SSO - ROBUST SINGLE SIGN-ON MODEL

By

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BONAFIDE CERTIFICATE

Certified that this project report titled **ROBUST SINGLE SIGN-ON MODEL** is the bonafide work of **Mr. DHANAPAL .K** (Register Number: 71205621009) who carried out the research under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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PONGI
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Project Completion Certificate

This is to certify that Mr. **K. Dhanapal** (Register No: 71205621009) of Kumaraguru College of Technology, had done his project at Pongi Systems Pvt. Ltd., Chennai with the project title **"SSO - Single Sign On model"**, under the guidance of Mr. S. Akash Karthik . B.E., from Dec 2007 to Jun 2008. During the project, he has successfully covered all the areas required for his project.

For Pongi Systems Pvt. Ltd.

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ABSTRACT

This project **"A Robust Single Sign-On Model based on Multi-Agent System and PKI"** is to propose a novel Single Sign-On (SSO) approach based on Multi-Agent System (MAS) and Public Key Infrastructure (PKI) authentication scheme. This allows the model to benefit from key advantages of the two schemes, i.e. the capacity of the multi-agent technique and the strength of PKI.

In addition we also deal with the issue of agent service disruption and recovery as well as real-time client privilege management. We apply MAS concept to facilitate multi-application authentication and authorization process for multiple concurrent users. Depending on the type, an agent servers such various functions as client certificate validation, authorization check, access grating, administration, application delegation scheduling. PKI is employed to create trust among agents.

The multi-agent (MAS) is a technique in the artificial intelligence area focusing on the system where several agents communication with each other. Multi-agent system is defined as "a loosely coupled network of problem-solver entities that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity". Technically, we apply MAS concept as a mediator to perform the authentication control of the relying entities having certificate; verify the user role and grant the permission to the legal applications; schedule client requests and allocate the application services to multi users autonomously and dynamically; support the recovery of application agent making the use of application robust. Besides, we also point out some implementation issues related to the real world application and current status of our ongoing implementation. Finally, we outline some promising idea for extending the capability of our system model, in the future work section.

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First and foremost I thank God for his good will and blessings showered on me throughout the project. The success of this project needs cooperation and encouragement from different quarters. Words are inadequate to express my profound and deep sense of gratitude to those who helped me in bringing out this project successfully.

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LIST OF ABBREVIATIONS

Acronyms	**Full Form**
SSO	Single Sign On
PKI	Public Key Infrastructure
MAS	Multi Agent System
HTML	HyperText Markup Language
XML	eXtensible Markup Language
ADO	ActiveX Data Object
ASP	Active Server Pages

CHAPTER 1

INTRODUCTION

1.1 ORGANIZATION PROFILE

"Pongi Techno Solutions" is a software development firm providing technology solutions to a diverse customer. PTS an organization committed to share knowledge and provide quality in its core competencies and in a way nurture talent for the future endeavors. We believe that we would be able to offer a great support for Customers through our time tested and mature processes and proven global delivery model.

Dedicated to the planning, design and development of world-class software products. We combine a proven business model with some of the industry's top talent to provide our clients with the best services and products possible.

ABOUT THE PEOPLE

As a team has prowess to have a clear vision and realize it too. As a statistical evaluation, the team PTS has more than 150,000 hours of expertise in providing real-time solutions in the fields of **Embedded systems, Smartcards, RFID, Biometrics, GPRS, Networking, C++/VC++, VB.net, ASP.net Client Server Technologies with Java/J2EE/J2ME, LINUX.**

Team PTS always has one fundamental aspect clear in mind and it's about change, information age has one thing to remain for sure i.e. change and PTS is a full-blooded info-age complaint organization. We have a competitive edge with which it would put its best foot forward in order to create a win situation for anybody who is associated with PTS one way or another.

NETWORKING AND COMMUNICATION ARCHITECTURE

Our goal is to:

- Combine knowledge, technology and innovation to develop cost-effective solutions
- Conduct business in a way that mutually benefits both customers and employees
- Adhere to exemplary moral standards in all relationship

OUR VISION

"Dreaming a vision is possible and realizing it is our goal."

OUR MISSION

Our mission is to partner with our customers, help them manage change and drive significant improvement in their business processes through the effective use of technology.

IT INFRASTRUCTURE CONSULTING

PTS assists with the design, selection and implementation the IT infrastructure that guarantees required performance, security, availability and scalability.

The consulting process can include:

- High Level Design, Prototyping and Implementation
- Server Architecture and Clustering Service
- Selection of Hardware and Software Server Platforms, DBMS Servers and Remote Communication Platforms
- Messaging Strategies

CHAPTER 2

SYSTEM STUDY AND ANALYSIS

2.1 PROBLEM DEFINITION

The Single Sign-On concept has been now adopted to supply the security system to be more feasible and efficient for managing the exposure of number of users in distributed system environment. Apparently, PKI is recognized as a powerful technique to satisfy the security services including confidentiality, authentication, integrity, and non-repudiation. The PKI is thus mostly adopted as a trust model for embedding in messaging environment.

The multi-agent (MAS) is a technique in the artificial intelligence area focusing on the system where several agents communication with each other. Multi-agent system is defined as "a loosely coupled network of problem-solver entities that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity". Technically, we apply MAS concept as a mediator to perform the authentication control of the relying entities having certificate; verify the user role and grant the permission to the legal applications; schedule client requests and allocate the application services to multi users autonomously and dynamically; support the recovery of application agent making the use of application robust. Besides, we also point out some implementation issues related to the real world application and current status of our ongoing implementation. Finally, we outline some promising idea for extending the capability of our system model, in the future work section.

2.2 EXISTING SYSTEM:

In distributed system, there could be several applications to support a variety of business purpose as demanded. In such environment, a security, non-repudiation and authentication technique is critically required. The encryption and password authentication are a common technique used by most application. However, the security level of the information and application depends on the value in the business context.

2.3 PROPOSED SYSTEM:

The multi-agent (MAS) is a technique in the artificial intelligence area focusing on the system where several agents communication with each other. Multi-agent system is defined as "a loosely coupled network of problem-solver entities that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity". Technically, we apply MAS concept as a mediator to perform the authentication control of the relying entities having certificate; verify the user role and grant the permission to the legal applications; schedule client requests and allocate the application services to multi users autonomously and dynamically; support the recovery of application agent making the use of application robust. Besides. we also point out some implementation issues related to the real world application and current status of our ongoing implementation. Finally, we outline some promising idea for extending the capability of our system model, in the future work section.

The contributions of the paper are:

- A strong authentication mechanism based on PKI and two-factor authentication;
- An application of MAS on SSO
- A capability of multi-user and multi-application authentication with high robustness;
- A PKI-enabled trusted agent cooperation;
- A practical, flexible, robust model for administration, parallel computation and resource allocation.

2.4 SYSTEM ANALYSIS

REQUIREMENTS SPECIFICATION

This phase is the process of gathering information. When the requirements are fully completed, one proceeds to design.

DESIGN

Design should be a plan for implementing the requirements given. When the design is fully completed, an implementation of that design is made by coders.

IMPLEMENTATION

Implementation means the process of converting a new or a revised system design into an operational one. It is the most crucial stage in achieving a new successful system and in giving confidence on the new system for the users that it will work efficiently and effectively. In this phase, we can build the components either from scratch or by composition. Given the architecture document from the design phase and requirement document from the analysis phase, we can build exactly what has been requested.

VERIFICATION

Verification refers to the set of activities that ensure that system correctly implements a specific function. Validation refers to a different set of activities that ensure that the system that has been built is traceable to customer requirements. Verification and validation encompass a wide array of software quality assurance (SQA) activities that include formal reviews, quality and configuration audits, performance monitoring, simulation, feasibility study, documentation review, database review, algorithm analysis, development testing, qualification testing and installation testing.

MAINTENANCE

Maintenance is the process of maintaining our software in future if any malfunction occurs.

2.5 FEASIBILITY ANALYSIS

Feasibility analysis is the measure of how beneficial or practical the development of the System will be to the project. Once the problem is explained information is gathered about the system to test whether the system is viable Technically, Financially and Operationally. feasibility analysis consists of

- Detailed definition of tasks
- Definition of current and future system environments
- Determination of critical success efforts
- Analysis and selection of system components to be migrated
- Analysis of technical and economical feasibility
- Resource planning and project duration
- Hardware and software recommendations.

Thus, feasibility study is carried out in three phases as follows:

2.5.1 TECHNICAL FEASIBILITY

Technical Feasibility is the measure of practicality of a specific technical solution and the availability of technical resources and expertise. It centers on the existing computer system (hardware, software, etc.) and to what extent it can support the new addition. This involves financial consideration to accommodate technical enhancement.

