OIL RESOURCES OF THE WORLD

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DEDICATION

I dedicate this thesis to my family, friends, near & dear ones for their unconditional love, encouragement, constant support and belief in me.
ABSTRACT OF THE THESIS

Oil Resources of the World
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The main foundation of this thesis is based on Geographic Information Systems (GIS). The complete idea is to show the importance about the current status of the oil resources present in the world. The objective is to represent the top oil producing nations on the world map in a very simplified manner. This focuses on the highest amount of oil available in terms of Thousand Million Barrels by different nations of the world.

The goal of showing all the information about the current scenario of the oil resources was achieved by programming on maps in Geographic Information Systems. This GIS Application uses MOJO, which is a plugin for map GUI. There are 17+ layers of maps which are embedded within each other to show a combinatorial effect of different oil nations. It has a timeline, having decades, which can display the different statuses about the availability of oil resources on the world map corresponding to the selected decade in the timeline. The timeline will be covering a range of 80 years from 2000 to 2080, to understand different oil scenarios in the past, present and the future. The highlighted nations capable of producing enormous amount of natural resources like Oil, more information about them can be obtained by hovering the mouse over the nation and clicking on them inside the world map. Information like capacity of Oil Production per day in Thousand Million Barrels can be obtained along with a web link taking you to their respective Oil Production details webpage.

Application includes influence of world population, their rate of consumption of the Oil Resources and their relation with the rate of production of Oil from the currently available Oil Reserves. Analytical charts also included, where the user can easily understand the dependence of human population and the Oil resources in the world.

Information about Peak Oil has been presented to demonstrate where the World is currently standing in the consumption of available oil resources and when can we expect the last few years of this beautiful OIL AGE.
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CHAPTER 1

INTRODUCTION

This thesis shows the different scenarios of the Oil Resources of the World and analyzes those using a dynamic timeline along with charts. A Geographic Information system is a combination of Information system and spatial data. A GIS application allows us to query spatial data from a database which can be visualized and analyzed in the form of a map. Geographical data which consists of co-ordinates of locations are projected onto maps in any GIS application.

The aim of the thesis is to build an interactive learning GIS Application to give the end user a better understanding of the Oil Resources available in the World along with the scenario of where the world currently stands in this OIL AGE. The java module comprises of tools and layers containing data points which focus on which nations are going to be the highest Oil Producers of the world, along with the information of which nations have the chances of surviving and keeping these resources to the maximum in terms of Thousand Millions Barrels.

Map Objects Java Edition is a product released to developers to build Java Applications by ESRI which produces software to build Geographic Information System software and geodatabase management applications. The user has been given access to the information about the existing oil resources remaining in the world in all possible ways. When the user selects any decade in the timeline, all the active nations corresponding to that decade can provide more detailed information when a user clicks on them in the map. This way the user can get information from the map itself as well as from the authorized website about the oil resources of that nation.

The chapters in this thesis documentation are respectively providing information about the technologies which have been used to successfully finish necessary tasks, software implementation of the application built in java, and information about the runtime setup used,
the data requirements for proper analysis and representation and finally, a complete overview of the project.
CHAPTER 2

TECHNOLOGIES

This chapter mainly focuses on explaining the various technologies we used to perform development in this application. This project can also be carried out using various other methodologies. However, we have used technologies that are known to work together at the ground level, and, without restructuring the entire application, are scalable to a much larger application.

Java is platform independent and supports the development of desktop applications by a number of packages, as will be seen. There are ways to display geographical information to a Java environment named MOJO, which is a collection of packages provided by ESRI. MOJO has been mainly developed by Dr. Carl Eckberg of San Diego State University. A lot of methods were developed by Dr. Carl Eckberg by using the classes from ESRI and because of those pre-defined methods, our GIS application got many features.

2.1 JAVA

The high level programming language Java, developed by Sun Microsystems, is a computing platform. A computing platform is an environment in which an application runs software on hardware. Java JRE and JVM are a run-time environment, which is required to run a Java program. Java JVM runs bytecode which is generated by a Java compiler from Java source code. The bytecodes are represented in stored class files. A Java program can be compiled on any operating system, because it is a platform independent language and therefore tagline Write once, run anywhere [1].

