



# E-Road Management System

Software Requirements Specification Document

**Sri Lanka Institute of Information Technology**  
**Special Honors Degree of Bachelor of Science in Information Technology**  
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# **E-Statistical Analyzer**

**Project ID: P2011-072**

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# Declaration

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# 1. Introduction

This document is created in order to provide the software requirements and a research review on the project we selected for the E-Road Management System (E-RMS). E-RMS is the project we intend to develop for the fourth year project for Comprehensive Design/Analysis Project subject.

## 1.1. Purpose

This document defines the Software Requirement Specification for the E-Road Management System (ERMS). It's going to presents the detailed description of the WLBS. It explains the purpose and the features of the system, the interaction between the users, what the system will do, and how it will work. And it includes functional requirements, non functional requirements, and the use case diagrams and descriptions. This section gives an overview of functionality of the proposed software product.

And mainly consists with the methods and techniques we are going to use, how to apply those techniques in order to achieved system goals including all functional and non functional requirements and also describe the research part of our system in detail. The ERMS will provide a real time “traffic, accident and road block” attentions to the Clients through several ways.

Clients can access this system through mobile phones and desktop or laptop computers. The purpose of this document is to give an outline of the functionality and the technology requirement of the E-Road Management System (ERMS).

It is ensures that the software requirements of this proposed system are understood by the Research and Development team. Overall Description and Specific Requirements of this document contains details description of the software component which is going to be implemented. At the end of this document mention, specific deliverables, output components of the proposed project. Supporting information consist with appendix and other supportive materials.

This document is intended for several types of readers. Therefore document is writing according to the standard format unambiguously.

## 1.2.Scope

Final features and all requirements will be covered by this document provides proper description of the proposed system in order to understand the system well. This is a guideline document which facilitates good development process as well as better final product as its purpose is to guide developers in selecting a design that will be able to accommodate the full-scale application.

It will clearly explain about software limitations, technological challengers which system should overcome.

Further it defines the product perspectives which compare the system with other related competing products. It also provides product perspectives and details of the design process.

Requirements are categorized in to functional requirements and non-functional requirements.

Functional requirements are associated with specific functions, task or behaviors the system must support.

Non functional requirements are the constraints, on various attributes of these functions or task which have to pay more attention..

The E-Road Management System having four different modules they are:

- ❖ E-Destination Management System (EDMS)
- ❖ E-Statistical Analyzer (ESA)
- ❖ E-Path Identifier (EPI)
- ❖ E E-Mobile Tracker (EMT)

E-Statistical Analyzer (ESA), this is the main module under E-Road Management System. It is mainly focus on Analyzing the past and future. The outcome of the module (ESA) will be full of graphs generation and the Simulator to predict the future. Graphs

are often an excellent way to display the results. In this system 'graph generation' is one of the most important parts for managing the traffic in Sri Lanka.

It will help to easily read data on a graph rather than paragraphs as the data are visually appear in the graph. It handles large data in a small area.

► Objectives:

- ✚ Provide a mechanism to get an idea about the future from the past statistical data.
- ✚ Ease the workload.
- ✚ Provides accurate and efficient reports.
- ✚ Minimize the unwanted delay time.
- ✚ Generate statistical graphs and reports.
- ✚ Simulator to get an idea about the future.

► Goals:

- ✚ To predict the future by analyzing the past.

► Benefits :

- ✚ Better relation with motorist.
- ✚ More accurate history and information.
- ✚ Improved road management information.
- ✚ Faster processing of staffs & services details.
- ✚ This solution will provide e-mail and internet facilities to all staffs.

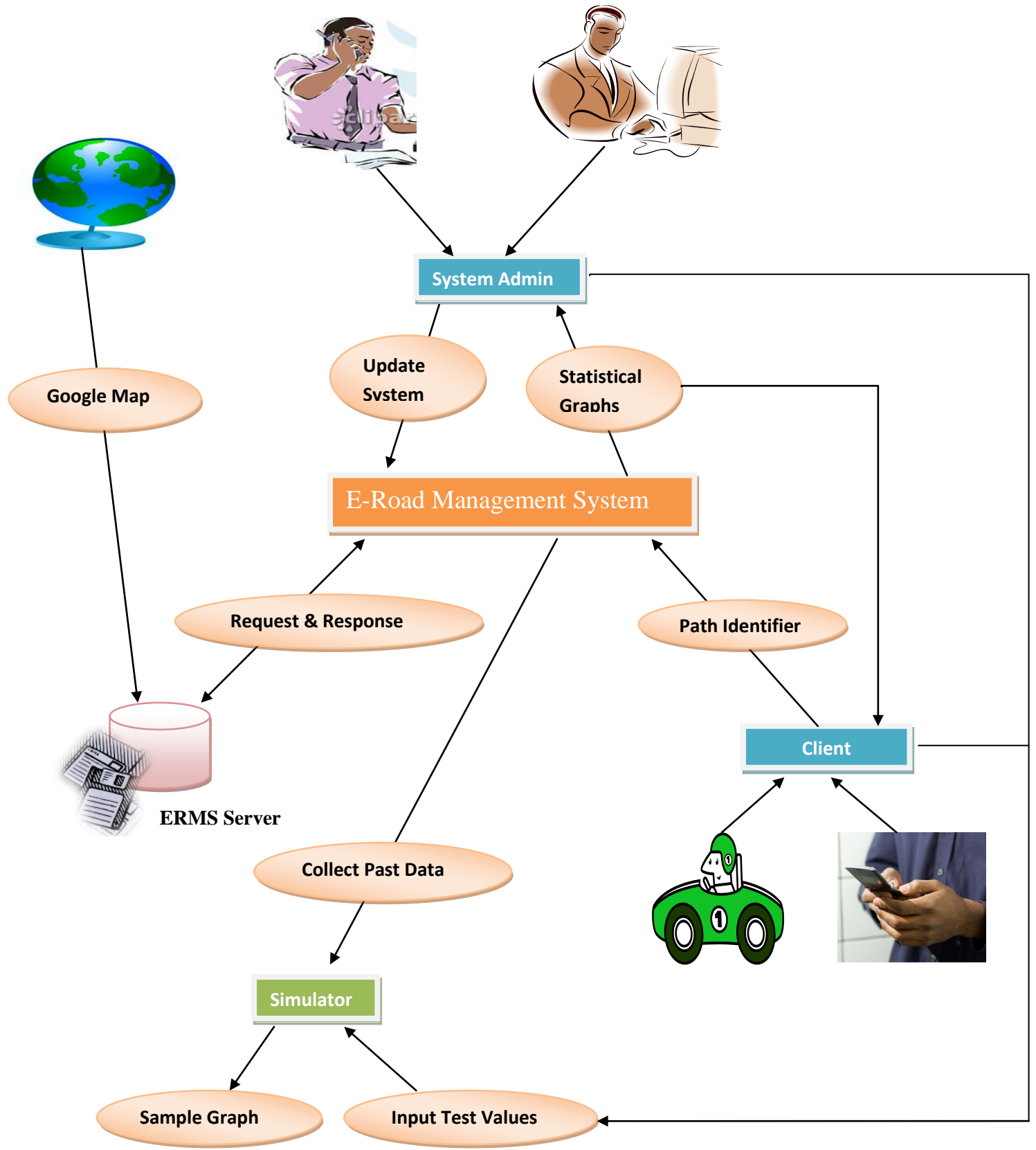
### 1.3. Definition, Acronyms and Abbreviations