The proposed system is to be developed using VB.net 2005 which is one of the leading technologies in the market. These technological resources are easily available and the company/project does not need to acquire any development licenses. Visual studio .NET 2005 is already available with the company and individual persons. These technologies work well on Microsoft platforms. At present, the system will work in an intranet environment. Future expansion is planned but will not affect this project.

2.5.2 OPERATIONAL FEASIBILITY

Operational Feasibility asks if the system will work when it is developed and installed. It checks for the support of the management, the current business methods, user's involvement and their attitude towards the proposed system, etc.

The proposed system has found encouraging support from the software backup users, the data collector's management as it will be of great use to them. The backup users and data collectors of the project are also committed to have the system operational as it will save time and reduce their workload. Also since the software backup users leads and data collectors can have easy access to data information, recover the data. The current processes followed in the project would be depicted in the system as it is.

2.5.3 ECONOMIC FEASIBILITY

Economic Feasibility is the measure of the cost-effectiveness of the proposed system. The investment to be made in the proposed system must prove a good investment to the project by returning benefits equal to or exceeding the costs incurred in developing the system.

The proposed benefits of the system will outweigh the costs to be incurred during system developed since the system does not require procurement of additional hardware facilities it is economically feasible. It uses VB.Net 2005 for its development. So it's found that the benefits outweigh costs. In addition capability of the system to incorporate future enhancement will improve the performance to suit the future need of the company/project.

2.6 USERS OF THE SYSTEM

The users of the proposed Business Resource & Workflow Management System have been categorized as below and each of the user categories will have a set of rights which manage their use of the proposed system.

- Software backup users
- Data Users

CHAPTER 3

DEVELOPMENT ENVIRONMENT

3.1 HARDWARE REQUIREMENTS:

Processor	: Intel Pentium IV
Memory	: 120 MB
Speed	: 550 MHZ
Floppy Drive	: 1.44 MB
Monitor	: 256 MB
Keyboard	: 104 Keys
Mouse	: Logitech
Printer	: Laser

3.2 SOFTWARE REQUIREMENTS:

Front End	: ASP.NET
Back End	: SQL Server 2000
Operating System	: Windows 98/XP/2000
Web Server	: Personal Web Server/ Internet Information Server
Web Browser	: Internet Explorer

3.3 PROGRAMMING ENVIRONMENT

3.3.1 THE VISUAL BASIC .NET

The .NET Framework is a new computing platform that simplifies application development in the highly distributed environment of the Internet.

The .NET Framework is designed to fulfill the following objectives:

- To provide a consistent object-oriented programming environment whether object code is stored and executed locally, executed locally but Internet-distributed, or executed remotely.
- To provide a code-execution environment that minimizes software deployment and versioning conflicts.
- To provide a code-execution environment that guarantees safe execution of code, including code created by an unknown or semi-trusted third party.
- To provide a code-execution environment that eliminates the performance problems of scripted or interpreted environments.
- To make the developer experience consistent across widely varying types of applications, such as Windows-based applications and Web-based applications.
- To build all communication on industry standards to ensure that code based on the .NET Framework can integrate with any other code.

The .NET Framework has two main components:

- Common Language Runtime
- .NET Framework Class Library

COMMON LANGUAGE RUNTIME

The common language runtime is the foundation of the .NET Framework. It provides a code-execution environment that manages code targeting the .NET Framework. Code management can take the form of memory management, thread management, security management, code verification and compilation and other system services. It also enforce strict type safety and other forms of code accuracy that ensure security and robustness. In fact, the concept of code management is a fundamental principle of the runtime. Code that targets the runtime is known as managed code, while code that does not target the runtime is known as unmanaged code. The class library, the other main component of the .NET Framework, is a comprehensive, object-oriented collection of reusable types that you can use to develop applications ranging from traditional command-line or graphical user interface (GUI) applications to applications based on the latest innovations provided by ASP.NET, such as Web Forms and XML Web services.

The .NET Framework can be hosted by unmanaged components that load the common language runtime into their processes and initiate the execution of managed code, thereby creating a software environment that can exploit both managed and unmanaged features. The .NET Framework not only provides several runtime hosts, but also supports the development of third-party runtime hosts.

For example, ASP.NET hosts the runtime to provide a scalable, server-side environment for managed code. ASP.NET works directly with the runtime to enable Web Forms applications and XML Web services. The runtime is designed to enhance performance. Although the common language runtime provides many standard runtime services, managed code is never interpreted. A feature called just-in-time (JIT) compiling enables all managed code to run in the native machine language of the system on which it is executing. Meanwhile, the memory manager removes the possibilities of fragmented memory and increases memory locality-of-reference to further increase performance.

.NET FRAMEWORK CLASS LIBRARY

The .NET Framework class library is a collection of reusable types that tightly integrate with the common language runtime. The class library is object oriented, providing types from which your own managed code can derive functionality. This not only makes the .NET Framework types easy to use, but also reduces the time associated with learning new features of the .NET Framework. In addition, third-party components can integrate seamlessly with classes in the .NET Framework.

For example, the .NET Framework collection classes implement a set of interfaces that you can use to develop your own collection classes. Your collection classes will blend seamlessly with the classes in the .NET Framework.

The .NET Framework types enable us to accomplish a range of common programming tasks, including tasks such as string management, data collection, database connectivity, and file access. In addition to these common tasks, the class library includes types that support a variety of specialized development scenarios.

For example, we can use the .NET Framework to develop the following types of applications and services:

- Console applications.
- Scripted or hosted applications.
- Windows GUI applications (Windows Forms).
- ASP.NET applications.
- XML Web services.
- Windows services.

INTRODUCTION TO ASP.NET

Visual Studio .NET allows you to create applications that leverage the power of the World Wide Web. This includes everything from a traditional Web site that serves HTML pages, to fully featured business applications that run on an intranet or the Internet, to sophisticated business-to-business applications providing Web-based components that can exchange data using XML.

A Visual Studio Web application is built around ASP.NET. ASP.NET is a platform including design-time objects and controls and a run-time execution context for developing and running applications on a Web server.

ASP.NET in turn is part of the .NET Framework, so that it provides access to all of the features of that framework. For example, you can create ASP.NET Web applications using any .NET programming language (Visual Basic, C#, Managed Extensions for C++, and many others) and .NET debugging facilities. You access data using ADO.NET. Similarly, you can access operating system services using .NET Framework classes, and so on.

WEB SERVER CONTROLS

Web server controls are a second set of controls designed with a different emphasis. They do not map one-to-one to HTML server controls. Instead, they are defined, as abstract controls in which the actual HTML rendered by the control can be quite different from the model that you program against. For example, a RadioButtonList Web server control might be rendered in a table or as inline text with other HTML.

Web server controls include traditional form controls such as buttons and text boxes as well as complex controls such as tables. They also include controls that provide commonly used form functionality such as displaying data in a grid, choosing dates, and so on.

3.3.2 MS-SQL SERVER 2000

The RDBMS concept is gaining momentum all over the world. Microsoft SQL Server is a RDBMS for Windows, released in USA by the Microsoft Corporation.

Since processing calls for extensive data input and processing, retrieval of required information must be quick and efficient. SQL Server supports the event-driven nature of the windows environment and has many event trapping features like on click, on open, on Dbl click, Before Update, After Update etc.

Event procedures are coded and tagged to those events according to the necessity of the application. These procedures are run at those particular events and thus the whole coding is based on event-driven methodology. The forms of SQL Server help; to create Tables, Screen Queries aid in creation-complicated queries and generation informative reports is made an easy task.

SQL Server stores records in organized lists called tables. One or more tables in SQL Server make up a whole database. A table is just a collection If records with the same structure. All of the records in the table contain the same type of information. SQL Server allows setting up tables and like them to other tables.

Microsoft SQL Server is relational database. This means that the data in several tables is linked through one or more fields present in the tables. It's this business of linked tables that separates database programs like SQL Server from the other types of database, a flat file database which allows only single table in which to store all information.

The OLAP Services feature available in SQL Server version 2000 is now called SQL Server 2000 Analysis Services. The term OLAP Services has been replaced with the term Analysis Services. Analysis Services also includes a new data-mining component. The Repository component available in SQL Server version 2000 is now called Microsoft

SQL Server 2000 Meta Data Services. References to the component now use the term Meta Data Services. The term repository is used only in reference to the repository engine within Meta Data Services.

Microsoft SQL Server 2000 is a set of components that work together to meet the data storage and analysis needs of the largest Web sites and enterprise data processing systems. The topics in SQL Server Architecture describe how the various components work together to manage data effectively.

A database typically has two main parts: first, the files holding the physical database and second, the database management system (DBMS) software that applications use to access data.

