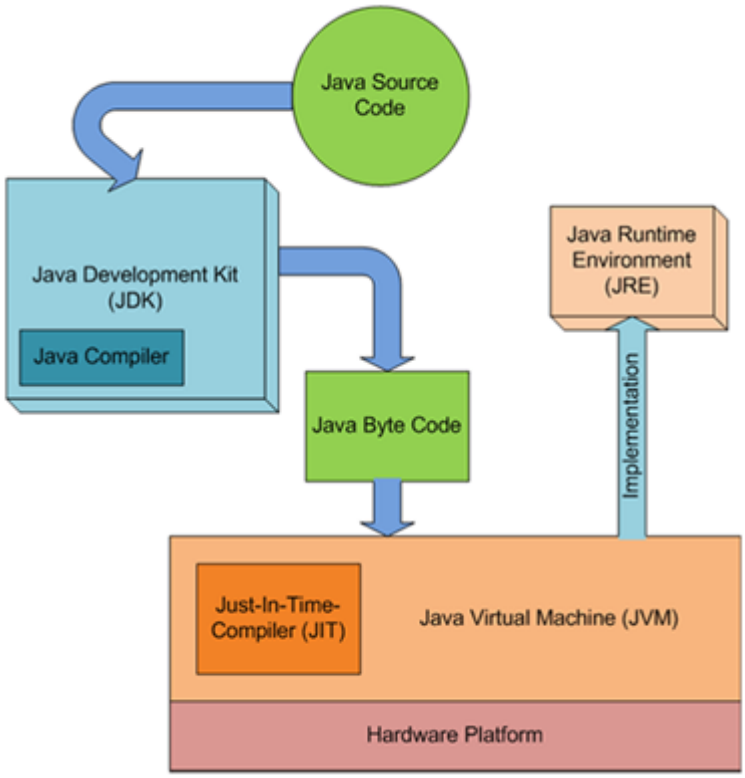


Figure 3.4 Diagram to show the relations of JVM, JDK, JRE, JIT [26]

JVM controls different memory areas at run time with using a kind of instruction set. Each hardware platform has a different JVM which is supplied by JREs. It is like a implementing a programming language with using a virtual machine.

JVM instruction includes an opcode specifying the operation to be performed. It is followed by operands including values to be operated upon. From the point of view of a compiler, the JVM is a processor that has an instruction set, Java bytecode which can be generated. Source code to byte code is converted by the JRE and gets interpreted to the platform specific runnable ones.

Just-in-time Compiler (JIT) is the part of the JVM. It is used to speed up the execution time. It compiles parts of the byte code not all that have same functionality at the same time. Therefore, it reduces the time that is needed for compiling.

At the end, let’s say that “compiler” refers to a converter from the command set of a JVM to the command set of a CPU [26].

3.4 Database

Database is a collection of data stored in a file. Data are structured as a table. Tables can connect with each other. If a database has these relations of table, it is called a relational database.

MySQL, Oracle, The Microsoft SQL server and IBM DB2 are example of relational database systems. These systems have a program to manage tables. Database system is responsible both for security of data and processing of queries which is about analyzing, sorting or adding etc. Furthermore, all of this should be able to stay not only single, but over a network.

Database client is a program that is connected the database. It is responsible for simplifying the using of the database for users. Database clients can assume a variety of forms [28].

3.4.1 Relational vs Object Oriented Database Systems

Relational databases have dominated the database market. They have suitable structure for business data. Besides object-oriented databases can store free-standing object. They don't need to arrange the data into a table. Object-Store, O2, Cache is an example of these databases.

Relational databases can be accessed by object-oriented programming languages logic. Object-oriented database systems enable direct access to object with the questions in the programing language. It is not possible with relational database systems in which everything must be structured in tables.

3.4.2 MySQL

MySQL is a world's second most widely used relational database management system that open-source, multithreaded and multiuser. It is a project under the terms of the GNU General Public License. MySQL was firstly created by Swedish company and now owned by Oracle Corporation [29].

3.4.3 Features of MySQL

MySQL is an open source database system. So that it has many different features. These are:

- Relational Database System: MySQL is a kind of relational database system.
- Client/Server Architecture: MySQL is a client/server structure. There is a database server and many different clients. Client means application program. They communicate with the server to query data, save or update data, etc. They can run both on local computer and Internet. If the number of users increase, using file-server systems instead of client/server system is getting extremely inefficient.
- SQL compatibility: MySQL supports SQL language. Querying and updating data is done by SQL language. There are many SQL versions. MySQL use standard type with significant restrictions and many extensions.
- SubSELECTs: MySQL is capable of processing recursive queries in a form.
- Views: MySQL gives a permission to use views that relate to an SQL query that is viewed as a distinct database object.
- Stored procedures: Stored procedures are related to SQL codes which are stored in database. They are useful for inserting or deleting data that keep on tables. Programmers do not process the table directly, they rely on stored procedures to do this. It helps the administrators of database and increases the efficiency.
- Triggers: Triggers are SQL commands. They are executed automatically by the server in database operations such as insert, update and delete.
- Unicode: MySQL supports all character sets.
- User Interface: There are convenient user interfaces for administrators.
- Full-text search: This search technic simplifies searching for words that are standing within a field. For example, if you control a kind of forum that includes many text data, you have to use full-text search to provide efficient search systems.
- Replication: Replication provides copying the contents of a database onto other computers. This is proper for handle system failures and increate protection of database and increase the speed of queries.

- Transactions: Transaction means the execution of several database operations as a group. System ensures that either all operations will execute completely or none of them. This is proper for solving the problem such as power failure, the computer crashes, or some other troubles.
- Foreign key constraints: These rules control that there are not cross references in linked tables.
- GIS functions: MySQL has provided the storing data into two-dimensional geographical data.
- Programming languages: MySQL has many different APIs, so users can use any programming language such as C, C++, Java, Perl for client programming.
- ODBC: MySQL supports the ODBC interface. This allows MySQL to run under Microsoft Windows or UNIX.
- Platform independence: Like client applications can run under variety of operating systems: MySQL also can be executed under any of them.
- Speed: The large number of benchmark tests shows that MySQL is a very fast database program [30].

3.5 Java2EE (Enterprise Software)

Enterprise means that a group of particular parts come together to achieve a goal. Enterprise software includes many distinct parts. But companies that need enterprise software want to integrate all parts of them with maximum enterprise benefit [31].

Enterprise software has many ways to provide integration of company. These ways are:

- Enterprise software can provide a service to contact customers with company on the internet.
- If you sell your product on the internet, enterprise software can reach many buyers.
- Enterprise software tenders lower cost web sales channels.

- Enterprise software makes market available on anytime contrary of human resources. It provides good service while reducing operational costs.

3.5.1 Java2EE

Java 2EE is architecture to create complex, large sized, distributed Java Applications. It was promoted by Sun in 1999. It has some changes especially in Enterprise JavaBeans (EJB).

Java 2EE consists of following:

- Design guidelines
- Reference implementation
- Compatibility test suite
- Application Programming Interfaces (APIs)
- Technologies to simple production

Figure 3.5 shows relationship between Java2EE platform parts.

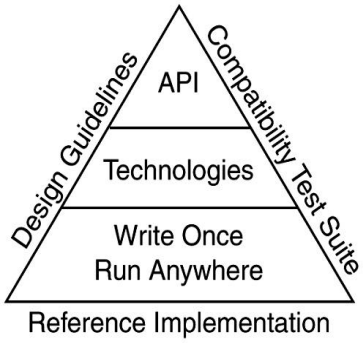


Figure 3.5 Java2EE platform elements [31]

Platform creates to write once, run everywhere logic.It uses a group of programs and APIs.

3.5.2 History of Java2EE

Java was produced for developing applications that runs on desktop and other devices as a language. After Internet connection became widespread, Java updated it into a language for client-side developments. It makes this with capabilities like applets and JavaBeans. To do this, many different APIs were developed to use resources by enterprise software applications.

Using of Java Technologies on client side systems has some problems such as latency. Loading libraries is reason for this latency. But simplicity of java, platform independent frame and many APIs are some advantages for enterprise software development.

Even though java programs run on any server, it has no server-side capability. Sun Company saw this problem and created Java Servlet. The concept of the servlet was produced and utilized for enterprise application development. Servlets were not designed to control complex issues related to transactions, concurrency and synchronization.

Then, Enterprise Java Bean (EJB) is developed to facilitate server-side development. It provides large set of out of box services.

Specific types of applications can develop with the use of different Java platforms. Three concepts exist. These are:

- Java 2 platform, Micro Edition, Java2ME: platform for developing applications that are uses on embedded devices like mobile phones.
- Java2 platform, Standard Edition, J2SE: It is also known as Java Development Kit (JDK) includes applets, JavaBeans etc.
- Java2 platform, Enterprise Edition, J2EE: Platform uses for large-sized applications.

3.5.3 Why Java2EE

Although Java2EE is new and unknown technology, it offers some benefits. Implementation of system without learning of execution environment and creating systems can be ported easily between hardware and OS. Developing complex applications need deep knowledge of different platforms such as communication issues, security issues and database access etc. Java2EE provides a good environment to implement business logic without consider other issues.

The Java2EE enterprise development provides a model that has a partition of development, deployment and execution. Programmers do not have to tend deployment details like database names etc.

Java2EE supports hardware and Operating System independence. For this reason, systems that use Java2EE architecture can be ported between various hardware and operating systems.

Java2EE has a benefit of component base architecture. This provides many advantages to programmers. These are:

- Higher productivity: Creating applications with prebuilt and pretested components are possible.
- Rapid Development: Components that have before can be put together rapidly to create a new program.
- Higher quality: Component based application developers do not deal with testing on whole application. They concentrate on testing on integration and functionality with come part of components.
- Easier maintenance: Maintenance of individual components is easier and has cost effective.