This section contains definitions, acronyms and abbreviations that are used throughout this document.

The following table lists the common abbreviations, which come throughout this document, in order to improve the maximum references of the readers.

Abbreviation	Descriptions
<b>ERMS</b>	<b>E- Road Management System</b>
<b>ESA</b>	<b>E- Statistical Analyzers</b>
<b>SRS</b>	<b>Software Requirement Specification</b>
<b>EDMS</b>	<b>E-Destination Management System</b>
<b>EMT</b>	<b>E-Mobile Tracker</b>
<b>MB</b>	<b>Mega Bytes</b>
<b>RAM</b>	<b>Random Access Memory</b>
<b>MSSQL</b>	<b>MSSQL is the relational database management system (RDMS), which has more than 11 million installations. The program runs as a server providing multi-user access to a number of databases.</b>
<b>VS-2010</b>	<b>Visual Studio 2010.</b>
<b>Web</b>	<b>A subnet of internet providing hypertext service.</b>
<b>Database</b>	<b>Information relating to the registered Client, logins, selected locations.</b>

### Architecture Diagram





Our system overview can be described in a summarized manner through the Architecture diagram

E Statistical analyser is to enhance the data processing activity on the road management system. This module contains the research study about the past data on accident rates over the past years, population study, number of vehicles and the relationship between population and etc. By studying the above data author will come up with some equations which will be use full for automatic graph generation for the future.

This chapter presents the detailed description of the E statistical analyser.

It explains the purpose and the features of the system, the interaction between the users, what the system will do, and how it will work.

This chapter includes functional requirements, non functional requirements, and the use case diagrams and descriptions. This section gives an overview of functionality of the proposed software product.

The new system is going to radically change the way in road management, administration and services as the orders will be input directly into the computer in this function.

This solution will also provide the following non quantifiable benefits.

- Better relation with motorist.
- More accurate history and information.
- Improved road management information.
- Faster processing of staffs & services details.
- This solution will provide e-mail and internet facilities to all staffs.

## 2. Overall Descriptions

Policing of road traffic in Sri Lanka has become a major task for police. Due to increase in volume of road traffic in the Island the Sri Lanka police facing many challenges to get control of it. But this is a difficult task to manually control it. So the author and the team are planning to create an application to solve this problem. By logging on to this system the user will be able to see the traffic congestions in cities especially during the peak hours and will be able to see the alternative paths to particular places.

Author's task in this application is to create auto generated graphs for Road Vs traffic, Road Vs No of vehicles and Road Vs Time. By viewing these graphs the users of this application will be able to manage their time and prevent unwanted delays. In addition to this an auto generated mail will be sent to the users to advise them on special occasions such as Kandy Perahara, Nuwara Eliya season Anuradhapura season, Kataragama and Thalavila feast May Day and visit of Heads of states and State functions. System will also send alert messages to the users about the accidents, road blocks, fire, explosions and other disasters. So the users can plan their programs ahead and avoid the unexpected circumstances related to traffic.

Furthermore the application will points out the speed limits in dangerous bends and curves. This will be done by lesson learnt by past accidents. By the initial analysis the numbers of accidents are increasing because of increased number of vehicles, poor development of road and poor traffic management. So this system will help to reduce the accidents by having good safety management measures. A graph will be generated within the application to see the statistics of the accidents.

In addition this application will also support to extend the knowledge of the users on road traffics. For example, the system will provide advice such as accidents can be avoided by limiting speeds in particular places; maintain safe distance with the vehicle in front and wearing helmets both the rider and the back seat person.

In this module having simulator part for get to know the future. It is going to very help full for people to manage their efficient time and can avoid the inconvenience which arise by traffics. For this simulator part going to develop with the helps of graph theorem, time serious algorithm, etc. For graph generation part is planning to do in Fusion charts to get the attractive 3D graphs.

## 2.1.Product Perspective

There are several traffic control systems in the developed countries to manage the traffic problems. But in the present traffic system, traffic flow is not smooth due to various factors like,

- ✚ Pre-fixed timings at every junction irrespective of real time load. However the cycle duration is dependent on the time of the day.
- ✚ Single traffic personnel placed at every junction is forced to multitask by ensuring traffic flow and spotting those who bend traffic rules simultaneously.