The DBMS is responsible for enforcing the database structure, including:

- Maintaining relationships between data in the database.
- Ensuring that data is stored correctly, and that the rules defining data relationships are not violated.
- Recovering all data to a point of known consistency in case of system failures.

SQL Server 2000 is designed to support the traffic of the largest Web sites or enterprise data processing systems. Instances of SQL Server 2000 running on large, multiprocessor servers are capable of supporting connections to thousands of users at the same time. The data in SQL Server tables can be partitioned across multiple servers, so that several multiprocessor computers can cooperate to support the database processing requirements of extremely large systems. These groups of database servers are called federations.

CHAPTER 4

SYSTEM DESIGN AND DEVELOPMENT

4.1 ELEMENTS OF DESIGN

System Design is the most creative and challenging phase in the development of a software system. Design implies to a description of the final system and the process by which it is developed. The first step is to determine what input data is needed for the system and then to design a database that will meet the requirements of the proposed system. The next step is to determine what outputs are needed from the system and the format of the output to be produced.

During the design of the proposed system some areas where attention is required are:

- What are the inputs required and the outputs produced?
- How should the data be organized?
- What will be the processes involved in the system?
- How should the screen look?

The steps carried out in the design phase are as follows:

- Modular Design
- Input Design
- Output Design
- Database Design

4.1.1 MODULAR DESIGN

It is always difficult for any System Development team to grasp a system without breaking it into several subsystems/modules. These subsystems/modules will be a part of the original system, yet they will be independent in the sense that they will incorporate within them the major functionalities of the proposed system.

A software system is always divided into several subsystems and modules which make it easier to develop and perform tests on the whole system. The subsystems are also known as the modules and the process of dividing an entire system into subsystems/modules is known as Decomposition.

4.2 DIAGRAMS

4.2.1 DATA FLOW DIAGRAM (DFD)

A data flow diagram is graphical tool used to describe and analyze movement of data through a system. These are the central tool and the basis from which the other components are developed.

The transformation of data from input to output, through processed, may be described logically and independently of physical components associated with the system. These are known as the logical data flow diagrams.

The physical data flow diagrams show the actual implements and movement of data between people, departments and workstations. A full description of a system actually consists of a set of data flow diagrams.