3.5.4 Container Architecture

To understand the Java2EE architecture, container system must be understood. (Figure 3.6)

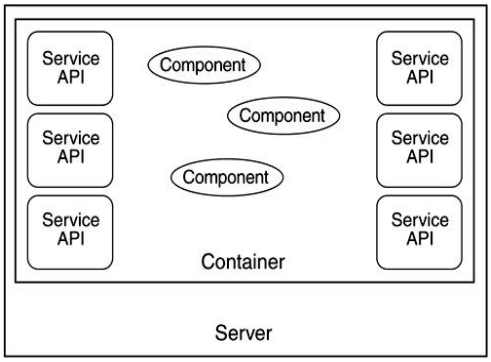


Figure 3.6 The Container concept [31]

A container is a kind of entity which responsible for specific task runs on the server. It is an environment for execution of Java2EE components. Also it provides independence between development and deployment parts. It may provide access to all of the Java2EE APIs. Each components of Java2EE are deployed or executed by some kind of container. Java2EE has four different containers:

- Application container: host for java applications.
- Applet container: environment for applets
- Web container: hosts such as servlet or JSP.
- Enterprise container: hosts for EJB components.

3.5.5 Ejb

The EJB is located at the core of the Java2EE platform. It provides a mode for creating scalable, distributed server-based enterprise java application.

There are three types of EJBs:

- Session beans are best used for discrete problems. These beans often summarize the business logic with enterprise Java application. Session beans treasure up connections between sequential interactions with a client. And the other types of session beans are stateless. Each successive request is come by the same client as a new activity.
- Entity beans are related to persistent data in the data store which is complete or partial of the table in the database. They provide automatic services responsible for persistent data with object-oriented view. It always synchronizes with the actual data residing in the underlying database. Entity beans are often used to format this data. This process helps to control business logic and prepare the data for show on the web page. For example, a kind of data that stored on database table will be shown on the web site by Entity beans.
- Message-driven beans do not have released interfaces. It runs behind the scenes. They are stateless.

3.5.6 Mvc Architecture

The Model-View-Controller (MVC) architecture is used in the Smalltalk coding language. It helps us to understand Java2EE technologies fit and work together. Grouping the objects of the system with a set of responsibilities in the area of the persistent data and associated rules (Model), presentation (view) and the application flow (Controller). Figure 3.7 shows the architecture of MVC system.

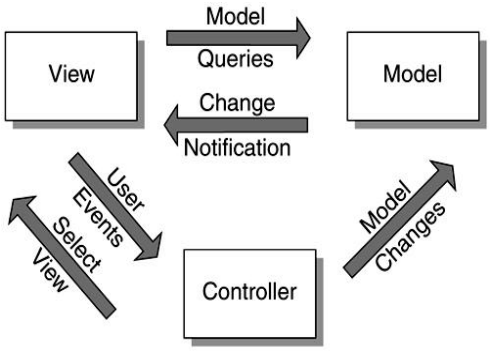


Figure 3.7 Model-View-Controller architecture [31]

The Model is responsible for retaining the program state and data. It can receive and respond the queries from the View. It can supply notifications to the View when things have changed and controller updates the model. It uses the execution of application logic which comes from the user inputs. It is additionally responsible for saying the View what to show in answer to user gestures. The View is responsible for the actual performing of the data that is furnished by the Controller.

To illustrate, consider a simple clock application developed using the MVC approach. Model is responsible for keeping track of time. Time is spontaneously updated by predefined mechanisms in the Model. The responsibility for displaying the time is accepted by View but it can be different forms. It can be analog display with two, three or four hands. It can also show a kind of digital digits. As time changes, The Model advises the View, and the View updates the time with digital or analog form. Then, for example, users want to change the time by using some Graphical User Interface (GUI) controls or typing in a new time. The Controller takes the request of users for changes and updates the model. It can be done with calling the appropriate operations that is defined on the Model. A model may have many different *views.*

3.5.7 Application Programming Interface (Apis)

In computer programming, an Application Programming Interface (API) is a set of routines, protocols, and tools for building software applications. There are several APIs in Java but I will explain which APIs I used in my program.

3.5.7.1 Java Database Connector (JDBC)

Interaction with databases is an particular part of the enterprise Java applications. The JDBC API is responsible for making it easy for programmers. This API simplifies the connecting and accessing to relations database systems. It renders a vendor independent interface to database. Using this API makes application portable.

JDBC API exists in the Java2EE. This API renders a usual interface in order to save the user from vendor specific variations as much as possible. JDBC implementations are supported by different database structures so differences are being solving under the covers.

In enterprise applications such as my thesis work, you don't need to tend to control JDBC. You can create entity beans to call necessary database calls. Become less common, more sophisticated and well-tuned support for entity beans require using JDBC directly instead of working on entity beans.

3.5.7.2 Java2EE Connectors

Java2EE Connectors provides a well-known structure to use data store. Enterprise Information Systems (EIS) can be large systems and dealing with connectors can be very complex.

CHAPTER FOUR - IMPLEMENTATION

The purpose of this program that is prepared for a master's thesis is to facilitate the management of documents coming from different ways to the Inspection Board and arranging the assignments of inspectors on a monthly basis. Taking into consideration the numbers of documents arriving the board and the numbers of inspectors working in the board, it has been tried to prepare an easy interface in which the high-speed internet technologies and visualization are used as much as possible.

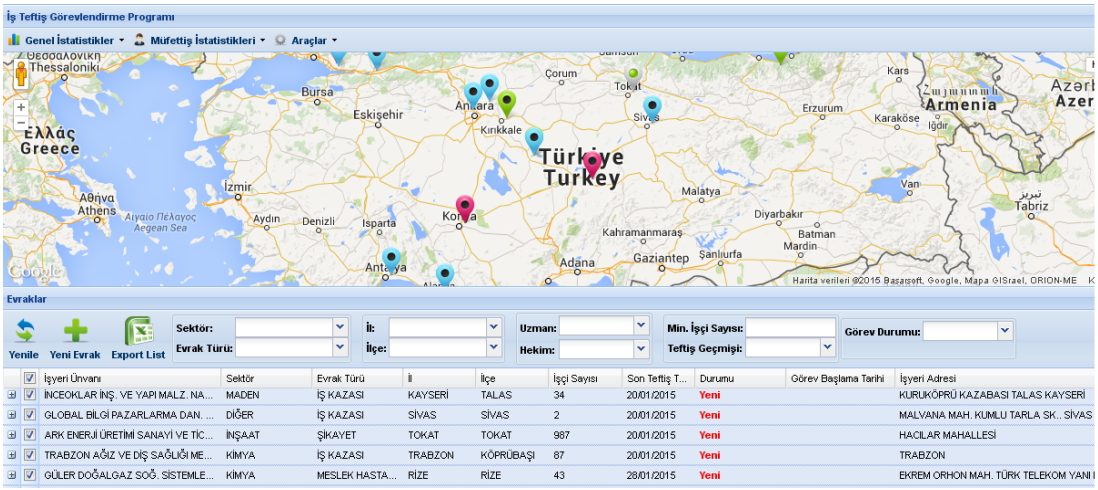


Figure 4.1 Program homepage

The homepage screen of the program (see Figure 4.1) consists of 2 panels and 1 menu bar. All the functions contained in the program are placed in these sections.

1. Menu bar contains current statistical data related to documents, the list of data of the places and distributions of the inspectors and settings parts of the program exist.

2. Map panel provides simultaneous representation of documents on the map. This panel has been prepared to provide a visual idea and to help producing a policy in assignment process.

3. This panel contains the list of all documents nIn this section, operations such as entering the documents into the system, assignment of inspectors in accordance with these documents and saving all in an excel file can be made.

4.1 Database Tables

"EMS SQL Manager for MySQL" program was used to create the database tables.

Figure 4.2 shows the database schema design.

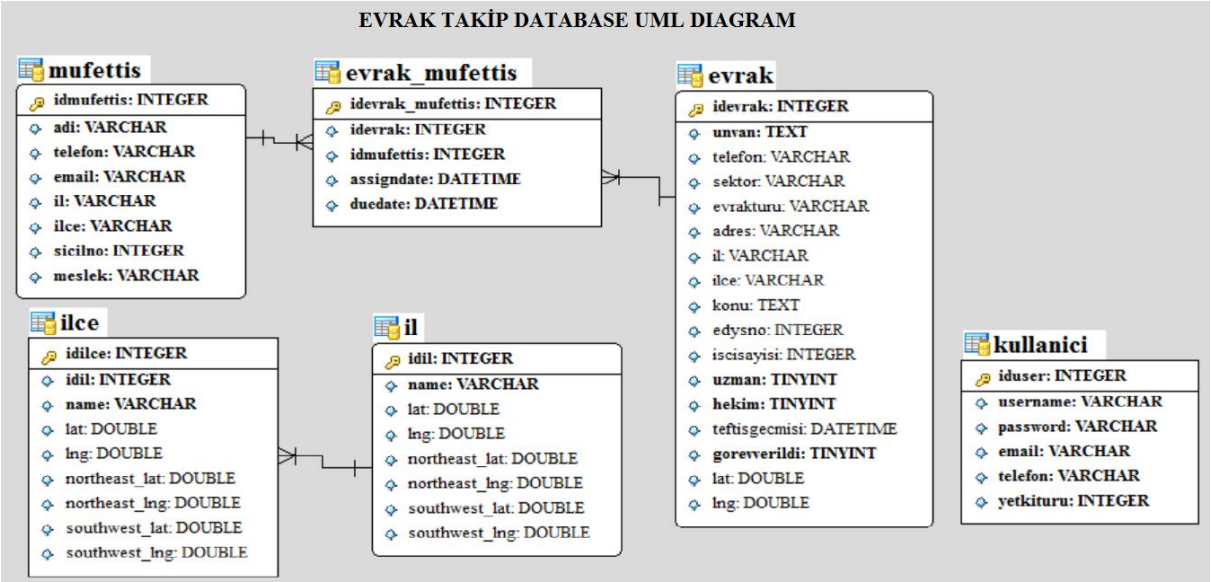


Figure 4.2 Database UML diagram

The “mufettis” table keeps the personal information of inspectors. "idmufettis" column has been identified as primary key. It keeps data in string type and is related to the table named "evrak_mufettis". This relationship provides the connection between the inspector and the document he/she is working on.