There is no support for providing a fast passageway for emergency vehicles. Though They have sirens, vehicles ahead seldom pave way. Especially in traffic jams, the time taken to get through is considerably increased. These hold ups also lead to various problems on a day to day basis. The proposed system tracks motion of every vehicle within city limits, gives a faster passage for emergency vehicles, and plans corrective actions during jams and other such situations. Also, the proposed system takes into account the real-time load of traffic at each junction, and allocates time for each road in the junction, that facilitates a free flow thus saving commuters time at each junction.

Automotive technologies are gaining ground in modern road traffic-control systems, since the number of road vehicles and passengers is rapidly growing. There is a perpetual need for safety-critical traffic automation, and traffic engineering makes the dynamic or static analysis and the synthesis of automotive vehicle technologies possible. The main goal of engineering is the planning and management of traffic systems.

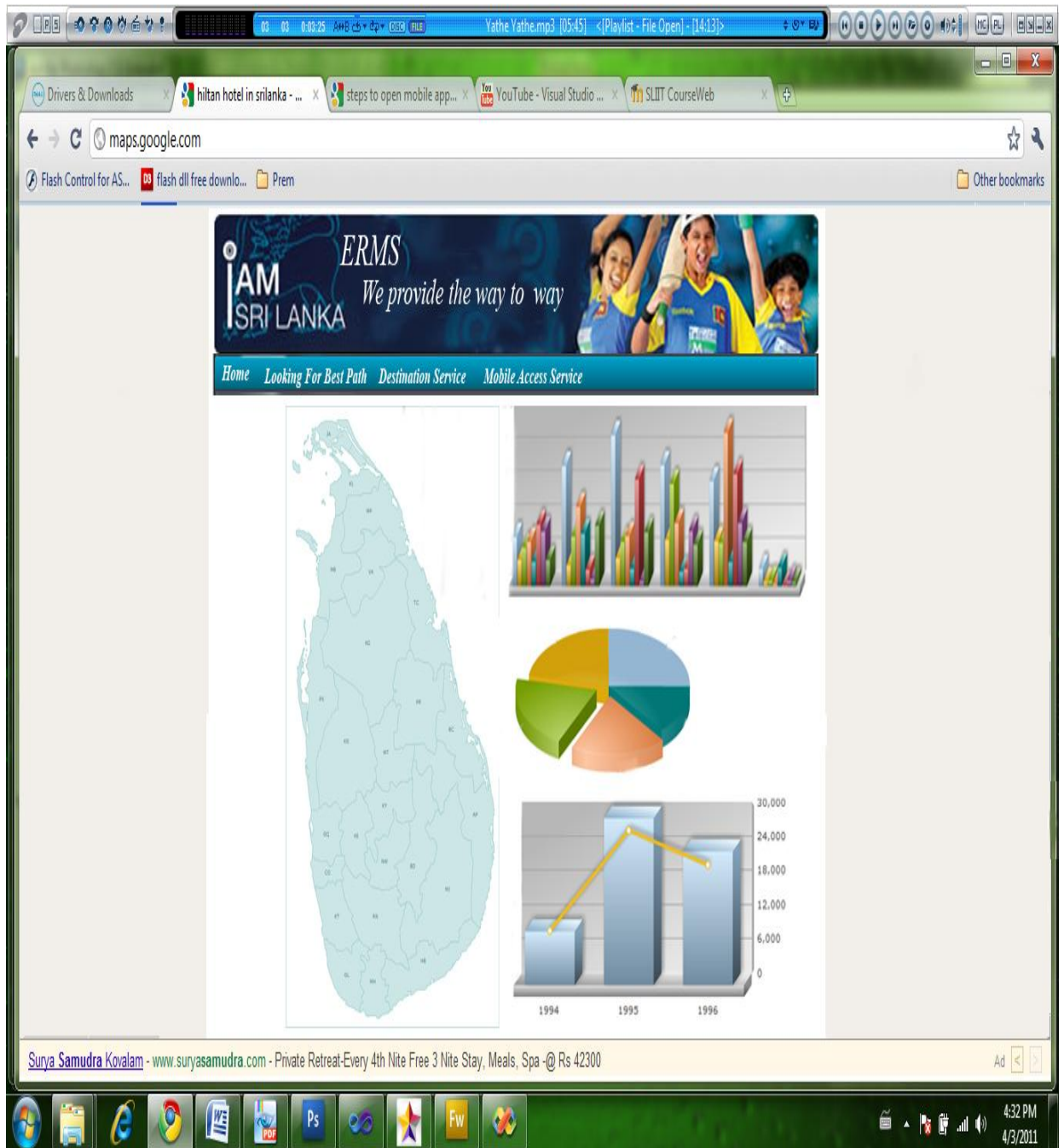
The project supports the development of reliable and optimal control structures for urban traffic and for motorway systems. The intelligent and cooperative set-up of actuation and its linkage to the central control system is vital for avoiding traffic jams and accidents. Moreover, environmental costs (e.g. pollution) can be decreased.

According to the research done on road management, the author found few projects related to it. But those projects mainly used the signal light monitoring and some traffic monitoring concepts. Our system is totally different from the above concepts. This research is going to give an excellent solution for people who suffer from traffic and can avoid the unwanted delays, and inconvenient.

### 2.1.1 System interfaces

The system uses the .NET Framework for developing, and Microsoft SQL Server for Database storage.

### 2.1.2 User interfaces



### 2.1.3 Hardware interfaces

The system not needed the special hardware. It is using following hardware interfaces.

1. PC
2. Server
3. Other networking devices

#### 2.1.4 Software interfaces

The system will be built with Visual Studio 2010. And system development phase uses the c# language that run on the .NET 4 frameworks. The web site will be supported by any web browser. Therefore there the users of the website are also free from any system interface requirements.

#### 2.1.5 Communication interfaces

As the web site is developed is in a machine acts as the server machine, users of the web sites needs an internet connection to use the web site. Therefore a modem to connect to the internet and an interface for the modem is needed. As the database grows there will be a need for a database server as well, in that case a high speed network connection between the application server and the web server must be created. So at such a point some more communication interface may need and the least expensive fastest available connection will be used according to that time. Because of this reason a specific communication interface for this purpose will not be suggested in this document.