The greatest strengths of the language are the features which are considered and listed below:

- **Object Oriented:** OOP classes contain both data and behavior, and are used in combination with different types of software organization involving the key concepts of inheritance, polymorphism, and encapsulation.
- **Simple**: The syntax is based on C++, enhanced by features such as garbage collection and devoid of negatives like pointer arithmetic.

- **Secure**: Java was designed with security in mind, much of which is provided automatically.

- **Portable**: It can be used to generate bytecode on any platform.

- **Robust**: Java’s exception handling and strong type checking mechanism make it stronger and less error prone. [1]

## 2.2 MAP OBJECTS

Written by ESRI but mainly developed by Dr. Carl Ekberg in San Diego State University, with Map Objects Java version, dynamic maps can be integrated into the Java development environment to create a collection of packages. A Java-based geo-API has the classes required for content creation of applications, and they are available as jar files delivered as a library. The middleware software has little need for any other geographical data manipulation or spatial information analysis.

The library files of map objects are completely written in Java. Along with the Java AWT and Swing libraries (graphical user interface toolkits in Java), the developer is provided with a basic reasonable geographic and customized Java-based application development.

The custom maps can be created by combining existing Shape files and relevant files which are available from the internet as well as the intranet. Moreover, alongside the image formats such as GIF, BMP, PNG, JPEG and TIFF and ArcSDE layers, these generated Shapefiles can be assimilated into the geographic information system’s application, along with the availability of wide range of GIS based capabilities.

The edition of java which has been used for this GIS application supports server side as well as client side.

The components available on the server side allows the developer to generate services for maps, JSPs, EJBs and J2EE which is a standard for industry for application server providers. On the other hand, the client side components allows the developer to generate a UI (User Interface), make queries and send them through UI for data fetching purposes.

MOJO provides already defined toolbars such as Selection tool bar for the selection of a given region on a map, and Zoom Pan tool bar, in order to view and manipulate the map
graphical data. Along with these two toolbars, the GUI toolkit in Java can provide a lot of other customized toolbars which are well assimilated into the geographical information systems application. There is another tool called Legend Editor. This tool allows the user to manipulate or select a specific layer and fetch the information related to that already selected layer. This tool is very effective and helpful in providing all the necessary information about the layer quickly and easily, while altering the layer representation.

MOJO also provides different methods which support the promotion and demotion of layers. It means the layer’s legends which are displayed in the Table of Contents can have a different order of display when deemed appropriate by the user of the application. It also has an ability for the dynamic construction of point layers by taking values, separated by commas, from a separate external file. This has really been a very beneficial thing for developers which can generate other user defined tools, for instance, distance calculation between multiple points by keeping in consideration the longitude as well as the latitude through the support of plenty of projection coordinate systems [2].
CHAPTER 3

REQUIREMENTS

The ambition of this application based on Geographic Information Systems is to provide the user with detailed statistics and information about the survival of the Oil Resources of the world. This application majorly focuses on the years of 2000 to 2080.

The complete development of this GIS based thesis has been done under the proper supervision of Dr. Carl Eckberg from San Diego State University, Computer Science Department. The requirements of this application are distinguished based on three major categories as follows:

1. Functional requirements
2. Platform requirements
3. Data requirements

3.1 FUNCTIONAL REQUIREMENTS

The Functional requirements are very important to understand as they provides us a structure and design of how the application has to be worked with enhanced information functionalities and details about its corresponding features. The functional requirements explain all the specifications of how the user interface should respond and how all the accustomed tools should work accordingly. The functional requirements for creating this interactive tool are described as follows:

1. The shapefiles are created for different nations of the world in order to represent them over the world map, along with their respective decade on the timeline. Some shape files represents the huge continental areas to demonstrate the remaining oil resources in terms of Thousand Million Barrels.

2. Default base map is displayed when the application is launched. The default base map is the World Map and it displays the current scenario of the oil resources.