The "evrak" table keeps the detailed information of the documents that reached the presidency. All documents are kept in a single table and the classification process is made on side of the "clients" by the ingenuity of "bean". While creating records of documents in this table, there will be empty cells since all of the documents do not fit the standard, and yet the assignment process is still done for these non-standard documents.

The "evrak_mufettis" table is the common data center that keeps the records of documents whose assignment process is completed and the information of the inspectors. Assignment date and the date and time information when the inspector was informed about the assignment are also added to this table.

The “il” and “ilce” tables keep the latitude and longitude information which needed to display the documents on the map. The data in this table does not show variability. They are used for marking on the map as needed. These two tables are used together because they are interrelated.

In the “kullanici” table the user information will be logged into the system is kept. Users are authenticated using “Yetkituru” column. It is a data table that stores independent data which is not associated with the other tables.

4.2 Login Dialog

The screen given in Figure 4.3 meets all users regardless of their authorization when one wants to access the Program. With this Form-Panel, users who want to access the program are required to enter the user name and password information.

Figure 4.3 Log-in screen

For users, identification of the user name consisting of a minimum of 3 characters and password consisting of a minimum of 4 characters is planned. In case of entering the user name and password that does not provide the necessary criteria login process check is not performed and the entry is directly rejected.

When the information is entered in the correct format into the system and enter button is pressed, it is checked to see whether the correct user name and password are entered or not. If the inputs are verified a new session is initiated and the program becomes available. In cases where inputs are not verified "Geçersiz Kullanıcı/Parola" warning message is displayed.

If entered into the system with the "Oturum Açık Kalsın " option checked, the user name and password information is stored in the computer as cookie. To enter user name and password at each entry would lead to a waste of time and workforce therefore, the "Oturum Açık Kalsın " option seems to be useful.

Also the users may forget their login passwords in time so a "Parolamı unuttum" link has been put on the login screen. If users cannot remember their password, they must write e-mail adresses when they registered into the system. If the email address exists in the database, the new password is sent to the user's e-mail address (see Figure 4.4).

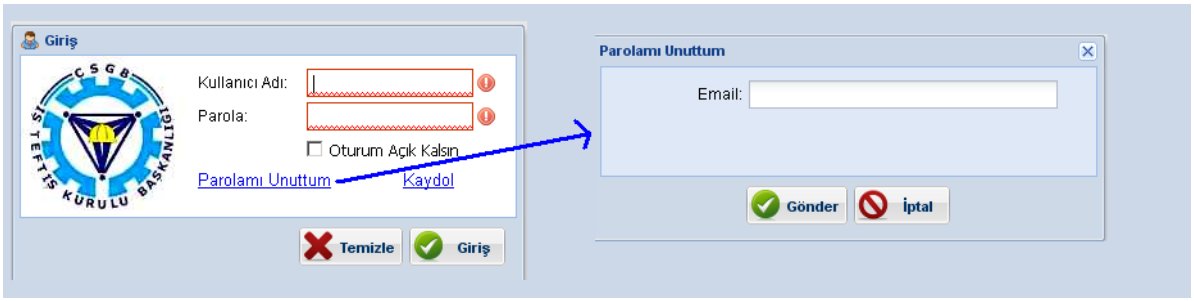


Figure 4.4 I Forgot my password screen

A simple interface is also prepared for new users who will register for the system. Users are able to register for the system by entering the required information into the user table in this interface (see Figure 4.5)

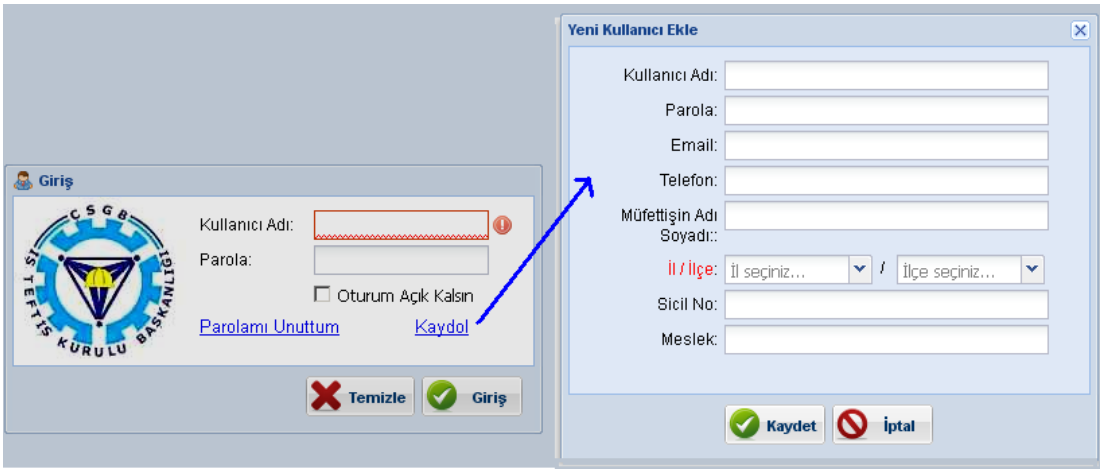


Figure 4.5 Add new user screen

4.3 Menu Panel

Some user functions of the program were placed on menu panel. In this placement, the frequency of occurence and objectives of the functions are considered. Accordingly, this panel contain access links to statistical data regarding documents and inspectors and there is also a settings section in the panel.

4.3.1 Sectoral Statistics

In the first of these functions, there is a screen on which the province-based numerical distribution of the documents according to the sector and document type. A simple screen is designed for this process and seen in Figure 4.6 and 4.7 by selecting the sector or document type on the pop-up window the number of document distributions can be seen.

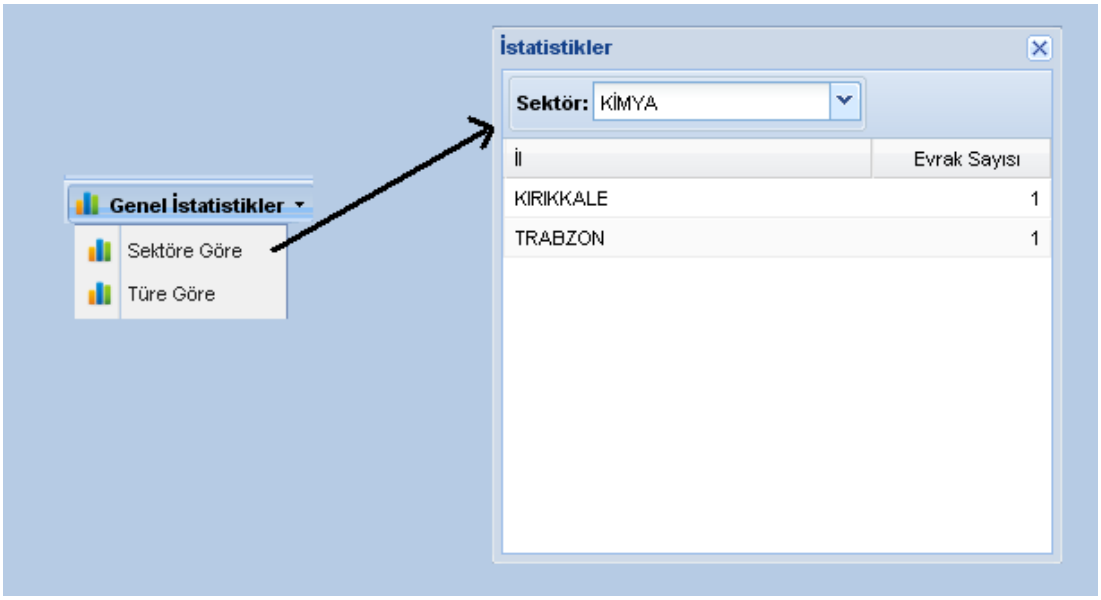


Figure 4.6 Statistics by sector

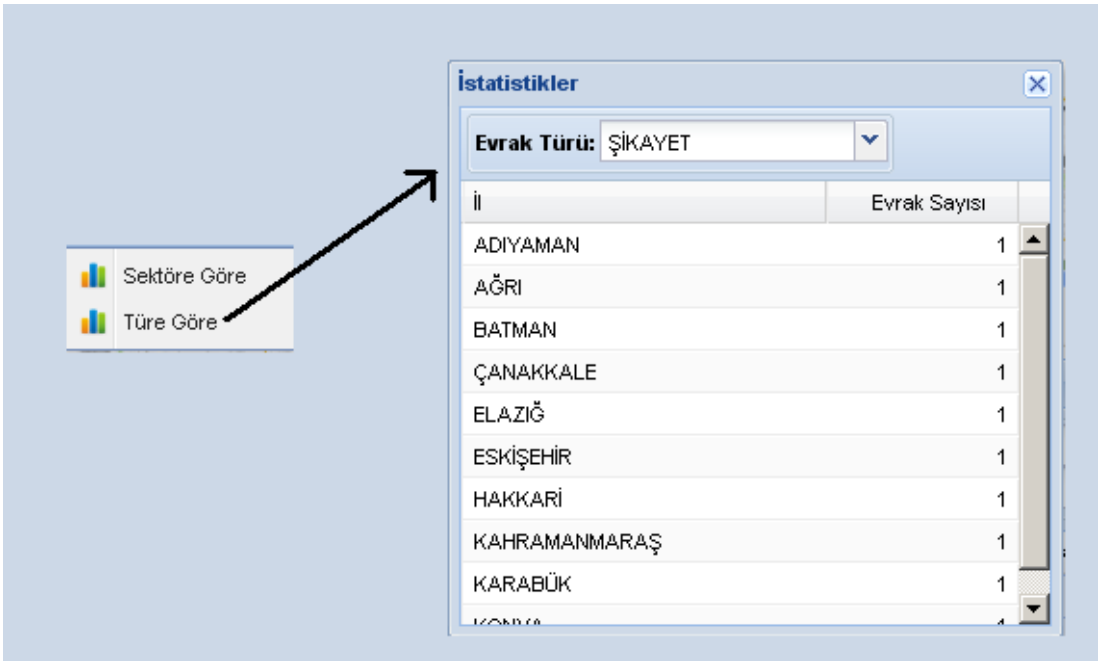


Figure 4.7 Statistics by description

There are inspectors with different professions in the Inspection Board and the professions of inspectors guide assignments. Therefore, the selected sectors are determined by taking into consideration the profession of inspectors. An inspector can be assigned only two provinces at once so, to produce industry-based statistical data will greatly facilitate the assignment process by considering the number of

documents and sectors.General planning and document grouping processes can also be easily done through this screen.