DATA FLOW DIAGRAM 1: OVERVIEW OF SSO

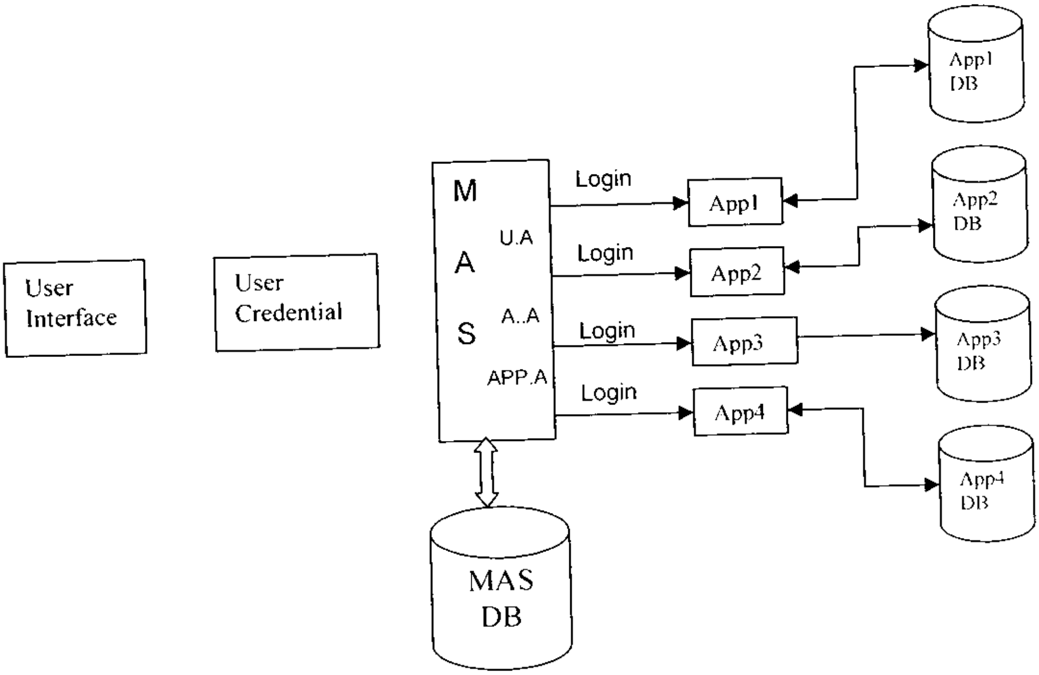


Figure 4.2.1.1 : Over View SSO

DATA FLOW DIAGRAM 2: ADMIN AGENT

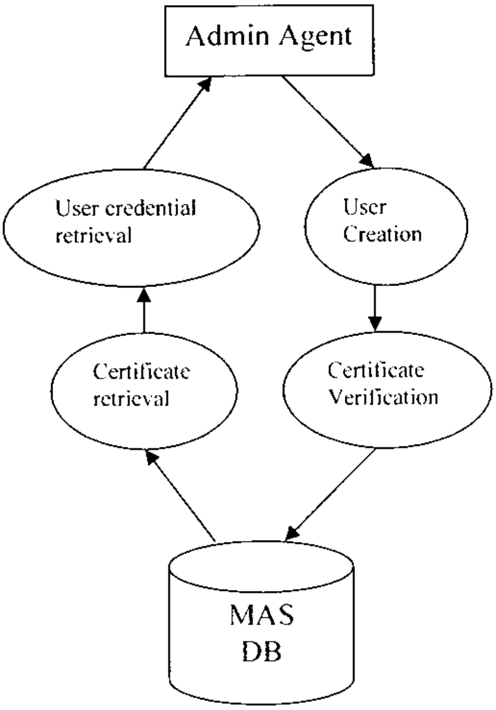


Figure 4.2.1.2 : Admin Agent

DATA FLOW DIAGRAM 3: MAS AGENT

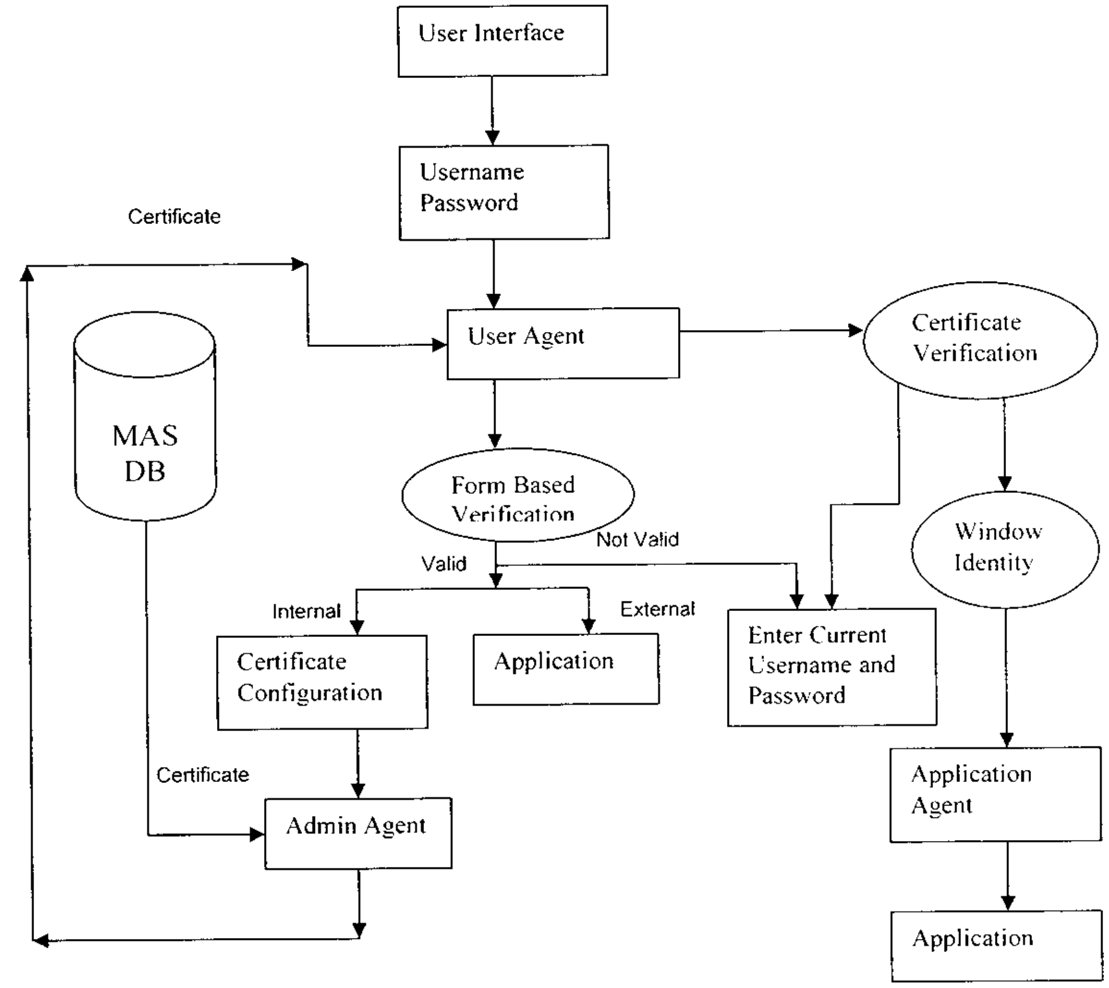


Figure 4.2.1.3 : Mas Agent

DATA FLOW DIAGRAM 4: APPLICATION AGENT

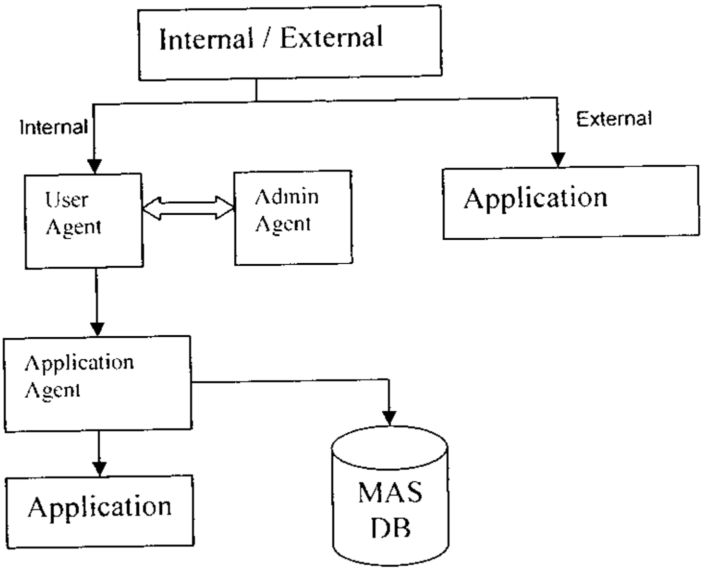


Figure 4.2.1.4 : Application Agent

DATA FLOW DIAGRAM 4: USER AGENT

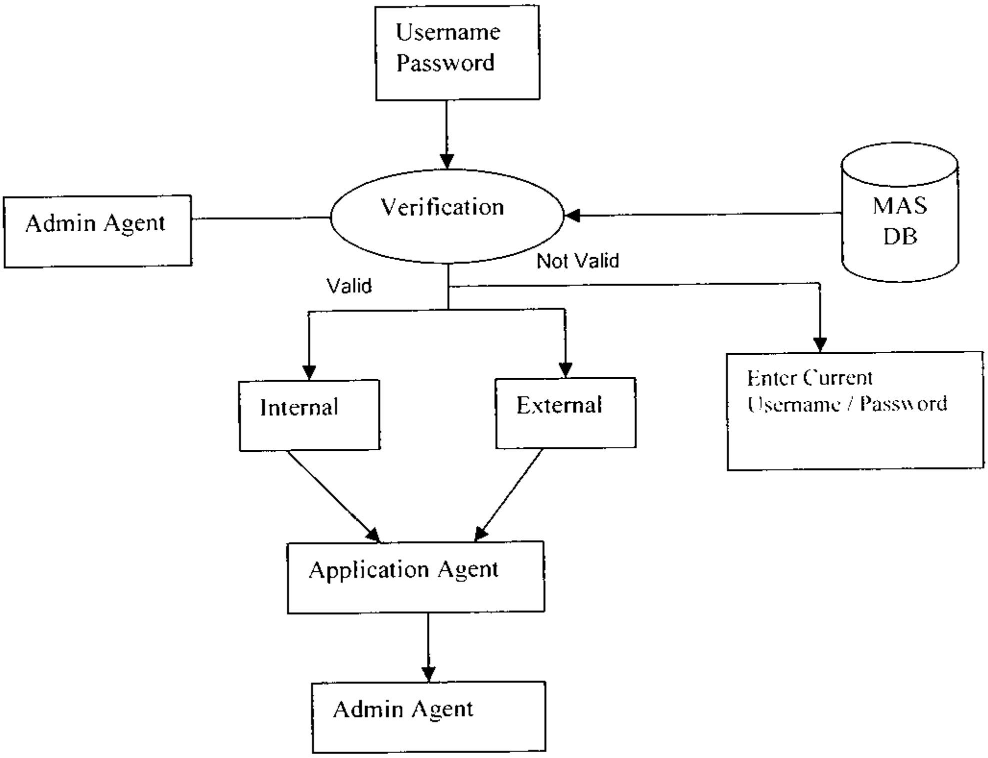


Figure 4.2.1.5 : User Agent

4.3 SYSTEM DESIGN

4.3.1 DETAILED DESIGN

Following is the detailed designed description of the modules that form the project. The modules in this project are

- Authentication
- Verification
- Admin Agent
- User Agent
- Application Agent

The **Authentication module**, Client is generally a user who requests to use application(s). In our system, the users need to authenticate themselves by using the certificate securely stored in a smart card or a token for two factor authentication before accessing the application(s). In addition. the single sign-on is required in this process so that the users can access several applications without necessity to be authenticated by each system individually.

The **Verification module** is used to verify the user role and grant the permission to the legal applications. This is designed by using RSA Algorithm in which private and public keys are generated. And also the Hash Key which has 16 bits is generated.

The following three modules are Application Server where the entire application information and database lies.

Admin Agent (AM) represents administrator to manage other agents in real-time fashion e.g. updates the user capability information to the agents. kill a suspicious UA.A unique key pair and certificate are issued to an AM.

User Agent (UA) is responsible for validating client certificates, verifying client requests, and delegating corresponding application(s) to the client. Each UA will be dead after a complete logout, or after certain idle period, which is the SSO session time out value.

Application Agent (AA) is mapped to a particular application and functions as the representative of an application in serving requests from UA's. Its job is to schedule the sequence of client connecting to applications, to support the multiple application selection by clients, and to log on to the application on behind of the user. Each AA has its own key pair and certificate.

4.3.2 DATABASE DESIGN

A database is a collection of inter-related data stored with minimum redundancy to serve many users quickly and efficiently. The general objective of database design is to make the data access easy, inexpensive and flexible to the user. An elegantly designed database can play a strong foundation for the whole system.

The details about the relevant data for the system are first identified. According to their relationship, tables are designed through the following method

4.3.3 TABLE STRUCTURE

DESIGN CONVENTIONS USED

1. Appropriate words that describe the table should be used.
2. Words used to describe the table should be separated with an Underscore '_'.
3. No special character other than an underscore is used in formulating a table name.
4. No number should be used anywhere in the table name string.

TABLES:

BPO TABLE:

Table Name: Bpo Admin

Field Name	Data Type	Size
Sno	numeric	9
Pages	nvarchar	50

Table 4.3.3.1Bpo Admin

Table Name: BpoReg

Field Name	Data Type	Size
Uname	nvarchar	50
Fname	nvarchar	50
Xthno	nvarchar	50
Dob	nvarchar	30
Eid	nvarchar	50

Table 4.3.3.2 Bpo Reg

Table Name: BpoLogin

Field Name	Data Type	Size
Uid	numeric	9
Uname	nvarchar	50
Pass	nvarchar	50
Grade	nvarchar	50

Table 4.3.3.3 Bpo Login

MOBILE

Table Name: Mobile Admin

Field Name	Data Type	Size
Sno	numeric	9
Pages	nvarchar	50

Table 4.3.3.4 Mobile Admin

Table Name: MobileImg

Field Name	Data Type	Size
Sno	numeric	9
Design	nvarchar	50
Price	numeric	9
Modal	nvarchar	30

Table 4.3.3.5 Mobile Img

Table Name: MobileUser

Field Name	Data Type	Size
Sno	numeric	9
Pages	nvarchar	50

Table 4.3.3.6 Mobile User

MOTOR

Table Name: Motor Admin

Field Name	Data Type	Size
Sno	numeric	9
Pages	nvarchar	50

Table 4.3.3.7 Motor Admin

Table Name: MotorImg

Field Name	Data Type	Size
Sno	numeric	9
Design	nvarchar	50
Price	numeric	9
Modal	nvarchar	30

Table 4.3.3.8 Motor Img

Table Name: MotorsWebsite

Field Name	Data Type	Size
Sno	numeric	9
Website	nvarchar	50

Table 4.3.3.9 Motor Website

SOFT

Table Name: Soft Admin

Field Name	Data Type	Size
Sno	numeric	9
Pages	nvarchar	50

Table 4.3.3.10 Soft Admin

Table Name: Soft Website

Field Name	Data Type	Size
Sno	numeric	9
Website	nvarchar	50

Table 4.3.3.11 Soft Website

Table Name: TOKEN

Field Name	Data Type	Size
Sno	numeric	9
Status	nvarchar	50
Tokenid	numeric	9

Table 4.3.3.12 Token

Table Name: WORKER DETAILS

Field Name	Data Type	Size
Id	nvarchar	50
Name	nvarchar	50
Category	nvarchar	30
Salary	numeric	10
Cmpy	nvarchar	50

Table 4.3.3.13 Worker Details

CHAPTER 5

SYSTEM TESTING AND IMPLEMENTATION

System Implementation is the part of the software engineering life cycle, where, the design artifacts are converted to a working application. Coding is done in this stage using an apt framework and programming language, which would solve the specific problem the best way. Once the design is coded into a working application, it has to be verified, validated and tested in detail. The tested product if successful is deployed in the user environment.