3. The GIS application must contain tools like zoom in, zoom out and pan.
4. A custom toolbar which contains a Hotlink tool to get more information about the Oil Resources.
5. A custom toolbar showing Print button which can add basic print functionality.
6. Toolbar to provision addition and removal of layers dynamically.
7. A tool for giving help to users like a help menu which can describe how any of the available tools or any other features work.
8. There are .csv files containing information about nations which have good amounts of oil resources.
9. The GIS application should include a Table of Contents. The table of contents displays the layers and gives information about them and editing of the content which are demonstrated.
10. For easy deployment of the GIS application, a jar file should be generated so that the application can be executed and run on any platform.
11. The timeline has been displayed perpendicular to the world map. The timeline displays information about the oil Resources, and different scenarios are generated dynamically corresponding to the decade selected on the timeline.
12. A user selecting any year on the timeline, must see a display of the countries belonging to the decade. As the years on the timeline go up, the world map keeps on reducing the countries due to the fact that the oil resources will be reduced as the number of years will be increasing.

3.2 PLATFORM REQUIREMENTS

The java files which are using mojo plugin can easily be executed and are runnable from the place where java is installed. An Integrated Development Environment, in this case eclipse IDE, has been used for the development, since all the code has been written in Java. The various technologies which have been used for the interactive tool development are as follows:
1. Java

3.3 DATA REQUIREMENTS

For representing the information about the situation of our planet Earth, a numerous and diverse amount of data has been gathered from many decades in the past. The fossil fuels have been developing on our planet for a long time, which means billions of years have been spent in creating oil from natural processes. To understand these process along with the time required to generate necessary fossil fuels like Oil, an enormous amount of study has been
done and is still going on. For our application, we have visited many Oil age related educational websites to fetch our oil related data and represent it in a well organized manner.

In our GIS application, there are 17 layers of maps which have been developed. All these 17 layers are basically generated from the main layer of the World Map. Some of these layers represent different nations of the world which get highlighted over the world map, when their respective decade has been selected in the timeline. The remaining other layers represent the huge continental regional areas in order to represent the amount of Oil remaining based on Thousand Million Barrels.

Moreover, the application is equipped with various important terms like PEAK OIL, which really helps in giving us some idea of where exactly the human race is standing in the consumption of oil resources and how many years we have to live in this oil age, approximately.

Detailed information is also provided by the availability of hypertext links so that when a user hovers over any nation, then the user can be redirected to the respective website related to the details about the Oil Production of the corresponding nation.
CHAPTER 4

ENVIRONMENT SETUP

This Geographic Information Systems based application using the mojo plugins can be easily started directly from the terminal line. We can also trigger our application inside the Interactive Development Environment (IDE) such as Eclipse, keeping the configuration to run it correctly. As we are using Mojo plugins to demonstrate geographical information, it is very important to set the path for them as well as for Java. This is the most critical step to be done before starting the application for execution. For easier development, Interactive Development Environment (IDE) Eclipse IDE has been used, where all the java classes have been written and executed along with the mojo jar files, which have been imported into Eclipse IDE, in the form of external plugins or libraries. Importing of external libraries can be done by configuration of the option menu’s build path. Now, after successful importation of all required libraries, the application can be started by selecting the main class of the application and choosing the option of Run as a Java Application.
However, our Geographic Information Systems (GIS) application can be executed using the terminal line in the following manner.

1. The command `moj_compile`: This command compiles the whole application and a class file is generated.

2. The command `moj_run`: This command the takes all the required class files and runs the application.

Now, it’s always great to have an executable of the application in order to run it from anywhere without explicitly going into the terminal and executing those above mentioned commands. So, for that an executable JAR file can be created, and it uses a manifest file, which has the instructions of where the location of all the class files are and in addition to that, the location of all the necessary libraries required for the application.
CHAPTER 5

SOFTWARE IMPLEMENTATION

The major focus of this chapter is to show the implementation of the software application with proper detailed explanation, so that, in future, when the application undergoes further development, the developers can understand the application easily. Screenshots are presented, wherever necessary, to show the user how a particular tool functions.

5.1 LAUNCHING THE APPLICATION

When the Geographical Information Systems application is run in the form of a JAR file, the JAR file directly calls the main class and so the main page of the application is opened. The main front page basically displays the base world map. Along with that world map, the table of contents appears, including the legend section which highlights and gives information about the name of each layer. The application also displays different toolbars and a status bar. All these contents are going to be explained in detail as the chapter proceeds ahead.