#### 2.1.6 Memory constraints

Minimum memory is expected to use no more than 256MB of Ram and 60GB of Hard Disk Drive as external storage. Processor speed must be equal or exceed 1.8 GHz. VGA must be equal or exceed 128MB.

#### 2.1.7 Operations

User must have an internet connection and the application server must be connected to the internet.

Users can login through the mobile network connection as well.

Users will be provided with sound record about the place description.

Administrator or the ERMS assistance will update the details on road and traffic by login through their account.

Pre planned activities will be automatically mailed to the users.

System will automatically generate graphs using statistical data which will be stored in the database about road traffics and accident rates.

### 2.1.8 Site adaptation Requirements

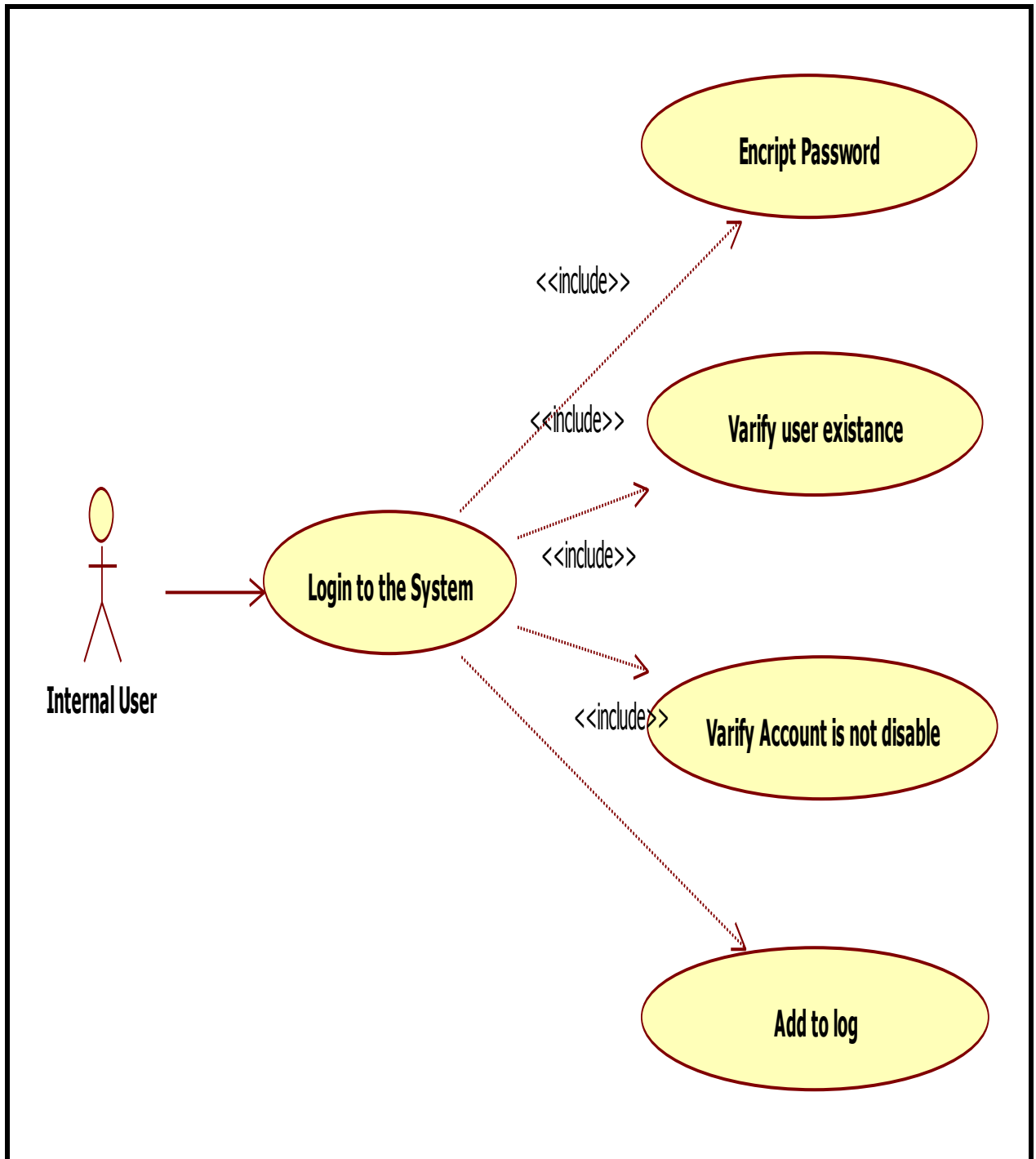
Within the installation process of the system, user should provide the username and password that the user expects to authenticate within the system.