Also with the type-based statistical data, the identification of prior types compared to other categories such as the work accidents and occupational diseases will be provided. Thus, in accordance with this data it will be possible to establish appropriate policies.

4.3.2 Month Statistics

In the month screen, as can be seen in Figure 4.8, assignment provincial distribution data of inspectors is presented in the selected month. In the list, there are only inspectors whose assignments are made for the selected month and information of provinces in which the inspectors are commissioned exists.

Figure 4.8 Statistics by month

The assignment of the inspectors process is not done only once in a month. When necessary or in urgen situations investigations assignments can also be made. When faced with such a situation, for example an investigation needed / wanted to be carried out in Kırıkkale in February it can easily be determined which inspector is working in that province by looking at the table. Assuming that there are about 1,000 inspectors working in Turkey, it seems difficult to achieve the knowledge of which inspector is working in which province one by one immediately. Therefore, this table is thought to be functional for such cases. In addition, since all columns of the table

perform the sorting process, it is possible to sort data by inspector name and province.

4.3.3 Inspector Statistics

In “Inspector” screen, statistical data regarding the distribution of the provinces in which the inspectors are assigned within a year is presented. The list of provinces that the investigator has visited in that year is showed in the opening screen. It is aimed to obtain a usable statistical output of the assignment processes registered in the database via this screen (see Figure 4.9).

Figure 4.9 Statistics by inspector

This statistical data is important for the determination of the regions where the inspectors working intensively. Because to provide the reliability of inspection, not serving in the same region constantly is an important factor for inspectors. Therefore, the administrator would be able to prevent the inspector working often in the same provinces. In this respect, it is considered to be useful.

4.3.4 Options

This section contains some informative screens for users and send mail screen for sending their problems/suggestions/complaints directly to administrators. Two screens were prepared for this as shown in Figure 4.10.

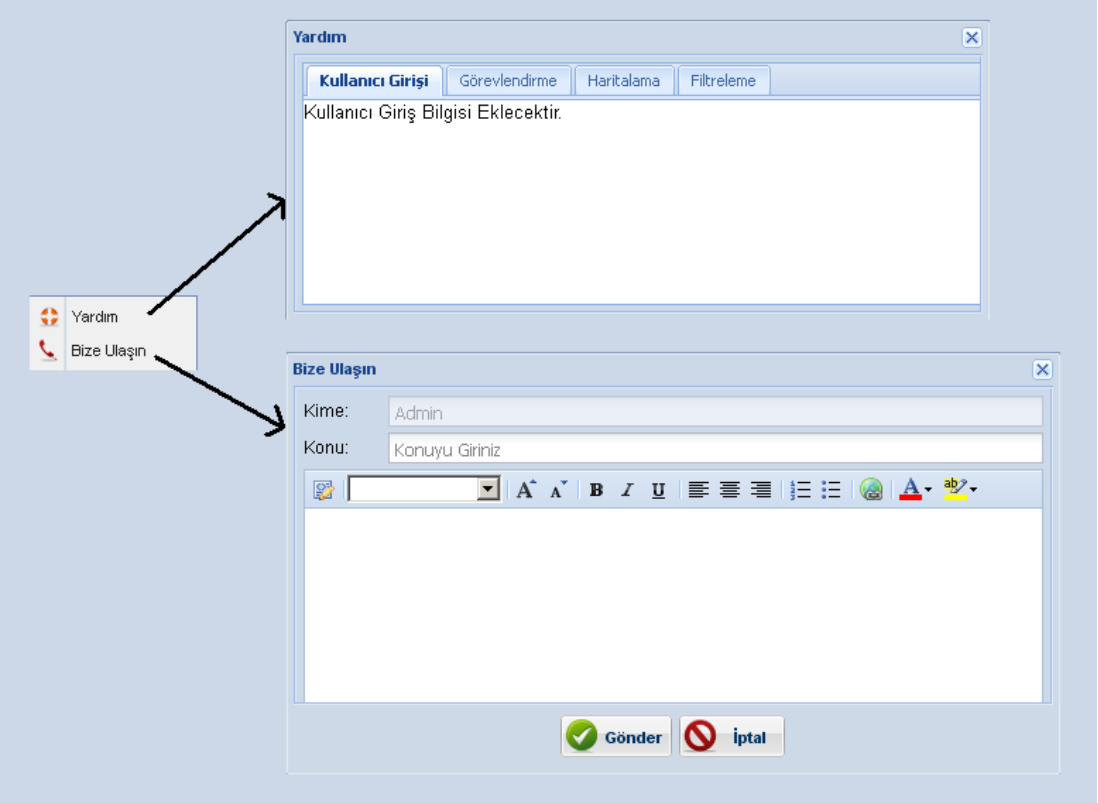


Figure 4.10 Options dialog

“Help” screen contains guidance data such as user entry, assignment, mapping, filtering etc..

"Contact me!" screen has been designed to facilitate the transmission of software bugs, new features needed in the program or any problems encountered directly to the page administrator. Users have the possibility of sending direct mail to the administartor via this screen. Mails sent fall into the page administrator's mail box registered in the database. The mail obtained by administrator is shown at Figure 4.11.

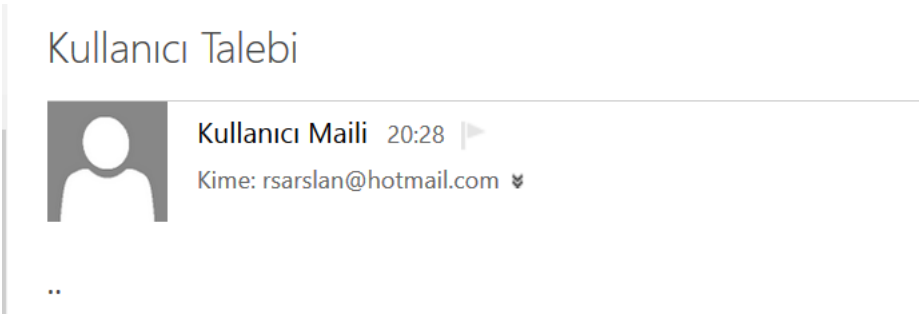


Figure 4.11 User mail

4.4 Map Panel

This is the part that forms the main structure of the program. It meets one of the primary goals of the program and is a structure that cannot be found in the system currently being used. In the panel, it is tried to visualize the registered documents in the system on the map according to the latitude and longitude data of provincial and district centers of the documents. With this panel, it is aimed that directors can make a general assessment with the sectoral-based distinctions of filtered documents on the map. A screen seen in Figure 4.12 is presented to the users.

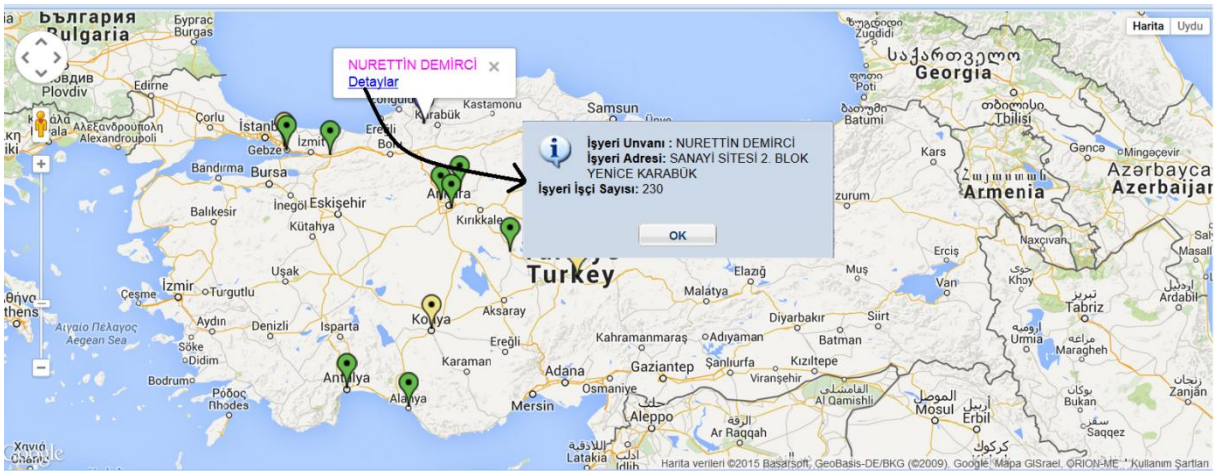


Figure 4.12 Map panel

Screen shows generally provincial and district-based distributions of documents on the map. It also provides a simultaneous display for specially filtered documents such as sectoral, document type or the number of workers as well as displaying all documents. While showing only the business title when clicked on the pointers on the screen, it is possible to reach more detailed information about business by clicking on the details link. All of this data is received from the database in real time. Also, the pins are provided in different colors for sectors so that they can easily be distinguished.

The screen generally provides a visual representation of all documents. It gives the director a general opinion needed for specifying a policy for the assignments. It facilitates the visual distribution and management of documents. Information within the pin as well as more detailed information screen can be changed according to the required data. For the pins of documents pointing the same province and district,

random distribution process is used. Thus, it has been tried to prevent overlap of the pointers.

4.5 List Panel

Management of all documents on the program is made via this panel. Adding the new documents into the system in the required format, listing all documents in real-time, filtering documents according to the desired category, saving those filtered documents in excel format, assigning those filtered documents to the inspectors individually or as a bulk and user logout procedures are performed on this screen. In Figure 4.13 is given the overall screen image.