Now, the Geographic Information System application is using the MOJO plugin, hence, it also comes with two already defined toolbars. These toolbars play an important role in this GIS application, providing two predefined toolbars which can be used with the GIS application. The functionalities of the toolbars are different and they perform the required operations necessary for the user while the application is in running mode. These two most important toolbars are

1. Selection Toolbar
2. Zoom Pan Toolbar
Selection Toolbar: When the user wants to select a feature from the map, so as to get information about that corresponding selected feature inside the already selected layer, then the Selection Toolbar is used.

Zoom Pan Toolbar: The zoom pan toolbar is required when the user client wants to change the view of the map. So, if the user wants to zoom in some place to find detailed content, this toolbar will be required.

In addition to all of this, various other toolbars, custom toolbars, are also provided to give the client more flexibility and comfort in getting more information from our Geographical Information Systems Application. In the following section, we will discuss in detail about how these tools are working in the application.

5.2 Zoom Pan Toolbar

The collection of tools which have been provided through the toolbar from ESRI are explained in detail in the following sub-sections.

The Figure 5.2 depicts the Zoom Pan Toolbar.
The zoom pan toolbar has a lot of buttons and each of them has a different functionality. These buttons as shown in Figure 5.2 in the toolbar and are helpful in changing the nature of the map existing in the GIS applications. The following tools along with descriptions are available from the Zoom pan toolbar:-

1. Zoom to Full Extent – This will zoom to the entire area of the map
2. Zoom to Previous Extent – This will zoom to the previous display of the map
3. Zoom to Next Extent – This will zoom to the next display of the map
4. Zoom to Active Layer – This will zoom the map to all the selected regions
5. Zoom In – This will zoom into the region selected on the map
6. Zoom Out – This will zoom out of the current region
7. Pan – This will drag the map in the direction of the mouse
8. Pan in one direction – This will drag the map in a particular direction
9. Identity – This will inform about the specific information about the selected feature in the map.

5.3 SELECTION TOOLBAR

The picture shown in Figure 5.3 is representing the Selection Toolbar. This toolbar has been provided through the toolbar from ESRI. This toolbar gives information in detailed form about the data of the selected layer or any selected region. By default, the selection toolbar comes with a set of seven buttons. The way these 7 buttons work has been described in the following sub-sections.

![Selection toolbar]

Figure 5.3. Selection toolbar.

5.3.1 Select Tool

This is a very strong tool to create custom shape files. This tool enables the user to select a region from the map. The region can be selected by using the shapes like rectangle, circle, line or a polygon. The selected region then can be taken out of the map and can be stored in the system machine as a separate shapefile.
5.3.2 Search Tool

The search tool helps the user to find out the results based on the query fired from the user side. These results are generated from a predefined stored query.

5.3.3 Buffer

To form a region by covering the selected feature on a particular map like for instance the world map in our GIS application, a buffer can be used, which is given as input from the user.

5.3.4 Find Tool

The find tool provides the options like zoom and pan and with some list of layers in the form of a dialog box. Depending on the value mentioned by the user, that specific location is displayed on the current map inside the application. The options like Zoom and Pan get enabled in the map, when the user enters a value matching some place available in the current map layer and as a result of that, also gets highlighted.
5.3.5 Query Builder

Query builder is a tool which helps the user to fetch information about any selected layer. When the query builder is selected the dialog box is shown, and through the textbox available in it, a user can type and execute any SQL queries. The result is due to the execution of those queries in the background of the GIS application. The result of the executed SQL query is displayed in the bottom dialogue box. The options for highlighting any region, saving it, zooming options and many other tools get activated when the result is selected.
5.3.6 Attributes

Attributes are the tool which gives information about any specific feature’s attributes. When attributes are selected, then result of that specific region/section is displayed.

Figure 5.8. Attributes.

5.4 Custom Toolbar

This GIS application has a custom toolbar. It helps the user by providing some more additional functionalities, for instance, addition of a layer loaded from a CSV file. Figure 5.9 shows a sample of a custom toolbar and the functionalities of it are explained below.