5.1 SYSTEM VERIFICATION

System Verification answers the question "Am I building the product right?" It includes the review of interim work steps and interim deliverables during a project to ensure they are acceptable. Verification also determines if the system is consistent, adheres to standards, uses reliable techniques and prudent practices, and performs the selected functions in the correct manner. In data access, it verifies whether the right data is being accessed, in terms of the right place and in the right way.

5.2 SYSTEM VALIDATION

Validation answers the question "Am I building the right product?" This checks whether the developer is moving towards the right product, whether the development is moving towards the actual intended product that was agreed upon in the beginning. Validation also determines if the system complies with the requirements and performs functions for which it is intended and meets the organization's goals and user needs. It is traditional and is performed at the end of the project. In data access, it checks whether we are accessing the right data, in terms of data required to satisfy the requirement.

5.3 TESTING

This testing strategy examines the logic of the program. The system is tested; and all the functions are performed smoothly without any errors. By taking various kinds of test data, above testing was performed. Preparation of test data plays a vital role in the system testing. After preparing the test-data, the system under study is tested using test data. While testing the system by using test-data, errors are again uncovered and corrected by using above testing steps and corrections are noted for the future use.

The main types of tests carried out on Disk Management System are:

- System Test
- Unit Test
- Integration Test

5.3.1 SYSTEM TESTING

The aim of any software development is to create a bug - free, reliable and secure system that provides solutions to users specified requirements. To ensure this, a systematic test plan is mandatory. A test strategy exhaustively covers the objects, scope, staffing resources and documentation.

After the completion of the coding of the project, the developed system was tested on real–time data to check the accuracy of the data manipulations and their associated calculations.

The programs were tested with sample data supplied by the user and necessary corrections to the programs were carried out if any errors were found. All the reports are to be checked and approved by the user.

The system is very user - friendly with display and messages to assist the user wherever necessary. The users are trained to handle the system more effectively. The operational manuals supplied along with the computer system by the manufacturers are to be referred to by the user as and when he needs it.

Systematic testing involves taking the design document and creating a test plan turning its functionality descriptions into functionality tests. Every item in the design document exercised thoroughly to ensure that it works correctly. Ideally, the test plan would be created at the same time as the design documentation.

A programmer, a user or anyone else can execute the test plan. All that's required is following the plan closely, doing what it says, and ensuring that the results are as expected.

A serious of testing is performed for the proposed system before the proposed system is ready for user acceptance testing.

Black box testing treats the software as a black-box without any understanding of internal behavior. It aims to test the functionality according to the requirements. Thus, the tester inputs data and only sees the output from the test object.

White box testing, however, is when the tester has access to the internal data structures, code, and algorithms. White box testing methods include creating tests to satisfy some code coverage criteria.

ID:

All the ids are automatically generated to avoid unnecessary checking.

Numeric Field

The numeric fields must not contain any alphabets or special characters. This validation is checked.

Character Field

The character field must not contain any special characters. This validation is checked

5.3.2 UNIT TESTING

Unit testing focuses verification efforts on the smallest unit of the software design of the module. This is known as module testing. This is carried out during the programming stage itself. In this step, each module is found to be working satisfactorily as regards to the expected output from the module.

Test 1:

Procedure

The mandatory fields have to be filled before proceeding to next process.

Solution

The alert message has to be displayed to fill the mandatory details.

Test 2:

Procedure

The update process involves adding mobile detail, motor detail and the payment detail involving various operations.

Solution

This problem is solved by using session tracking.

Test 3:

Procedure

When a updating is in progress and if a user tries to create a new process.

Solution

The prompt is made that the updating progress and want to continue with the current process or the previous one.

5.3.3 INTEGRATOIN TESTING

After performing the validation, testing the next step is output testing of the proposed system. Since no system could be useful if it does not produce the required output in specific format. The output formation on the screen was found as correct to the format that was designed during the system design time according to the user needs. For the hard copy also, the output comes as the specified requirements by the user

Module or Unit Testing is the process of testing all the program units that make up a system. Unit testing focuses on an individual module thus allowing one to uncover all the errors made logically and while coding in the module.

In Single Sign Models each page is tested separately as a unit. Initially the flow of control and data through that page is checked. When considering a module as a unit, the flow of data and control through the whole module is tested. The result is stored in the test plan. In a page, each control is further tested in unit testing. The process is done in all the pages of the system. Once the errors are rectified, the testing procedure is repeated with same test cases to ensure this hasn't produced new errors. Hence this is a continuous process.

5.4 IMPLEMENTATION

Implementation is the process of having system personnel checks out and put the new system and required equipment into use, training the users to use the new application and construct any file of data needed.

Depending on the size of the organization this will involved using the application and depending upon the risk associated with its use, system developers may choose to pilot the operation in only one area of the firm.

Sometimes they'll run the old and new systems together to compare the system and begin using the new one when proved to be better than the old system. Once installed, both organization and the users will change and the environment will be different over months or years.

A Robust Single Sign-On Model based on Multi-Agent System and PKI is a flexible and maintenance system. It is easy to modify or expand a part. Since it is implemented in a well-known format.

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

6.1 CONCLUSION

In this project "A ROBUST SINGLE SIGN-ON MODEL BASED ON MULTI-AGENT SYSTEM AND PKI" we have presented the idea and implementation of how to apply MAS technique to enable the Single Sign-On service in the multi-user and multi-application environment. The design of user agent and application agent is introduced to perform the client authentication and multi-application delegation. The combination of two-factor authentication, PKI, and MAS are adopted to reflect the real need of current distributed applications. Therefore, user convenience is greatly increased by our system. Also the administrator can benefit from the low management cost since the security and authentication policies are centrally managed. Moreover the user privileges can be updated in real-time manner. We also propose the solution to ensure the availability of applications.

6.2 FUTURE ENHANCEMENT

The following features listed below if introduced could benefit the users of the system.

- Add additional network support for servers with a shared-level access. When browsing the network tree, program will now always try to connect to the selected server or network drive
- Add additional languages to support all languages
- We can also lend the program to others

APPENDICES

SINGLE SIGN –ON MODEL

Home Page

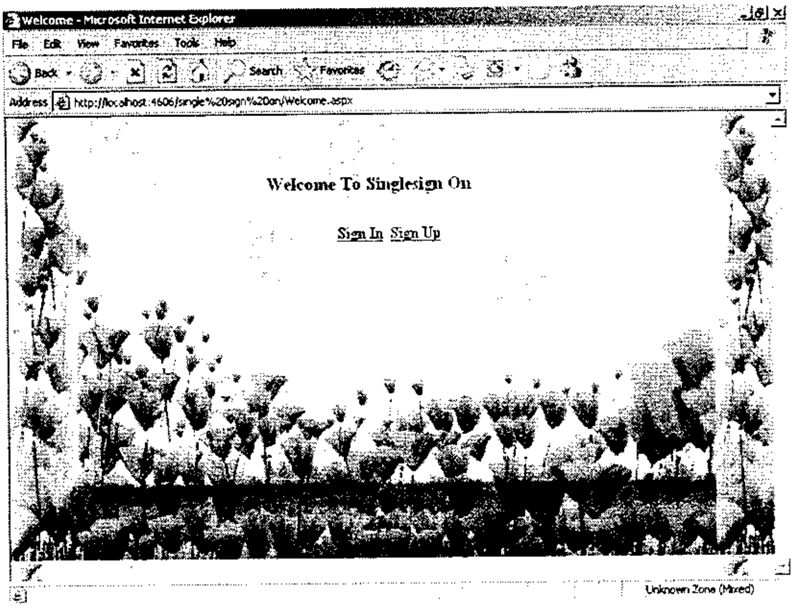

Welcome - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost:4606/single%20sign%20on/Welcome.aspx
Welcome To Singlesign On
Sign In Sign Up
Unknown Zone (Mixed)