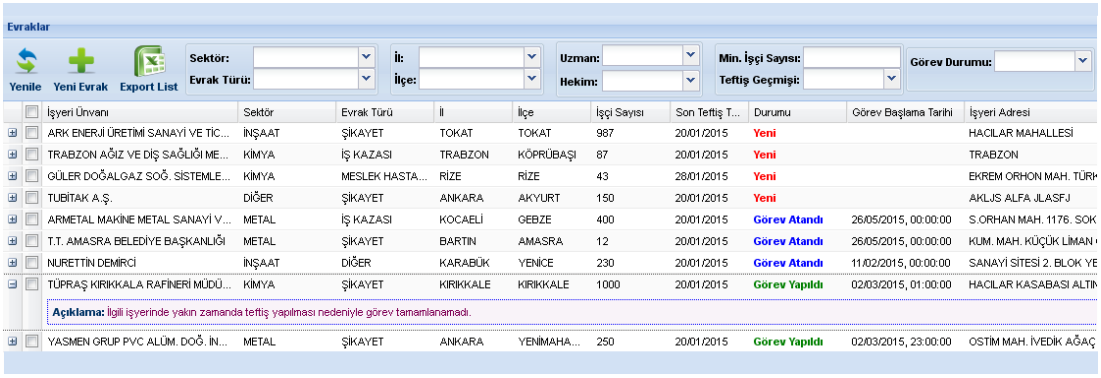


Figure 4.13 List panel

When the program opens, it shows a list of all documents entered into the system including those assigned before. Respectively, the information about business like business title, industry, document type, province, district, number of workers, date of last inspection, whether assignments were made before, addresses, phone numbers are displayed as a list. The purpose of this section is to access to all documents retrospectively.

4.5.1 New Document

When clicked on the Add New Document button on the screen shown in Figure 4.14, it is encountered a screen as shown in Figure 4.14.

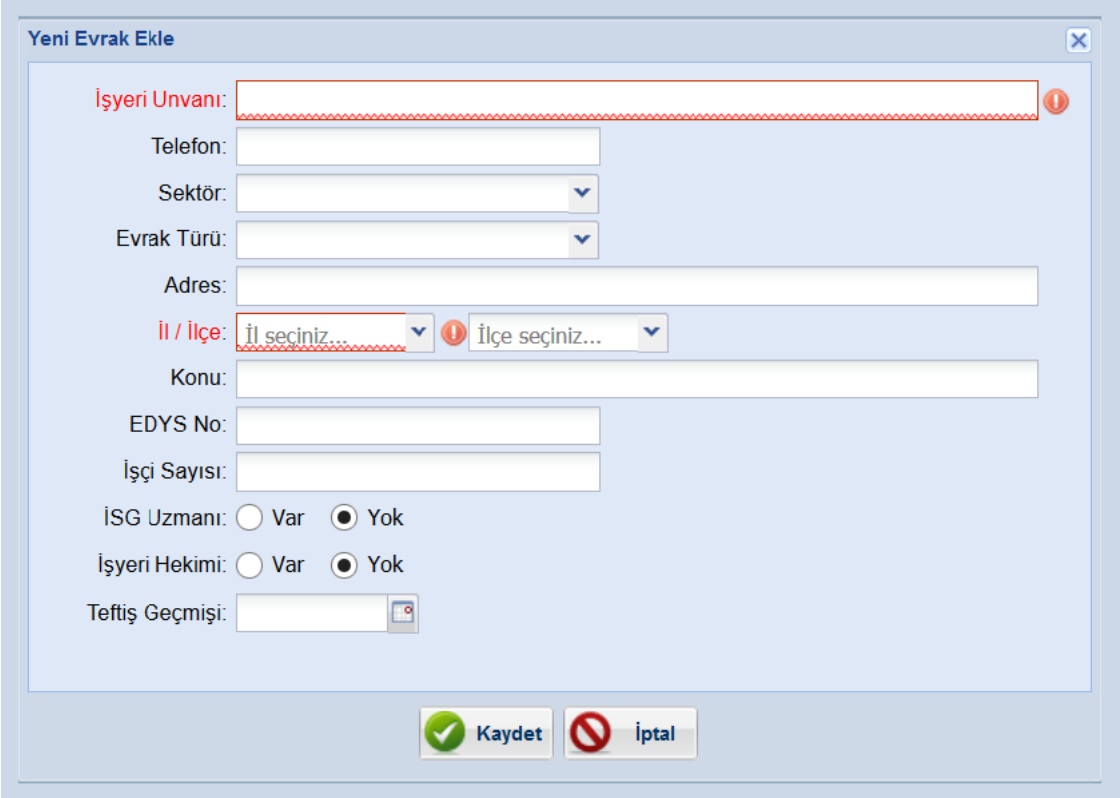


Figure 4.14 Add new document panel

Using this screen, users can entry the new document into the system. Also saving process is carried out by filling business information as shown in Figure 4.15. Since the main purpose of the program is to visualize the documents on the map; the title, province and district information of business are requisite fields. Other fields will be filled if available in document. Otherwise, they will be saved as empty. The two fields are important on this screen: existence of OHS expert and physicians and the number of workers. This data is entered into the system by users. But expert and physician information can also be gathered through İsg-Katip software system and the number of workers information can be accessed through the Sendika-Yetki portal. This data will then be automatically brought when connection is allowed to those systems. After all data is entered the document can be added to the system by pressing the "Kaydet" button. The list is instantly updated after adding documents and the document is also shown on the map. There is no need for any renewal process.

4.5.2 Filtering

As soon as the program is opened all the previously recorded data in the system is displayed. However, it is obvious that this would be negative with the increase in the number of documents therefore a filtering-ranking process is required in the system. A detailed filtering process can be performed as shown in (Figure 4.15) on the panel.

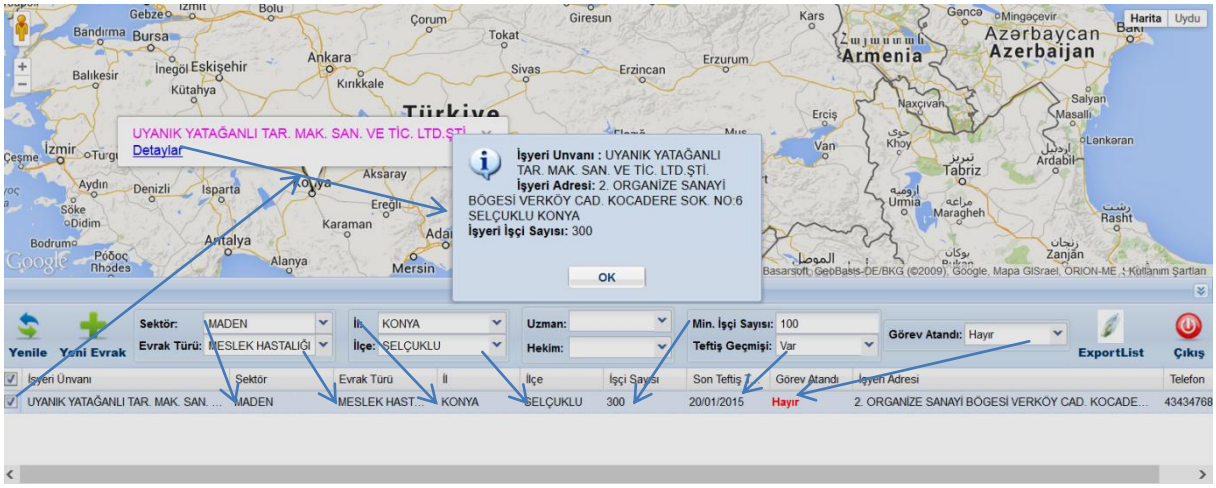


Figure 4.15 Filtering system

As seen on the screen filtering can be done by sector, type of document, province, district, existence of expert or physician, the minimum number of workers, whether inspected previously and an assignment is made on the business or not. An example of a filtering, the display of the filtered data in the list and updating in real-time operation on the map is shown on the screen. Thus, the detailed filtering operation can facilitate the director on deciding which document will be primarily examined. In each filtering process "selection-change-listener" is running and thus the updating of data from the database is provided. Those processes are carried out very quickly thanks to Java beans.

4.5.3 Export List

After performing the filtering process on the list as mentioned in section 4.5.2, transfering this list of documents from the grid to the excel sheet can be made. For this function clicking on the "Exportlist" button on the list panel after the filtering

process is enough. When clicked on the OK button in this screen the output of the list can be transferred to a certain address (see Figure 4.16).

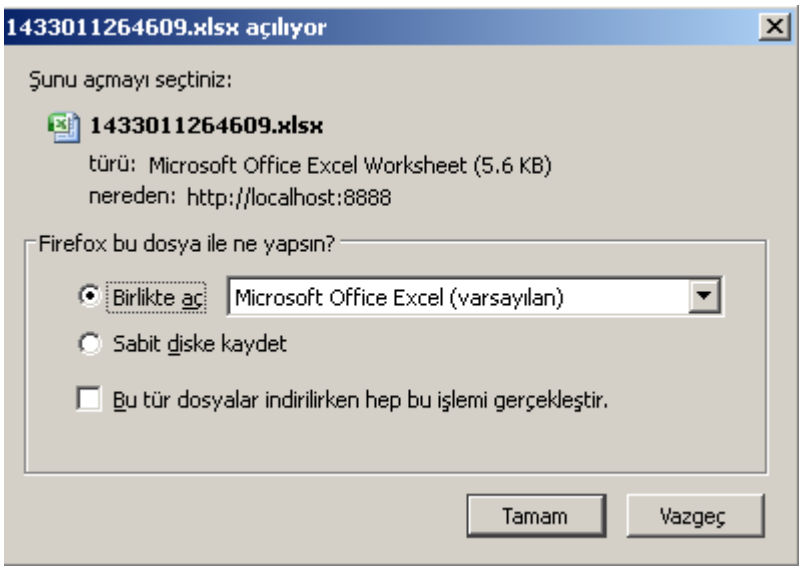


Figure 4.16 Excel export with random number

4.5.4 Log-out

User exit process is performed with this button also by deleting the user information stored in a cookie. If one closes the system without clicking the Log-out button and reopens it, the user login information is being remembered and the program screen is opened directly. In this way, users are prevented from re-entering the login information each time.