Figure 5.9. Custom toolbar.

5.4.1 Print Tool

The print tool gives the user the option to print the current existing map or save that map as a PDF. The following dialogue box pops up when the print tool is selected (see Figure 5.10).
5.4.2 Add Layer

Through add layer, the user is able to add a shapefile to the current existing layers in the GIS application. When this option is selected, a dialogue box pops up and through that, the user can select the path of the shape file. The user can add any type of file as far as ESRI allows it. After the user selects the path of the respective shape file, he click “ok” and then that layer gets added to the existing set of layers.
5.4.3 Pointer Tool

To remove or change the selected tool behavior to the default behavior, this Pointer tool is used. There is a change in the mouse pointer symbol and in its behavior too accordingly, when some other tool has been selected. When the pointer tool is selected, the cursor is returned back to the default arrow symbol and the behavior is also set to default.

5.4.4 Distance Measuring Tool

To measure the distance between any two points on the current existing map, the distance measuring tool has been provided. For measuring the distance, first of all, the user has to click on some starting point, and then drag the cursor to the ending point and then has to release the mouse. During this process, a line is drawn automatically, between the starting point and ending point. As this process continues, the distance is calculated automatically and displayed in the status bar in terms of miles or kilometers.

![Figure 5.12. Distance measuring tool.](image)

5.4.5 Hotlink Tool

The main purpose of the hotlink tool is to select one point from a data layer, and its data is displayed in our Geographical Information Systems project. Figure 5.13 represents information on a map of the selected point. A dialog box pops up, listing the selected point related to the oil resources, and displays information about the event and it can redirect users to corresponding network links. The underlying functionality can be described as: whenever a point in the layer has been selected, the corresponding CSV is searched by this hotlink tool. Whenever there is a match, there is an appearance of the dialog window.
5.4.6 XY Tool

The XY tool has been used to find some CSV file and dynamically generate a layer based on it. The complete list of latitudes and longitudes are stored inside the CSV file. Once the file is selected those coordinates are formed onto that layer and that layer is added into the Table of Contents (TOC).

5.4.7 Help Tool

Help tool is a very important tool which gives information about other tools. The HELP tool will show the information about the specific other tools, when the user hovers over that specific tool and uses the right click button. As a result, a dialogue box pops up along with the information of the corresponding tool.

5.5 MENU BAR

The menu bar consists of 4 menus
1. File
2. Theme
3. Layer Control
4. Help
In this chapter, all the respective menus are explained in depth. As the whole GIS application has been developed based on Java, we have used Swing Toolkit through Java APIs, to implement the Menus. The Java Swings are very useful and very light weight. Their efficiency is really high and good and we can easily integrate them into our GIS application. The submenus are explained below in details.

5.5.1 File Menu

The File menu comprises of mainly four sub menu items. Their functionalities have been explained as follows:

**Add Layer:**
Add a layer basically adds a new layer into the Table of contents when the user specifies the path to the location of the new shapefile.

**Print Menu Item:**
This option is for printing the current existing map.

**Remove Layer:**
To remove a layer from the Table of Contents, this menu item has been provided.

**Legend Editor:**
Using the Legend editor, the style, color, size and the shape of the symbol demonstrating the points on the layer can changed and implemented to any specific layer.
5.5.2 Theme Menu

The theme menu consists two sub menus:-

1. Open Attribute Table
2. Create Layer from Selection

The two sub menus are explained in detail as follows:

5.5.2.1 OPEN ATTRIBUTE TABLE

In order to know the properties of any specific layer, that specific layer has to be first selected from the Table of Contents. After that, the option Open Attribute Table has to be selected. Following that, a window will pop up listing all the information and data the selected layer is having. Figure 5.16 is a sample of the Open Attributes Table showing a list of data of the GIS application’s base layer.
5.5.2.2 CREATE LAYER FROM SELECTION

Many times, the user wants to save the features of the current map and save it separately in a different shapefile. So, in order for that to be fulfilled, this menu item tool called Create Layer from Selection has been provided. Now, the user can select the features from the current layer by utilizing the select features tool which is available in the Selection Toolbar. After this, a dialog box will be popped up where the user can enter the specific name of the region which has been selected. And that specific name will become the name of the newly created shapefile. Then the newly created shaped file adds up to the Table of Contents automatically. The user can always notice the highlighting of the selected features in a different color. Figure 5.17 shows the sample of create layer from selection.