## 2.2.Product Functions

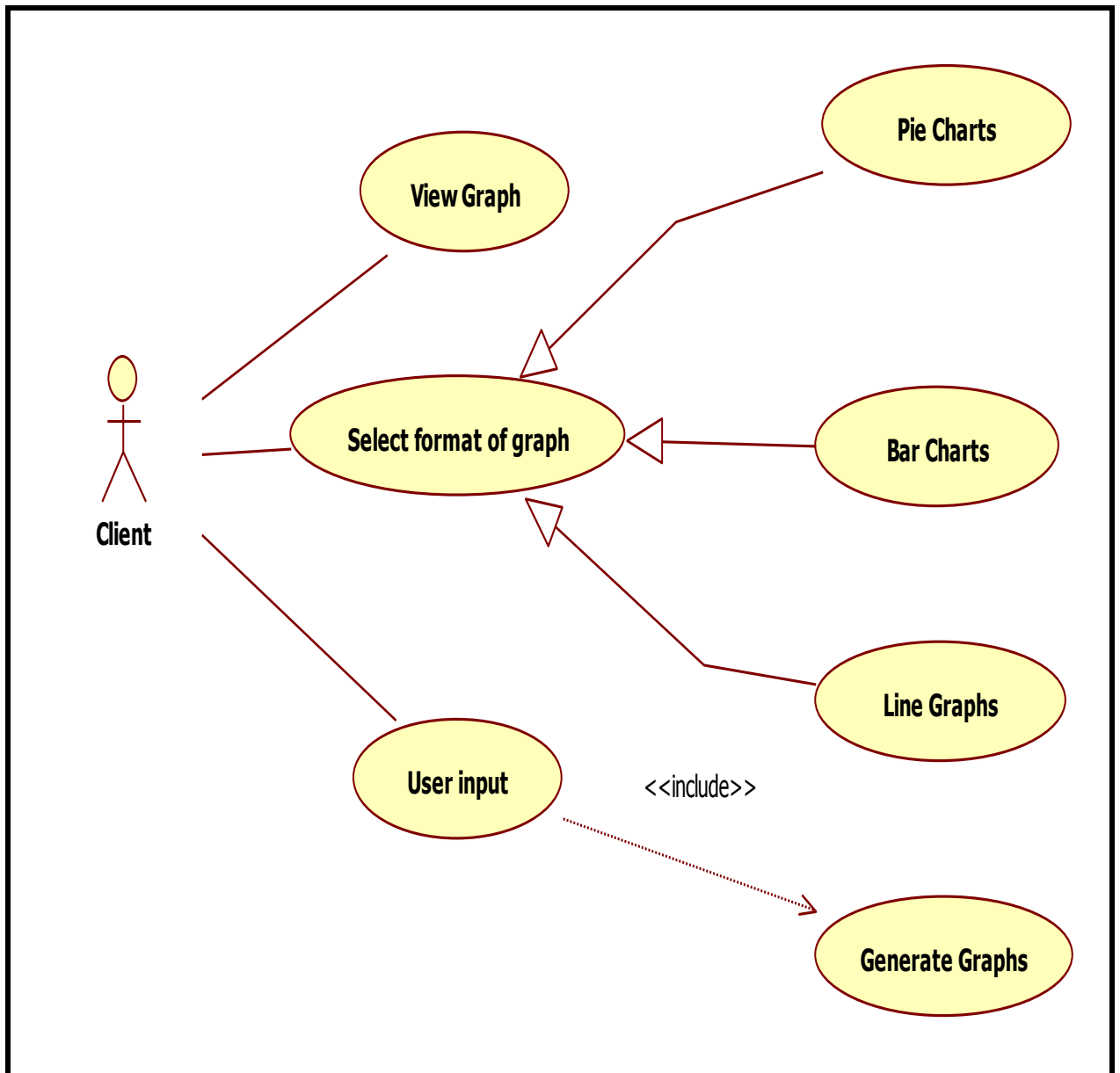
The use case modelling provides detailed information about the behaviours of the system or application. It contains use case diagrams and activity diagrams that describe how users interact with the system. The use case model identifies the requirements of the system in terms of the functionality that must exist to achieve the goals set out by the author or to solve a problem identified by the author.



Use cases illustrate the activities that are identified through requirement gathering process and it describe the results of the activities which will be received by the user. They do not describe how the system operates internally (Larman, 2001). Actors are the users of the system who interacts with the system directly. Use case diagrams depict the relationships between the uses cases and actors. This diagram can be refined iteratively until the requirements of the system are fully understood. Author prefers use case modelling as use cases are powerful technique for capturing and communicating functional requirements for system development. The author finds this methodology the most appropriate to WLBS to work with the stakeholders to identify the initial ideas of the system, model those ideas, and use that conceptual model to have stakeholder validate the requirements.



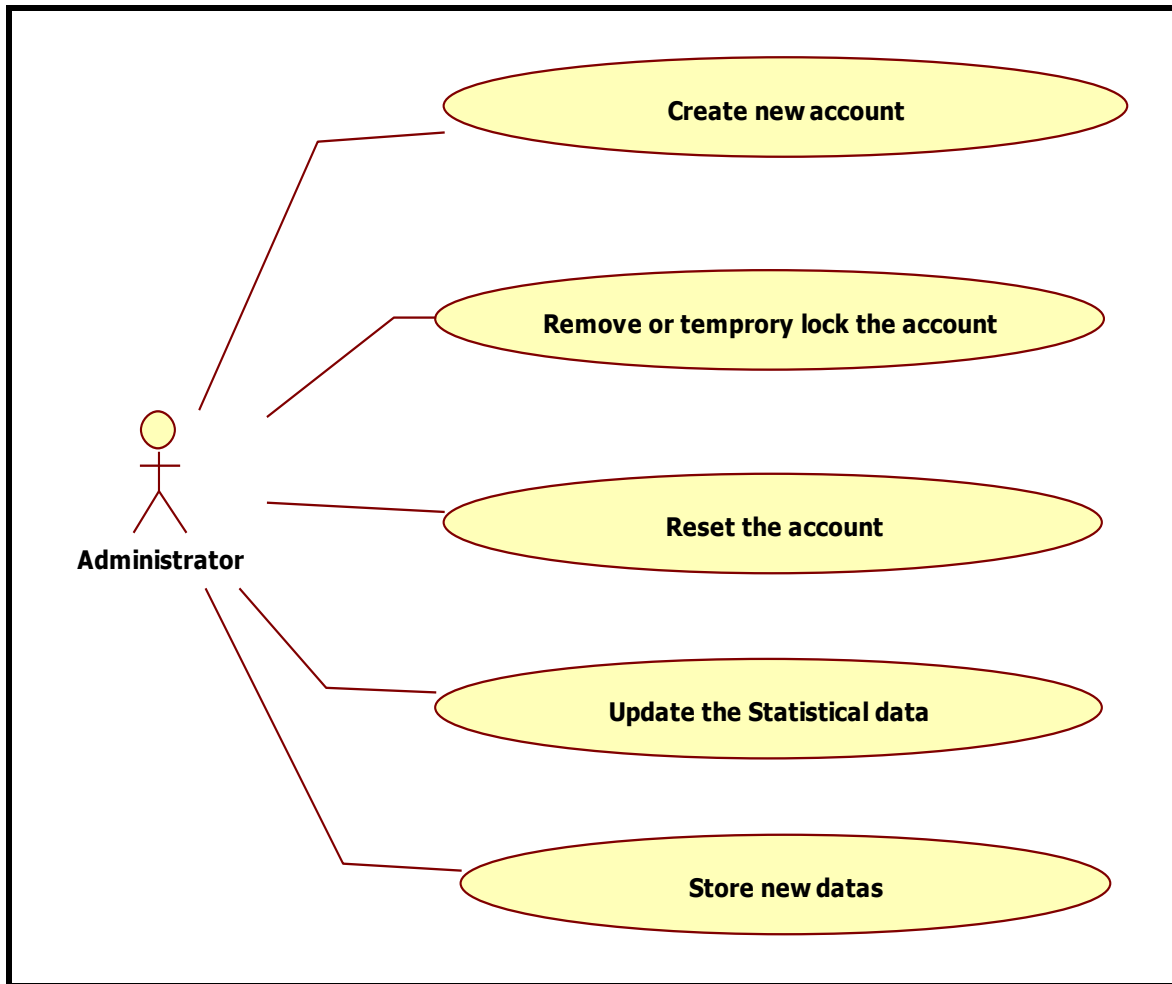
<b>Use case 1</b>	<b>Login to the System</b>	
<b>Pre conditions</b>	<b>System is in working order.</b>	
<b>Actors</b>	<b>Internal User</b>	
<b>Description</b>	1.	<b>User is asked to fill the user name and the password.</b>
	2.	<b>User gives the command to login</b>
	3.	<b>System will automatically match the user name and the password.</b>
	4.	<b>User will be redirected to the main menu.</b>
	5.	<b>The use case ends.</b>
<b>Exception</b>	<b>3.a</b>	<b>System will generate an error message.</b>