4.5.5 Assignment

After the filtering process is performed assigning the documents to the inspector's process is also carried through the list panel. With the help of pop-up assignment button shown when right-clicking on the related documents the assignment screen opens as shown in Figure 4.17.

Figure 4.17 Assignment panel

By using the "Müfettiş Seç" screen as shown in Figure 4.17, the assignment of inspectors can be made individually or as a group. In addition, after determining the inspector/group inspector assignment process is carried out by determining the beginning date of the task (which may be a later date).

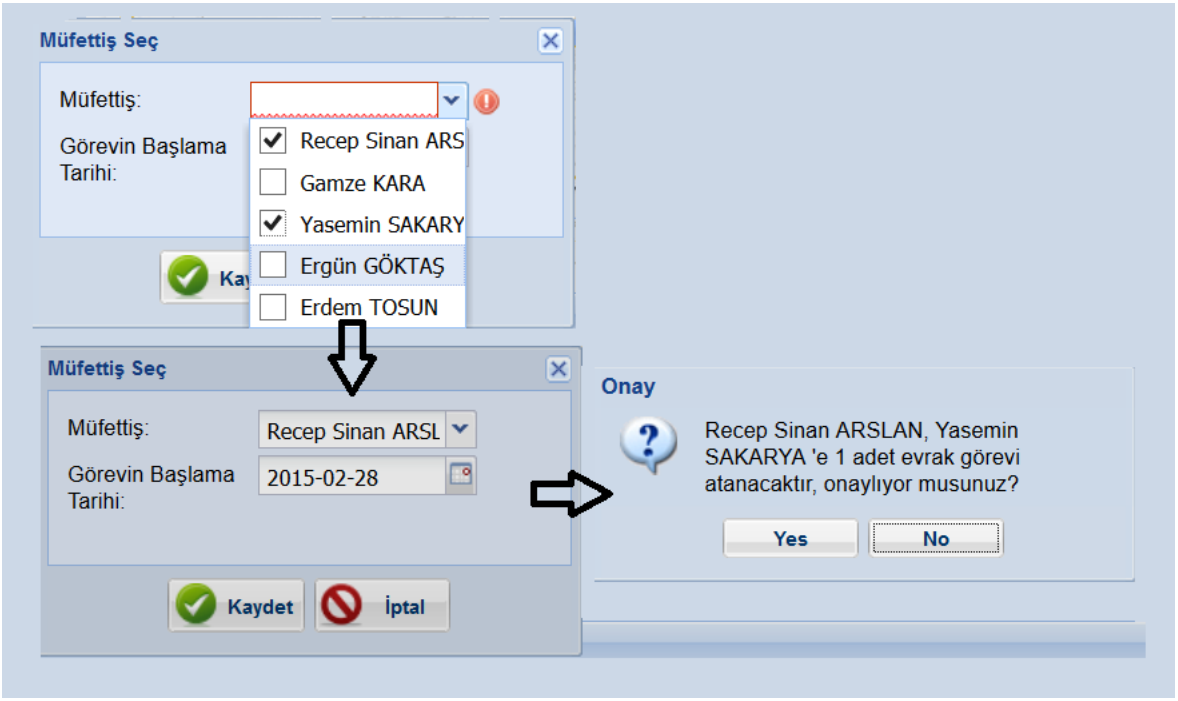


Figure 4.18 Assignment flow diagram

Program work flow of the assignment process is shown in Figure 4.18. Finally by answering yes to the confirmation question, the process of assigning related document or documents to the inspector is completed. After the assignment is

performed, the notification for related tasks is done via e-mails and messages. A sample screen output of email and messages is shown in Figure 4.19. Message content can easily be changed. It is sent in the message the notification of an assignment process in made to an inspector and the data about business titles. All the details concerning the task are transmitted to the inspectors via the output of a task text added to the email. The telephone numbers and e-mail addresses of the inspectors are accessed through the registered data in the system

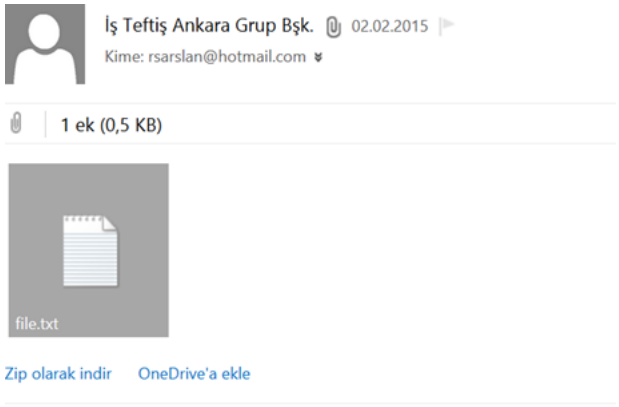
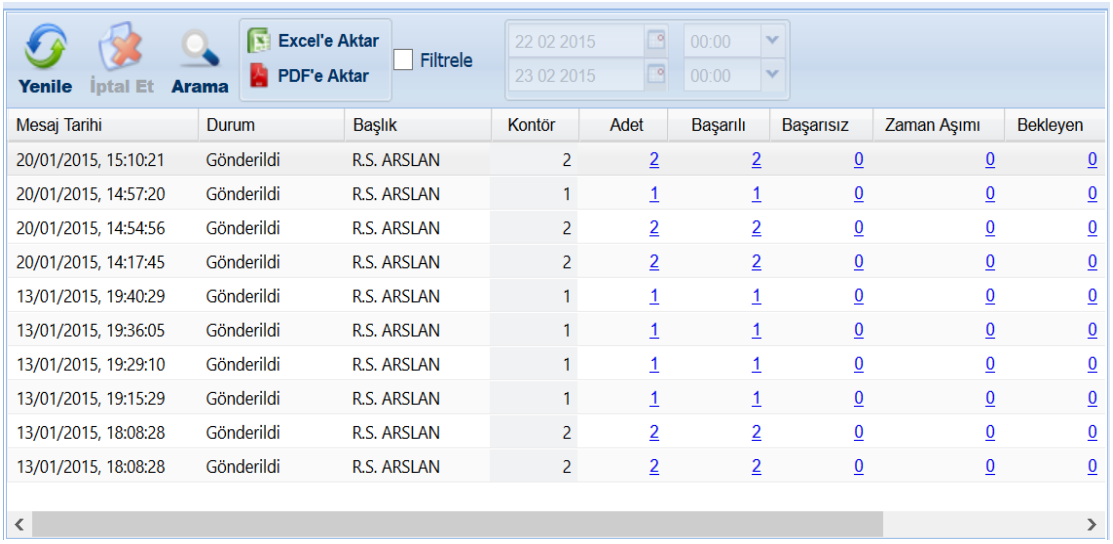


Figure 4.19 Assignment mail

As a result of these assignments, after informing by e-mail or message, it can also be accessed to the control data whether these messages are delivered or not. This data can be accessed using the screen shown in Figure 4.20.



Mesaj Tarihi	Durum	Başlık	Kontör	Adet	Başarılı	Başarısız	Zaman Aşımı	Bekleyen
20/01/2015, 15:10:21	Gönderildi	R.S. ARSLAN	2	2	2	0	0	0
20/01/2015, 14:57:20	Gönderildi	R.S. ARSLAN	1	1	1	0	0	0
20/01/2015, 14:54:56	Gönderildi	R.S. ARSLAN	2	2	2	0	0	0
20/01/2015, 14:17:45	Gönderildi	R.S. ARSLAN	2	2	2	0	0	0
13/01/2015, 19:40:29	Gönderildi	R.S. ARSLAN	1	1	1	0	0	0
13/01/2015, 19:36:05	Gönderildi	R.S. ARSLAN	1	1	1	0	0	0
13/01/2015, 19:29:10	Gönderildi	R.S. ARSLAN	1	1	1	0	0	0
13/01/2015, 19:15:29	Gönderildi	R.S. ARSLAN	1	1	1	0	0	0
13/01/2015, 18:08:28	Gönderildi	R.S. ARSLAN	2	2	2	0	0	0
13/01/2015, 18:08:28	Gönderildi	R.S. ARSLAN	2	2	2	0	0	0

Figure 4.20 Mail delivery screen

CHAPTER FIVE - FUTURE WORK

In this thesis study, documents are recorded into the database as processing these data produces categorized, detailed statistical data, they are visualized on the map and these documents are assigned to inspectors within the framework of some certain decisions.

While a program including intended functions has been prepared in the first section of the thesis study, there are functions and plugins that can be added to the program in future. The suggestions relating to these plugins are given below:

- To develop Android and ios-based mobile applications of the program: Thus administrators can access to all data and statistics by their mobile phones whenever they want.
- Assignment operation by using e-signature: In order to convert assignments into official documents, the assignments to be made by using e-signature are important. Thus, all operations that are made over the system will get a legal basis. Electronic signature infrastructure to be added to the program for this purpose will produce useful results.
- Summarizing the document contents by the system: Instead data are recorded into the system directly by the office staff, summarization of the document contents will be provided by using machine learning algorithms automatically. There are algorithmic approaches for these operations such as Fully Automated Summarizers (FAS), Machine Aided Human Summarization (MAHS), and Human Aided Machine Summarization (HAMS).
- Using algorithms to assign the nearest duties together by grouping them. In the program, administrators assign the duties by using monthly or annual inspector assignment data or statistical data on the sector and area-based

documents. While province-based grouping of the documents are done at this point, address-based grouping can not be done in province. The documents are appointed within the predictions. However, a software plugin, which makes it possible to group the closest documents by utilizing from analysis, will provide us to make healthier assignments.