![Create new shapefile?](image)

Figure 5.17. Saving a shapefile.
Figure 5.18. Features selected to be saved as Shapefile.

5.5.3 Layer Control Menu

This menu is basically for handling the layers in the application. The Layer Control Menu item has two sub-menus.

1. Promote selected Layer
2. Demote Selected Layer

For activating these two sub-menus, the specific layer must be selected by the user in the table of contents. After that, the user can manipulate the order of layers in the table of contents by moving them up or down depending on the sub-menu the user has selected.

Figure 5.19. Layer control menu.

Promote Selected Layer: Unless it is the top most layer in the TOC, the layer can be moved up the order.

Demote Selected Layer: Unless it is the last layer in the TOC, the layer can be moved down the order.
5.5.4 Help Menu

A HELP menu comprises of those items which helps in explaining and demonstrating how a tool works in the dialog box. The help menu comprises of sub-menu which will show a list of tools used in our Geographic Information Systems application.

1. **Help Tools:**
   The HELP tool can be selected by hovering the mouse over it and then clicking the right button on the mouse. After that, the user can collect information regarding any tool which has been used in our application.

2. **Analytical Charts:**
   This section contains real statistics about the rate of production of Oil across the world. The graphs are helpful in simplifying the understanding of various technical concepts like Peak Oil.

3. **About Oil Resources of the World:**
   This option can be selected by hovering the mouse and left clicking on it. A simple window pops up giving brief information about what our GIS application does.

4. **Contact us:**
   This option can be selected by hovering the mouse and left clicking on it. A simple window pops up giving information about the candidate and the university he is studying in and finished this thesis.
CHAPTER 6

OVERVIEW OF THE PROJECT

In this chapter is an overview of our GIS application describing how it works.

When the application is started by the user, Figure 6.1 shows the first look of our GIS application which is displayed on the screen. This is showing the latest information about the status of various oil reserves of the World in terms of Thousand Million Barrels by 2009. The layers representing the different nations and large oil reserves can be seen in the left side, inside the table of contents. There is a KEY also provided which shows the statistics of the remaining Oil Reserves in terms of Thousand Million Barrels. On the right hand side of the application is a black colored vertical timeline representing the decades from 2000 to 2080.

Figure 6.1. First look of GIS Application on start.
Figure 6.1 shows that when the user moves the timeline slider towards the 2016, that is our present, the world map changes dynamically and the current top 10 nations having the largest amount of Oil Reserves in terms of Thousand Million Barrels are displayed. The user can also see a Key stating “TOP 10 OIL RESERVES OF THE WORLD” [3].

When the user is hovering the mouse over these highlighted nations of the world, the name of the corresponding nation is displayed in the status bar. The name of the country dynamically changes on the status as the user moves the cursor over different countries.

For instance, in Figure 6.2, the user mouse is on Saudi Arabia, and so, the country name also appears in the status bar.

![Figure 6.2. Top oil reserves of the world.](image)

As the user moves the slider on the timeline more towards the future, that is, towards the decade of 2080, the Oil Reserves shown on the world map start depleting and the countries being highlighted start becoming black, which means, there Oil Reserves start finishing.
Figure 6.3 is a sample screenshot of the remaining Oil Reserves in 2050. We can see that, the timeline is near 2050 and the world map clearly shows the regions like, South America, Europe along with Russia and The Middle East, which will be successful in saving the Oil Resources by that time. The remaining regions which have been shown as black represents that there are no longer Oil Resources remaining [4].

When the countries are highlighted with different colors corresponding to the decade selected on the timeline, the user can get detailed information about the rate of oil production of any specific highlighted nation by clicking on the respective map of that country.