<b>Use case 2</b>	<b>View Graphs</b>	
<b>Pre conditions</b>	<b>System is in working order.</b>	
<b>Actors</b>	<b>Client</b>	
<b>Description</b>	1.	<b>User can view graphs.</b>
	2.	<b>User can view traffic graphs, Accident graphs through clicking the province in the Sri Lankan map.</b>
	3.	<b>The use case ends.</b>

<b>Use case 3</b>	<b>Select the format of the graphs</b>	
<b>Pre conditions</b>	<b>System is in working order.</b>	
<b>Actors</b>	<b>Client</b>	
<b>Description</b>	1.	<b>User can select the format of the Graphs. (Example:- Pie Charts, Bar Charts, Line Graphs)</b>
	2.	<b>User clicks Pie or any Charts</b>
	3.	<b>System will automatically generate charts.</b>
	4.	<b>The use case ends.</b>
<b>Exception</b>	<b>2.a</b>	<b>System will generate an error message when user didn't select any of them.</b>

<b>Use case 4</b>	<b>User can input data's system will analyze the future</b>	
<b>Pre conditions</b>	<b>System is in working order.</b>	
<b>Actors</b>	<b>Client</b>	
<b>Description</b>	1.	<b>System asked to input values</b>
	2.	<b>User enter the data's</b>
	3.	<b>System will automatically analyze the</b>
	4.	<b>The use case ends.</b>
<b>Exception</b>	<b>2.a</b>	<b>System will generate an error message when user didn't select any of them.</b>





<b>Use case 5</b>	<b>Create new account</b>	
<b>Pre conditions</b>	user logged in	
<b>Actors</b>	<b>Administrator</b>	
<b>Description</b>	1.	User initiates the create account command
	2.	User is prompted for username, I.C no, account type, set username, set password.
	3.	User gives the username, I.C no, account type, set username, set password.
	4.	System does authentication
	5.	New account is registered with the system
	6.	The use case ends.
<b>Exception</b>	4.a	Authentication Fails
	4.a.1	Prompt the user that he typed the wrong I.C no
	4.a.2	Allow him to re-enter the I.C no.

<b>Use case 6</b>	<b>Update the statistical data</b>	
<b>Pre conditions</b>	<b>Locked up login.</b>	
<b>Actors</b>	<b>Administrator</b>	
<b>Description</b>	1.	<b>Update the new accidents data's every year.</b>
	2.	<b>Update the traffic details</b>
	3.	<b>The use case ends.</b>

### 2.3. User Characteristics

- ✚ The system must be simple enough to be used by a novice computer literate, by following the simple steps given in the application.
- ✚ The desired users of this software should have experience in running an ordinary application in any platform.
- ✚ The intended users should be accustomed with installing the applications in an operating system.
- ✚ In our project we have assigned the administrator as a user.
- ✚ Client is one of the user of our system
- ✚ ERMS assistance also a user of our system.
- ✚ **Administrator:** Admin should be a computer operator or a police officer who has specially trained for our system. That person has the full control of the system. if any system crash occurs it can manually run the system.
- ✚ **Client:** No need to have much computer literacy. Simply use our mail generation function.
- ✚ **ERMS Assistance:** Admin should be a computer operator and should know how to send a SMS to our special number.

### 2.4. Constraints

The system will be developed on an average performance machine. At the time of this documentation it is about 1.8GHz processing power with 1GB of RAM. C# will be the implementation language for the desired product, but it will also be using library files which contain the implementation of HTK toolkit, which is written in C language.

Due to the fewer availability of voice recognition software for the other platforms the product will be produced with the intention of deploying in windows operating system. Since the voice recognition supports much Windows Vista or Windows 7 OS versions it is preferable if the user uses Windows Vista OS or higher.

### **Hardware Constraints**

The system would be developed using .NET Framework 2.0 thus limiting its usage and extensibility only to the operating systems with Microsoft Windows XP SP2 or above.

The minimum speed of the machine should be 2.0 GHz with Core 2 Duo or 3.0 GHz P IV computers.

### **Database Constraints**

The system would require a central machine containing high processing power and large disk space to accommodate image processing, neural network and image storage.