- Providing inspectors to access to addresses from the shortest way after system assignments: The system does not plan any route for inspectors. Inspectors access to addresses, which are given as a result of assignment, within their own plans. However, a route planning will be possible via software by entering GPS data related to assignment addresses of inspectors, as well. Route planning and reaching the workplace address in the shortest path will be useful in terms of both using the government resources effectively and ensuring inspectors to make a healthy plan. There are master's theses done on the subject. Some of them are as follows:

  - ✓ In the thesis study of "Mobile-based Navigation Web Application: Findin the Shortest-time Pathbased on Factor Analysis" prepared by Tao Pengand Xiaowen Wang, a student at the University of Gävle, an access from the starting address to the desired address through the shortest path can be provided by using GPS coordinate data for the address. By this calculation, traffic density for the inner city is also considered. For these operations, using the shortest path algorithm "Dijkstra" has been foreseen.

  - ✓ In the research article "Market-Based Task distribution with the Nearest Neighbor Heuristic Approach" published in the Journal of Science and Technology by Uğur Gürel, Osman Parlaktuna, Nihat Adar, and Selçuk Canbek, students at Anadolu University, it has been aimed to distribute tasks to users in multi-user applications and to build effective routes for those users. Therefore, it has been planned to minimize the durations of doing business and to maximize the compliance value of each user. "Dijkstra" and "the Nearest Neighbor Heuristic Approach" have been used for that. A system has been design, which will build non-coincident routes or solve the existing collisions.

CHAPTER SIX - CONLUSION

It has been tried to develop software needed for the assignment services and business flow of the Labor Inspection Board, which is one of the government agencies that transform with the developing information technologies. By using this software, it is possible to enter documents to the system via a simple interface, to visualize them on maps, to filter them by using effective parameters, to produce statistical data related to documents, and to present documents to inspectors as tasks. It has been aimed to transfer some operations to the automation systems needed by the Committee Board.

In the first section of the thesis study, the definitions of information and information technologies have been given, the background of the program production has been tried to be explained, the goals about the program planned to be prepared have been put forth, and examples from similar studies done before, related theses and articles have been given. In the second section, definitions about geocoding systems have been done, comparisons related to the similar systems in the light of researches done previously have been included, and it has been put forth why Google Maps Api has been used. In the third section, technologies used in the software side of the thesis and reasons for the selection of these technologies have been tried to be explained. In the fourth section, software development process of the thesis, description of interfaces, explanation of database schema have been tried to be explained by utilizing from visuality.

This program has shown that software system creates beneficial results and the transformation of the government structure is beneficial. After adding the new functions suggested in the fifth section, more effective results would be obtained. The algorithms such as the shortest route planning, grouping the closest documents would be useful in terms of effectively and fast completion of tasks. It is thought that both the government and the inspectors will gain advantages by running these algorithms.

As a result, the program has aimed to ease the works of the Labor Inspection Board and the intended functions have been adapted to the program, new goals have been introduced for the future.

CHAPTER SEVEN - REFERENCES

[1] Barutçugil, İ., *Bilgi Yönetimi,* Kariyer Press, İstanbul, 2002

[2] Çeri, Ş. Ö., *E-devlet Uygulaması Olarak Elektronik Döküman Yönetim Sistemi ve Bir Uygulama,* Thesis(M.Sc), The Institute of Social Sciences, Süleyman Demirel University, 2012

[3] Paradigm V., *Produce UML Use Case from Business Process Diagram(BPD)*[online], https://www.visual-paradigm.com/ [Visiting Time: 1/12/2014]

[4] Security, T. M., *The Ordinance Of Labour Inspection Board,* Ankara: The Ministry Of Labour and Social Security, 2012

[5] Filiz, B. G., *Web Haritalarında Mekansal Verilere Dayalı Bir Arama Kurtama Takip Sistemi Oluşturulması,* Thesis(M.Sc), Air Force Academy, 2013.

[6] Mercan, M. R., *İşletmelerde Beceri Eğitimi İçin Yeni Bir Konum Tabanlı Görev Dağıtım Programı,* Thesis(M.Sc), Sakarya University, 2014

[7] Kırbaş, İ., *Php, Mysql Ve Xml tabanlı türkçe dinamik web sitesi içerik yönetim sistemi: DyNA,* Thesis(M.Sc), Kocaeli University, 2007

[8] Kurt, K., *Java Teknolojisi Kullanarak İnternet Tabanlı Öğrenci Kayıt Sistemi,* Thesis(M.Sc), Muğla University, 2005

[9] Sjödin, E., *An Application for Map-centric Management of Photographs with Embedded Spatial Metadata,* Thesis(M.Sc), Linkoping University, 2006

[10] Ceyhan, Y. B., & Yerci, M., İnternet Tabanlı Coğrafi Bilgi Sistemleri ile Kartografik Üretimin Kontrol ve Yönetimi. *Harita Dergisi*, 72(134), 71-89, 2005

[11] Şahin, K., & Gümüşay, M, *İnternet Tabanlı Coğrafi Bilgi Sistemleri ve Orman Yangılarında Kullanılması,* Harita Dergisi, 138, 69-83, 2007

[12] Gürel, U., Parlaktuna, O., Adar, N., & Canbek, S., E*n Yakın Komşu Sezgisel Yaklaşımı İle Market Tabanlı Görev Dağıtımı,* Anadolu Üniversitesi Bilim ve Teknoloji Dergisi, 14, 173-182, 2013

[13] Krueger, C. W., *Software reuse*, ACM Computing Surveys (CSUR), 24, 131-183, 1992

[14] Kang, W. B., Kang K., *Software reuse research: status and future*, IEEE Transactions on Software Engineering, 31, 529-536, 2005

[15] Daughtry J.M., Farooq U., Myers B. A., Stylos J., *API usability*, ACM SIGSOFT Software Engineering Notes, 34, 27-29, 2009

[16] Swift, J. N., Goldberg, D., & Wilson, J., *Geocoding Best Practices:Review of Eight Commonly Used Geocoding Systems, Thesis(Msc),* University of Southern California GIS Research Laboratory, 2008

[17] Discovery, L., *[Howto] build user interface with GWT*[online], https://discoverylinux.wordpress.com/2010/01/09/howto-build-user-interface-with-gwt/ [Visiting Time: 28/1/2014]

[18] Vaughan, D., *Ext GWT 2.0, Beginners Guide, Packt Publishing,* Birmingham, 2010

[19] Kereki, F., *Essential GWT, Building for the web with GWT 2,* Pearson Education , Boston, 2011

[20] Niemeyer, P., Leuck D., *Learning Java(4th ed.)* O'Really, NewYork, 2013

[21] Gwt Project, *GWT Project Tutorial* [online], http://www.gwtproject.org/doc/latest/tutorial/RPC.html [Visiting Time: 1/12/2014]
[22] Niemeyer, P., *Simplier and Speedier GWT with server side RPC serialization* [online], http://www.techhui.com/profiles/blogs/simpler-and-speedier-gwt-with [Visiting Time: 14/1/2015]
[23] Pop, B., Medeşen, R., Jurca, I., *Performance Comparison of Java Application Servers*, Automatic Control and Computer Science, 2001
[24] Oracle C. *OpenJDK homepage*[online], http://openjdk.java.net/[Visiting Time: 1/12/2014]
[25] Oracle C., *Java SE 7 Features and Enhancements* [online], http://www.oracle.com/technetwork/java/javase/jdk7-relnotes-418459.html [Visiting Time: 25/12/2014]
[26] Kulandai, J., *Differentiate JVM JRE JDK JIT* [online], http://javapapers.com/core-java/differentiate-jvm-jre-jdk-jit/ [Visiting Time: 1/12/2014]
[27] Wikipedia, *Java Development Kit* [online], http://en.wikipedia.org/wiki/Java_Development_Kit#cite_note-2[Visiting Time: 15/03/2015]
[28] Wikipedia, *Database*[online], http://en.wikipedia.org/wiki/Database[Visiting Time: 12/12/2014]
[29] Bassil, Y., *A Comparative Study on the Performance of the Top DBMS Systems*, *Journal of Computer Science & Research*, 1, 20-31, 2012
[30] Kofler, M., *The Definitive Guide to MySQL5*, Apress, NewYork, 2005
[31] Umrysh, C. E., & Khawar, Z. A., *Developing Enterprise Java Applications with J2EE and UML*, Addison-Wesley, London, 2001