As a result, a window pops up and the user can get information about how many million oil barrels per day are produced by that country. A link is also available which redirects the user to the website of that countries detailed statistics about Oil Production and available oil reserves.
Figure 6.4 is a screenshot of the Russian Oil Resources when the user clicks on Russian Map during the decade of 2010-2020.

When the user clicks on the link “Russian Oil Reserves” in Figure 6.4, the user is redirected to the following page (see Figure 6.5 [5]).

6.1 CHARTS FOR ANALYSIS

There are few graphs which have also been added into the Geographical Information Systems application for the user to see some real statistics about the Oil Resources of the world. Figure 6.6 is a graph of PEAK OIL. Peak oil is the day that oil production reaches a maximum and will subsequently begin to decline until full depletion is ultimately reached [6]. According to latest statistics, the Peak Oil is probably now [7] [8].
Figure 6.5. Russian oil reserves details. Source: [5].

Figure 6.6. Years vs millions of barrels per day. Source: [8].
The graph seen in Figure 6.7 shows the comparison of world population and the Oil production rate in the world. We can clearly see that, initially in the graph, the oil production was very less in the early 1900’s. But as the decades passed, the rate of Oil Production increased at a higher rate and in around 1970s, it crossed the population (in billions). During the last few decades, the graph is showing, that the population and oil production are at the same level. But, as the time will proceed, the graph for rate of oil production is going to decrease in comparison to population [8] [9].

Figure 6.7. Billions of people vs millions of barrels per day. Source: [9].
CHAPTER 7

SUMMARY, DIFFICULTIES AND FUTURE SCOPE

7.1 SUMMARY

This thesis is based on Geographic Information Systems (GIS). The main goal of this project development is to demonstrate the importance of the current oil reserves the world is having. This thesis focuses on the current status of the oil resources present in the world. This objective is accomplished by representing the top oil producing nations on the world map in a very user friendly and easy way. The world map will show the highest amount of oil reserves available in terms of Thousand Million Barrels in various countries across the globe. Through implementing the software by performing programming on maps in Geographic Information Systems, our application was able to give an overview of the current status of Oil Resources across the world. The GIS application is having multiple layers of maps or in technical terms, many shapefiles, which are representing the combination of oil producing nations as large regional areas, to make it easier for the user to understand the objective of this project. The Graphical User Interface has a timeline included, which elaborates which region has the highest oil available in terms of Thousand Million Barrels corresponding to the selected decade in the timeline. The timeline covers 80 years of range from 2000 to 2080. For proper detailed information about the nations represented as per the selection on the timeline, there are website links which have been coupled with the nations when a user click on them inside the world map.

One can analyze the impact of these events by using the clear to understand and simplified charts that this application generates.

The application also informs the user about Peak Oil through a graph about where the World is currently in the consumption of available oil reserves and when the human race will encounter the last days of this era of the Oil Age.
7.2 DIFFICULTIES

The Oil Resources are spread over different regions and occupy vast boundary areas across the whole world. Information about nations and their current oil production based on Thousand Million Barrels are not well presented in the Internet. The data collected for generating the shape files of the high oil producing nations needed extensive search from educational websites. The Shapefiles are created using a Polyline Polygon Tool for GIS.

There was a lack of information about the exact prediction of how much these oil resources will be available in the future, since there were few websites which only showed approximate oil production on per year basis and how much capacity these few nations have to run the same production rate for the upcoming years. There was no exact timing when this OIL AGE will be over. The data is manually collected from the websites and is stored in a .csv file which is used as a source for inserting the same into the database. A lot of study was required due to the vastness of this topic.

7.3 FUTURE SCOPE

The application showcases information about oil resources using MOJO Java. The application can be further implemented using future technologies as we progress further reaching out to a higher audience. A few enhancements that could be done are listed below. The application can be made lightweight using JavaFX libraries, an addition in Java 1.8. This application can be developed as a smart phone app as well using Android and iOS SDKs.

A deeper study could reveal more information about the oil resources and events that occurred in the specific time which can be shown as a part of the timeline. Integration of google maps API can show boundaries in a more interactive way. The range of years can be extended as well. We can try and find new data sources with much larger data so that we can have much more clear representation of how serious these scenarios about the existence of oil resources are.
REFERENCES