Criteria	Prerequisite
<b>Processor</b>	Pentium IV 2.8 GHZ or higher
<b>Operating system</b>	Microsoft Windows Vista or above
<b>Hard disk space</b>	1 GB or more
<b>Mouse</b>	Required
<b>Key board</b>	Required

## 2.5.Assumptions and Dependencies

The system that is to be developed will depend on Microsoft Visual Studio environment and all the software that required running this system appropriately. This system will also depend on Microsoft operating systems (XP or later versions) since the Visual Studio Environment depend on it.

## 2.6. Apportioning of Requirements

Functional requirements are the requirements which specify the functions of the system or its component. It is about what the proposed system supposes to accomplish. Author has identified some functional requirements for the proposed E-Statistical Analyzer (ESA) through data gathered from questionnaires, interviews, and literature search.

Chapter 2 describes the basic requirements and functions of the system, while Chapter 3 details out the requirements described in section 1 and 2. The facts in the Chapter 3 may be subjected to changes in the final product due to time limitations.

### 2.6.1 Functional Requirements

#### **F1. User views the graphs.**

*Input:* - Select form of the graph (Line graphs, Pie Charts, Bar Charts)

*Output:* - Displaying graph according the selection.

*Process:* - System produce the graph by using the statistical data's which is stored in Database.

*Description:* - User can be selecting the form of the graph. The displaying graph will be the bar charts or line graphs or pie charts etc. The graph going to be containing the accident ranges per year in Sri Lanka, traffic data's example traffics time vs. no of vehicles uses a particular road and population vs. vehicles.

#### **F2. Simulator**

*Input:* - enter the value (user input).

*Output:* - Will display what will happen in the future when no of vehicles increase.

*Process:* - System auto generate and the outcome will future analyze data's, using the user input values.

*Description:* - By using this simulator we can get what will happen in the future when no of vehicles increase, when population increase and when road conditions change what will happen.

### **F3. Providing best path to the Motorist.**

*Input:* - Motorist's indicating where they want to go.

*Output:* - will show the entire best path with the help of Google Map.

*Process:* - System auto generate and the outcome.

*Description:-* Providing best path to motorist with the help of Google Map. After Motorist's indicating where they want to go it may show the entire best path avoiding traffic and road blocks, etc.

### **F4. In real time System will give an Alternative path when any road or two end points jammed in traffic.**

*Input:* - User will enter the destination place.

*Output:* - Will automatically show the entire best path without Traffic.

*Process:* - System automatically generates and shows the outcome in Google Map.

*Description:-* In real time if any road or two end points jammed in traffic, in a short amount of time it will be updated in the system. After that the system will automatically set the best path between two end points with the help of Google Map.

### **F5. If any accident happens system will automatically send emergency alerts to nearby hospitals, police stations.**

*Input:* - just login to the system.

*Output:* - Will automatically send alerts.

*Process:* - System automatically generate.

*Description:-* If any accident happens, after the authorized person updates the system. The system automatically looks for nearby Hospitals,

police stations and send emergency alerts (using auto generated SMS& mails).And direct them to the point. All this happens in the short amount of time.

**F6. Point the place when the person enters the entire place.**

*Input:* - Enter the place (Eg: Colombo)

*Output:* - System will point the place in Google Map.

*Process:* - System will automatically generate.

*Description:-*Client can search a place (E.g.: Colombo) and in on enter. The system will provide with pointing the place in Google Map and it may pointing all important places in that location just like Hospitals, Airport, Railway Station, Police Station.

## 2.6.2 Non-Functional Requirements

Non-functional requirements are requirements which specify criteria that can be used to judge the operation of a system, rather than specific behaviours. This proposed ESA (E-Statistical Analyzer) System would satisfy the following non functional requirements.

- ✚ Ease and reduce the work load of the end users
- ✚ Increase the reliability and efficiency of the work process
- ✚ Provide more capabilities in order to fulfil user requirements up to the maximum level.
- ✚ Increase user friendliness towards the system
- ✚ Interoperability of the system
- ✚ The response time for Graph generations and simulator outcome will be no more than 8 seconds.
- ✚ The time to verify the username and password will be no more than 3 seconds.
- ✚ Security requirements will be included in the system.

### 3. Specific Requirements

#### 3.1 External Interface Requirements

##### 3.1.1 User interfaces

This module mainly highlight the automated graph generation. The main users of the module are Administrator and Client. Admin having the main role in this module. The statistical data's which use is for graph generation, it is updated by Administrator.

##### 3.1.2 Hardware interfaces

##### 3.1.3 Software interfaces

As developers say our main system is running under server and administration machine. In server developers must to use .Net frame work 4.0 or later, SQL server 2008 or later (2010), Fusion Charts for charting purpose and Flash player.

In administration machine wants .Net frame work 4.0 or later and Flash player. If any user use web edition from any reason he/she want to install flash player in their computer.