CHAPTER EIGHT - APPENDICES

Appendix A: The sequence diagram of model of EvrakMD

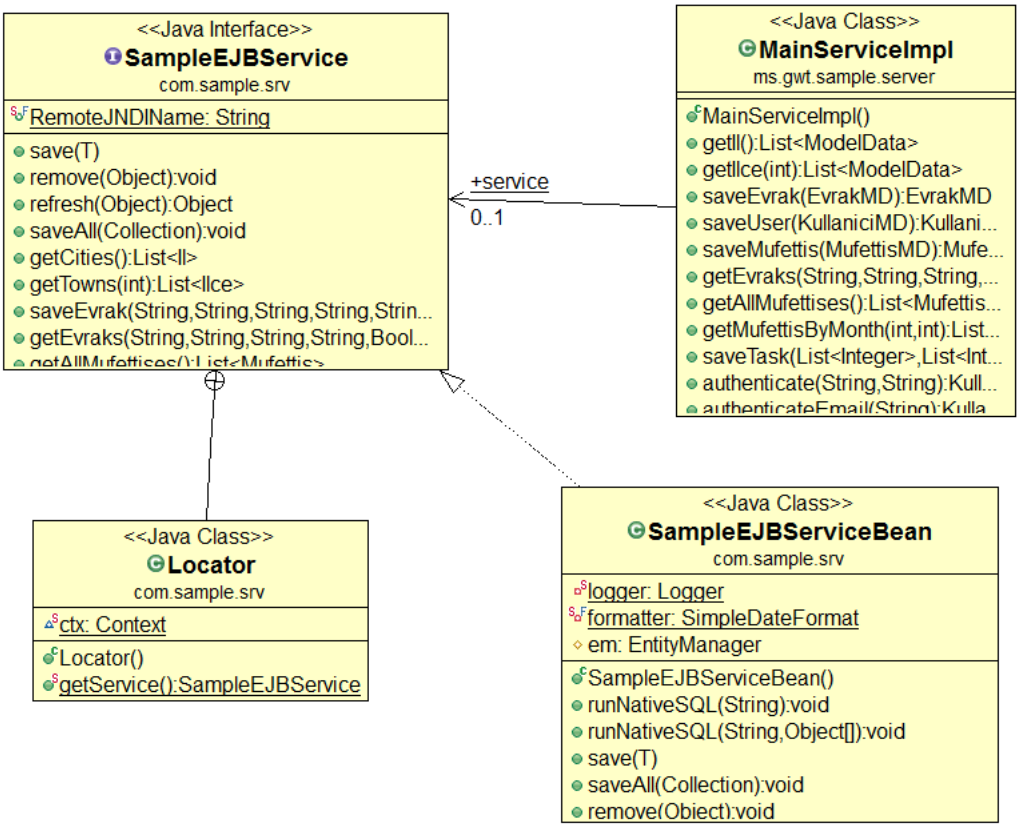


Figure A.1. EvrakMD sequence diagram

Appendix B: The sequence diagram of model of KullaniciMD

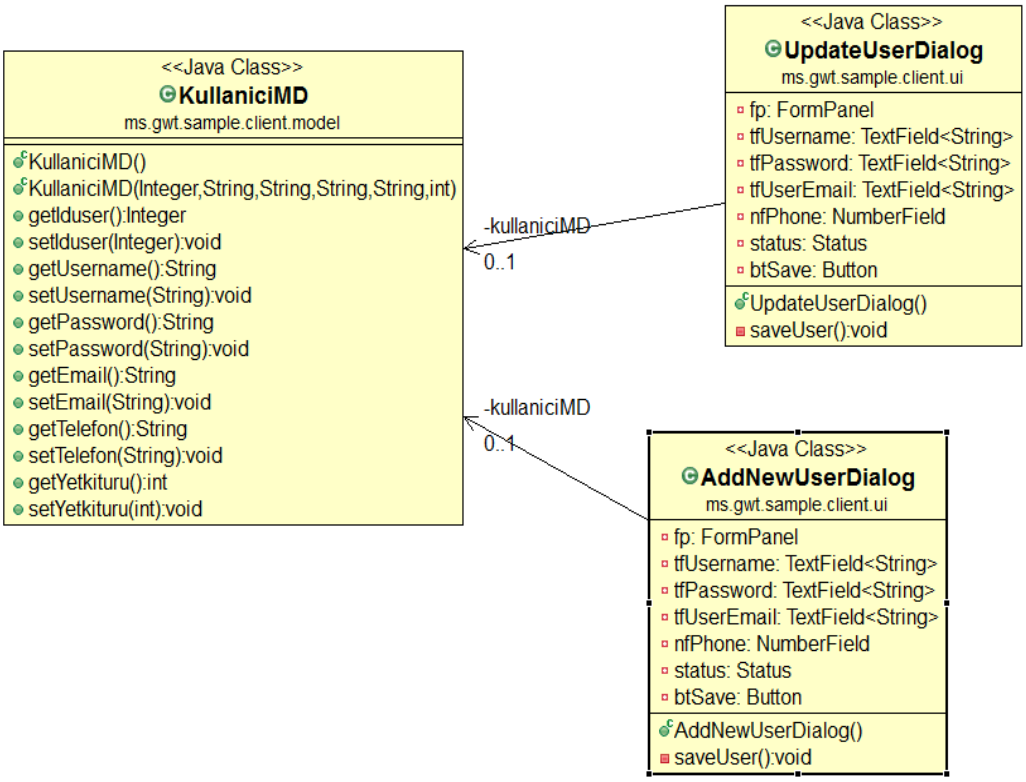


Figure B.1 KullaniciMD sequence diagram

Appendix C: The sequence diagram of model of MufettisMD

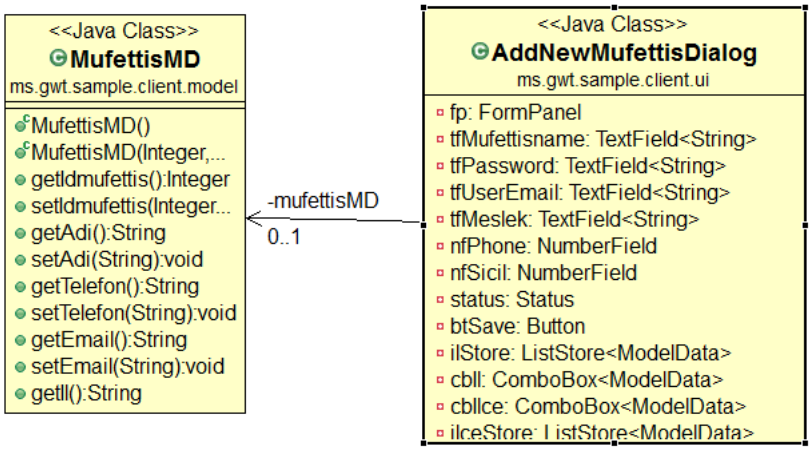


Figure C.1 MufettisMD sequence diagram

Appendix D: EJB bean tables diagram similar to database diagram

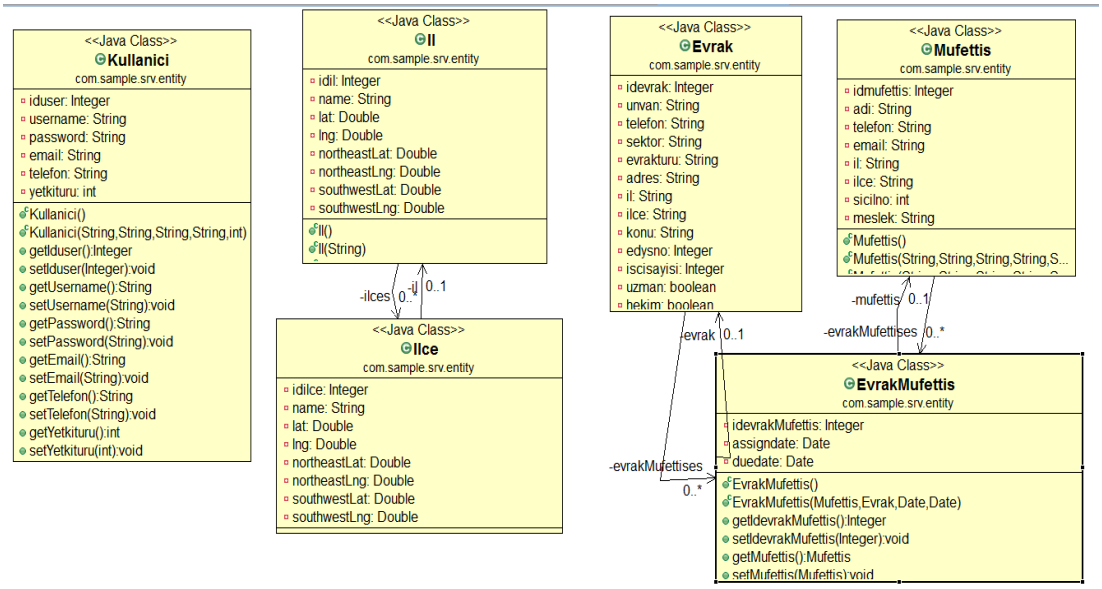


Figure D.1 Ejb bean tables diagram

Appendix E: Ejb service to implementation diagram

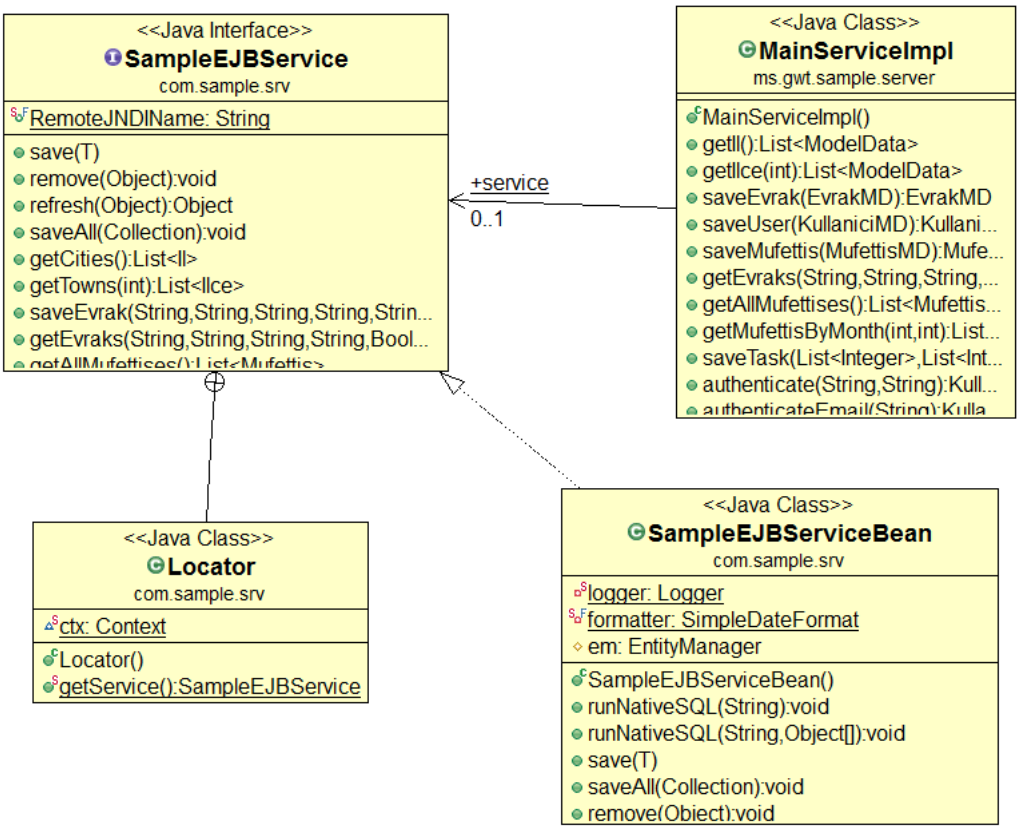


Figure E.1 Ejb service to implementation diagram

CHAPTER NINE - RESUME

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