Figure 7.1 Home

Sign up

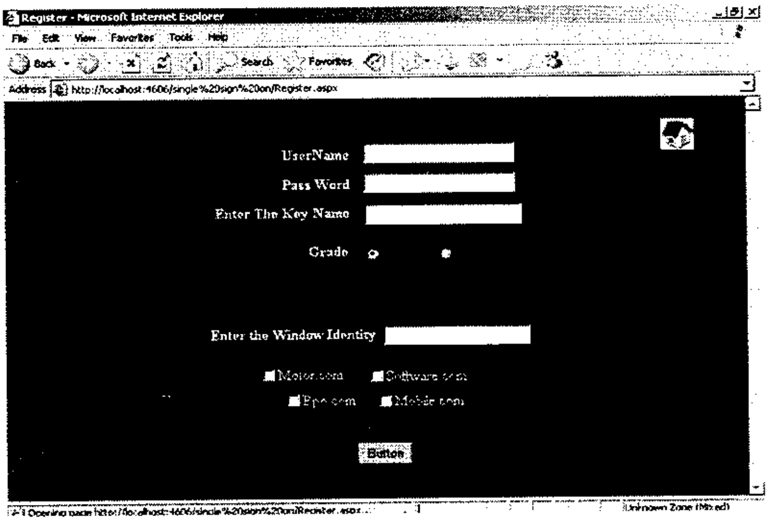
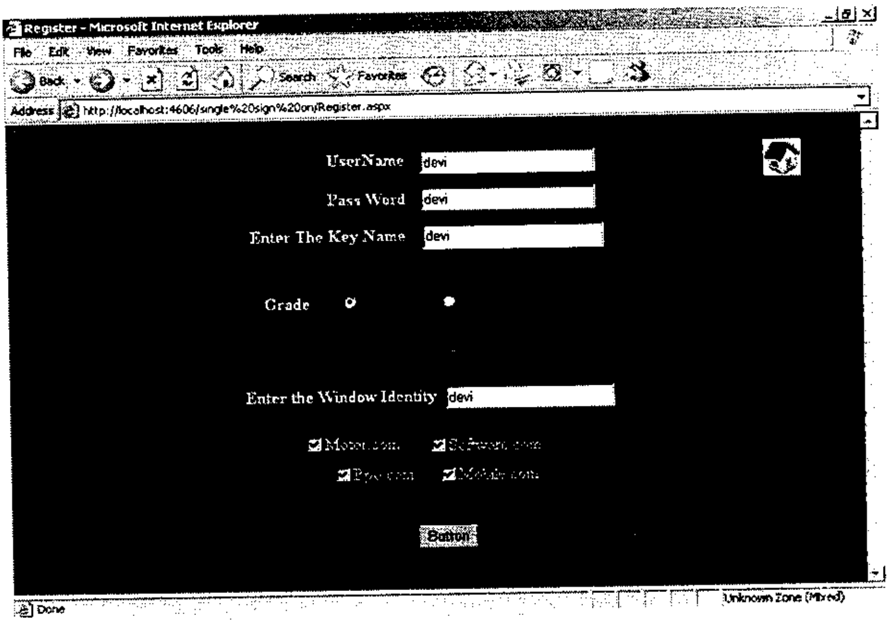

Register - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost:4606/single%20sign%20on/Register.aspx
UserName
Pass Word
Enter The Key Name
Grade ○ ●
Enter the Window Identity
■Motor.com ■Software.com
■Epo.com ■Mobile.com
Button
Opening page http://localhost:4606/single%20sign%20on/Register.aspx...
Unknown Zone (Mixed)

Figure 7.2 Sign Up

Key Name


Register - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost:4606/single%20sign%20on/Register.aspx
Done
Unknown Zone (Mixed)

UserName devi

Pass Word devi

Enter The Key Name devi

Grade ○ ●

Enter the Window Identity devi

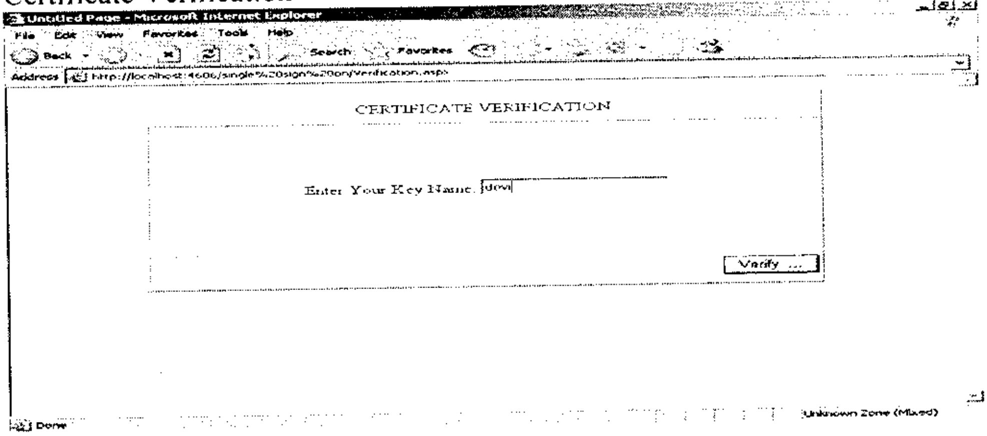
☑ Moter.com ☑ Software.com

☑ Ppo.com ☑ Mobile.com

Button

Figure 7.3 Key Name

Certificate Verification


Untitled Page - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost:4606/single%20sign%20on/Verification.aspx
Done
Unknown Zone (Mixed)

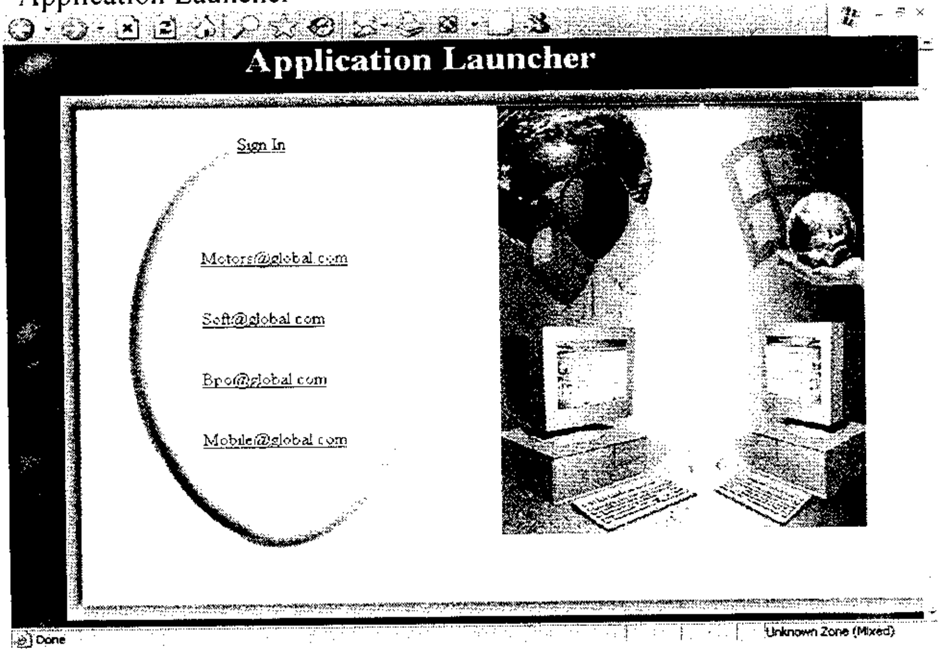
CERTIFICATE VERIFICATION

Enter Your Key Name: devi

Verify ...