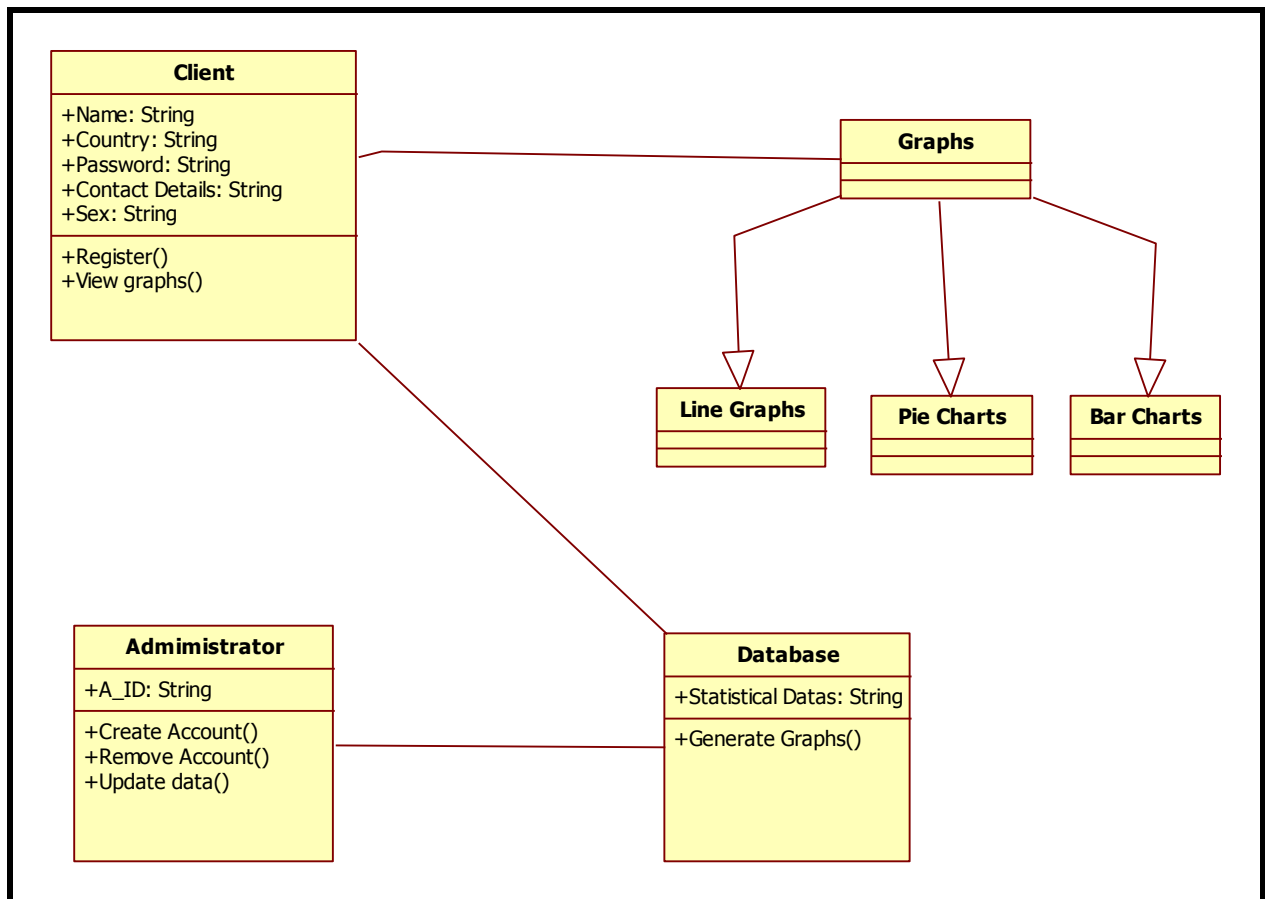
##### 3.1.4 Communication interfaces

Modem will be a communication interface which is used to handle the web links component.



### 3.2 Classes / Objects

Class diagrams are widely used to describe the types of objects in a system and their relationships. Class diagrams model class structure and contents using design elements such as classes, packages and objects. This diagram used to describe the classes of the system and the relationships between each other.



### 3.3 Performance Requirements

The system should provide results in less response time with better performance, high reliability, availability, easy maintainability and user friendliness.

To archive best performance developers have to use on server:

- Core processor server version
- 4GB or above RAM
- 4MB or above cache
- 80GB or above hard disk
- Dual adapt Network connection
- High bandwidth point to point link

To archive best performance developers have to use on Administrator Machine:

- Core processor
- 1GB or above RAM
- 2Mb or above cache
- 40 GB or above hard disk
- 256Mb or above VGA

Dual adapt Network connection to archive best performance in eb edition developers have to use.

On client Machine:

- Intel Pentium 2.8 or above processor
- 256Mb or above RAM
- 1Mb or above cache
- 20 GB or above hard disk
- 128Mb or above VGA
- Speed internet connection
- In web edition any number of users can access web pages simultaneously.
- No required any user login.

### 3.4 Design constraints

When we design a project according to the project management concepts, we should consider about four main constraints Time, Cost, Scope and Quality. We should consider about these conditions when we choose software and Hardware to develop the system. It will directly affect the quality of the system.

Challenge is develop the quality product with available financial resource of the team. Achieve a goal of the system according to the pre defined scope is another important challenge.

### 3.5 Software system attributes

#### 3.5.1 Reliability

The reliability of the system is an important issue, because the system is used for security purposes by law enforcement agencies. The ability of the system or a component to perform its required functions under stated conditions for a specified period of time is essential. The system contains both hardware and software. Therefore hardware reliability and software reliability should be considered.

#### 3.5.2 Availability

The system should be available at any time and able to give useful services at any given time. This is on line system, so availability is important since this is a web based so lines of communication should be available

#### 3.5.3 Security

In this system only the authorized users has the permission to log on to the some operations of the system other users can view some part of the information's but can't do any updating or modification Since the system is a remotely accessible system. The data passed via communication channels should be encrypted because the data transferred is sensitive data. The system will be protected by firewalls

#### 3.5.4 Maintainability

In this system only the authorized people can do the modifications to the system. Before switch on the system the database should be updated, hold is consisting of all the necessary records of all valid users. When the citizen request the service database should be update immediately. Therefore the database should be maintained.

#### 3.6 Other requirements

None

### 4. Supporting information

#### **4.1 Table of Contents and Index (place this at the beginning of the document)**

## 4.2 Appendices

Microsoft Project was used to draw the Gantt chart and plan the activities. This Gantt chart illustrates a project schedule, start finish dates of the terminal elements and summary elements of a project. It also shows the dependencies between activities. Mile stones focus mainly on the end dates which reminds the particular task need to be complete or certain objective need to be achieved. Given below is the actual project plan from the outset.

### References

Larman, C., (2001). *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process*. 2<sup>nd</sup> ed. [online] Upper Saddle River, New Jersey: Prentice Hall. Available from: Safari Tech Books Online. < <http://my.safaribooksonline.com/0130925691> > [Accessed: 23 March 2011].