Figure 7.4 Key Verification

Application Launcher



Application Launcher

Sign In

Motors@global.com

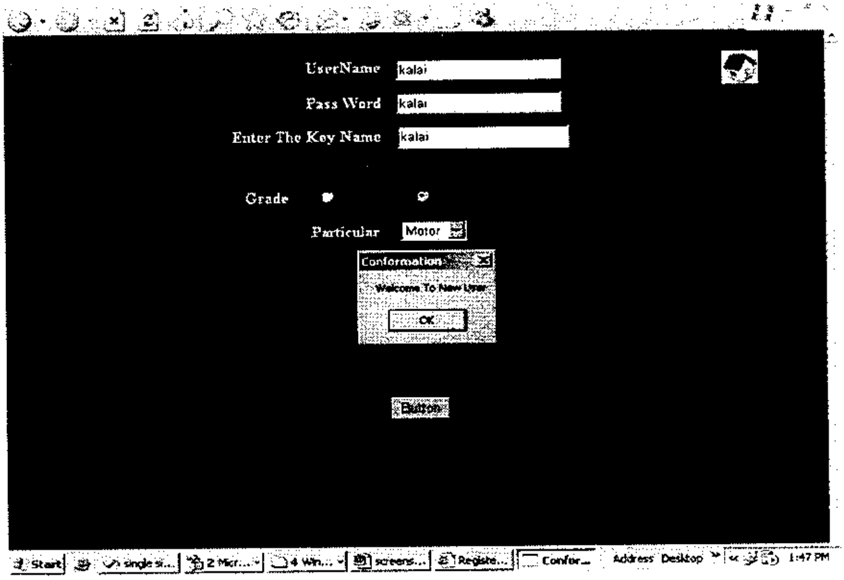
Soft@global.com

Bpo@global.com

Mobile@global.com

Figure 7.5 Application Launcher

New User



UserName kalai

Pass Word kalai

Enter The Key Name kalai

Grade ● ○

Particular Motor

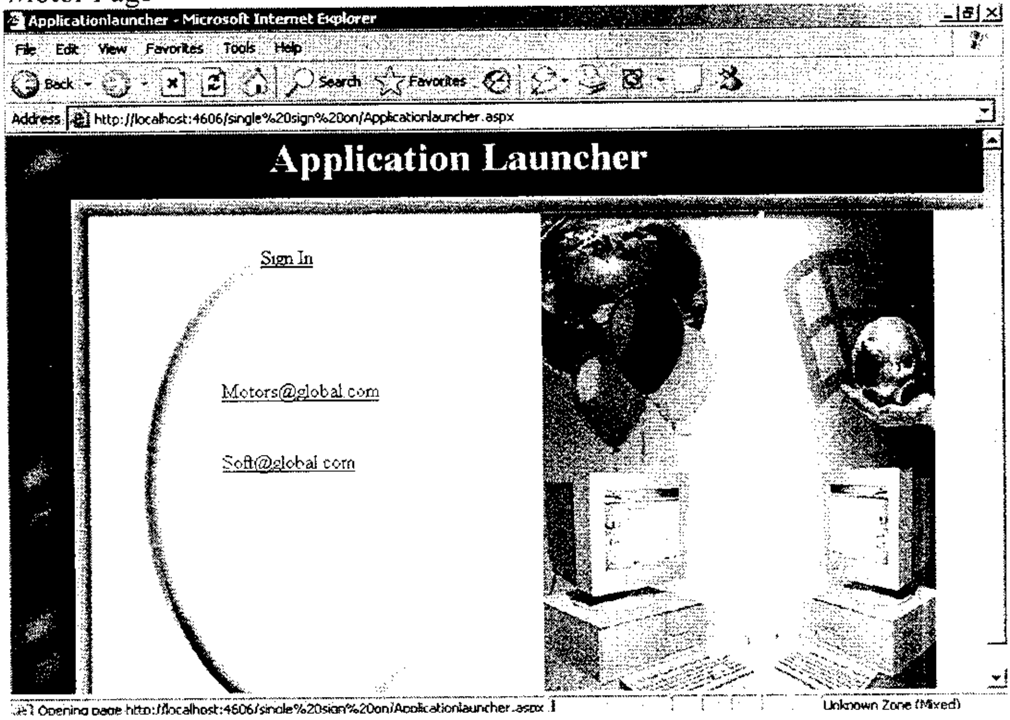
Conformation

Welcome To New User

OK

Figure 7.6 New User

Motor Page


Applicationlauncher - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address

http://localhost:4606/single%20sign%20on/Applicationlauncher.aspx

Application Launcher

Sign In

Motors@global.com

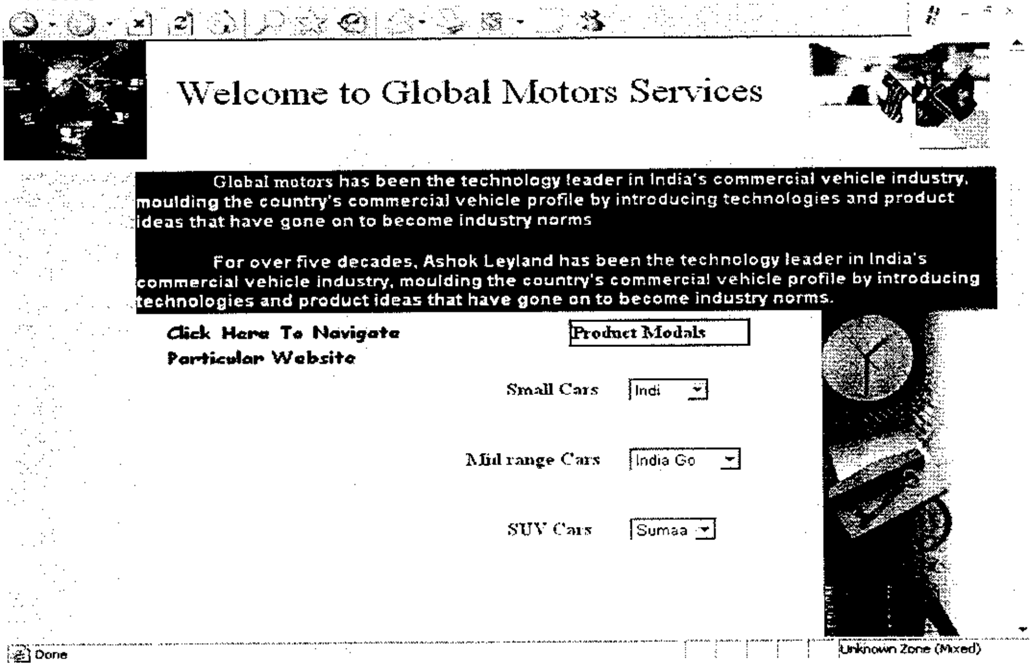
Soft@global.com

Opening page http://localhost:4606/single%20sign%20on/Applicationlauncher.aspx

Unknown Zone (Mixed)

Figure 7.7

Welcome Motor



Welcome to Global Motors Services

Global motors has been the technology leader in India's commercial vehicle industry, moulding the country's commercial vehicle profile by introducing technologies and product ideas that have gone on to become industry norms

For over five decades, Ashok Leyland has been the technology leader in India's commercial vehicle industry, moulding the country's commercial vehicle profile by introducing technologies and product ideas that have gone on to become industry norms.

Click Here To Navigate Particular Website

Product Modals

Small Cars: Indi

Mid range Cars: India Go

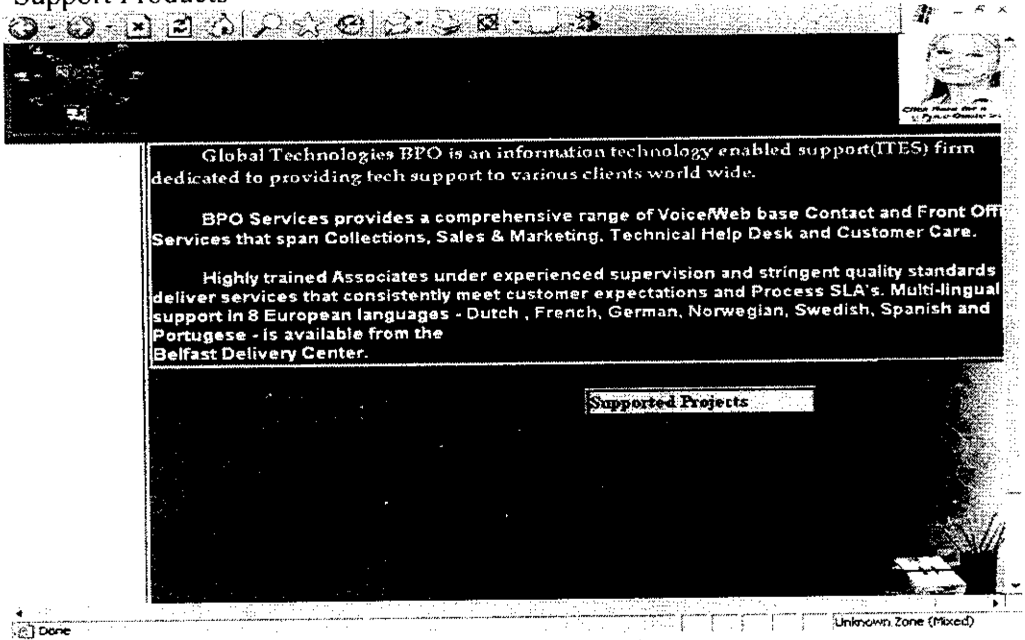
SUV Cars: Sumaa

Done

Unknown Zone (Mixed)

Figure 7.8 Welcome Motor

Support Products



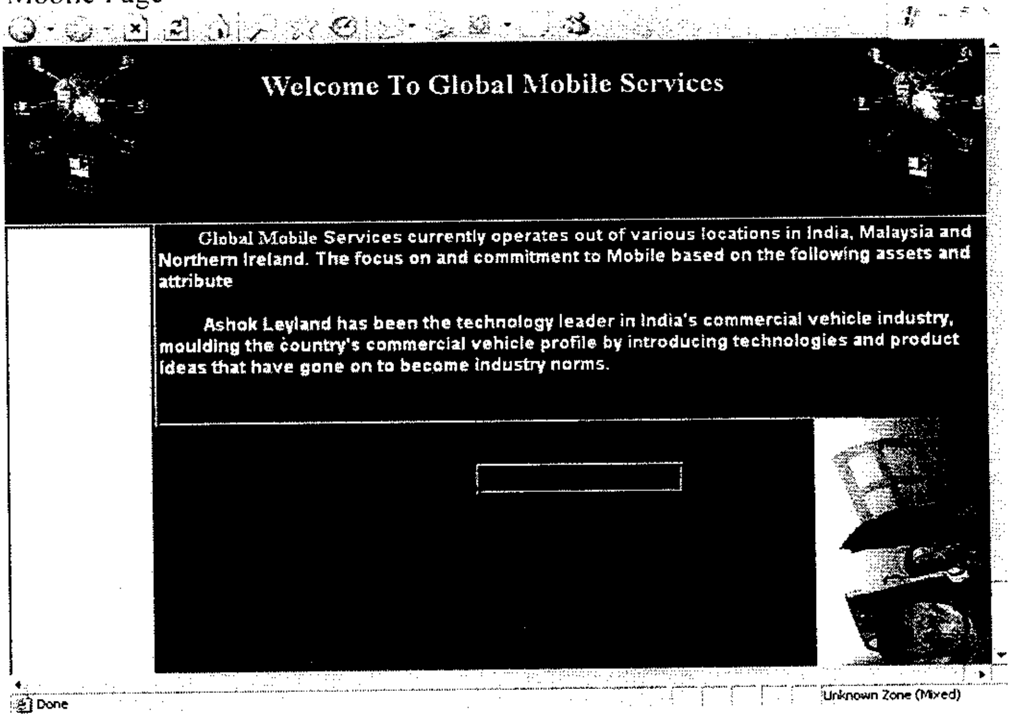
Global Technologies BPO is an information technology enabled support(ITES) firm dedicated to providing tech support to various clients world wide.

BPO Services provides a comprehensive range of Voice/Web base Contact and Front Off Services that span Collections, Sales & Marketing. Technical Help Desk and Customer Care.

Highly trained Associates under experienced supervision and stringent quality standards deliver services that consistently meet customer expectations and Process SLA's. Multi-lingual support in 8 European languages - Dutch , French, German, Norwegian, Swedish, Spanish and Portugese - is available from the
Belfast Delivery Center.

Figure 7.9 Support Products

Mobile Page



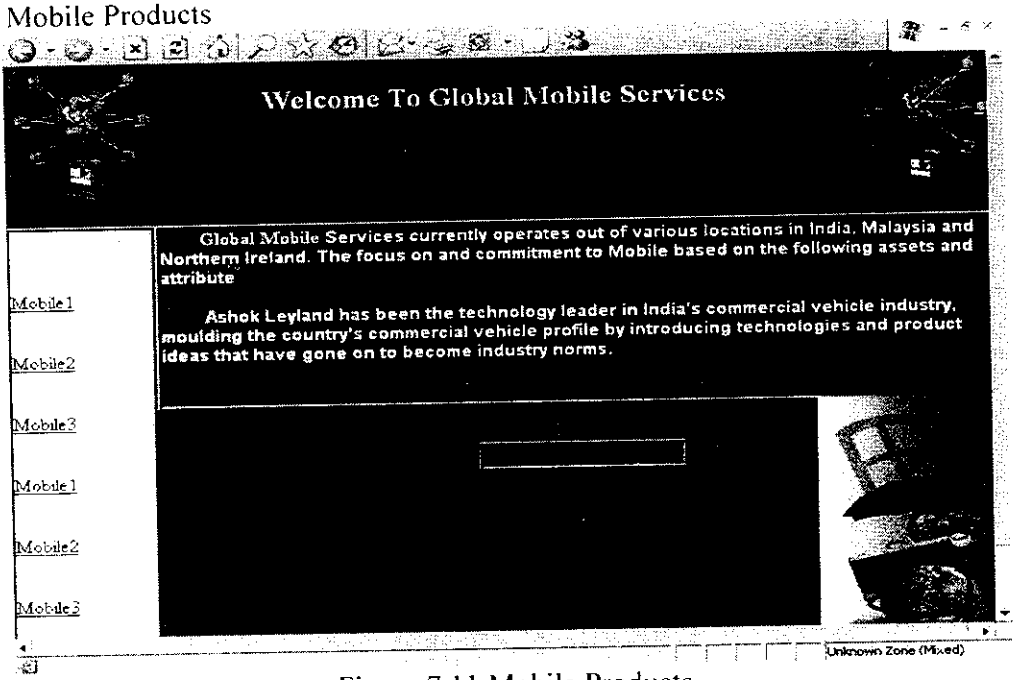
Welcome To Global Mobile Services

Global Mobile Services currently operates out of various locations in India, Malaysia and Northern Ireland. The focus on and commitment to Mobile based on the following assets and attribute

Ashok Leyland has been the technology leader in India's commercial vehicle industry, moulding the country's commercial vehicle profile by introducing technologies and product ideas that have gone on to become industry norms.

Figure 7.10 Mobile Page

Mobile Products



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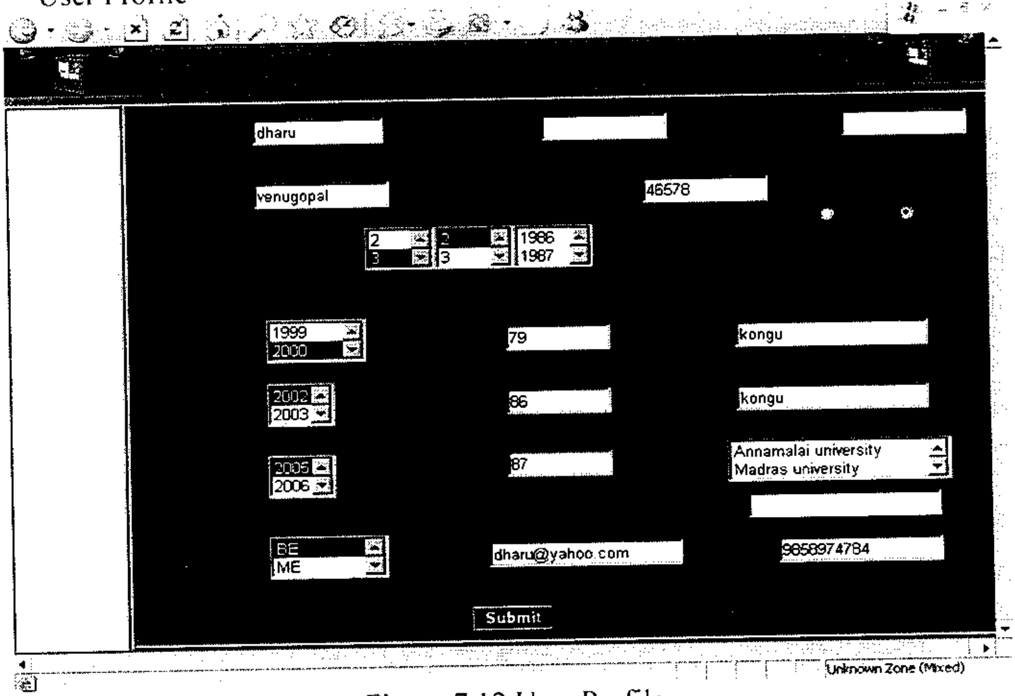
Global Mobile Services currently operates out of various locations in India, Malaysia and Northern Ireland. The focus on and commitment to Mobile based on the following assets and attribute

Ashok Leyland has been the technology leader in India's commercial vehicle industry, moulding the country's commercial vehicle profile by introducing technologies and product ideas that have gone on to become industry norms.

Figure 7.11 Mobile Products

User Profile



dharu

venugopal

46578

2 / 3 — 2 / 3 — 1986 / 1987

1999 / 2000 — 79 — kongu

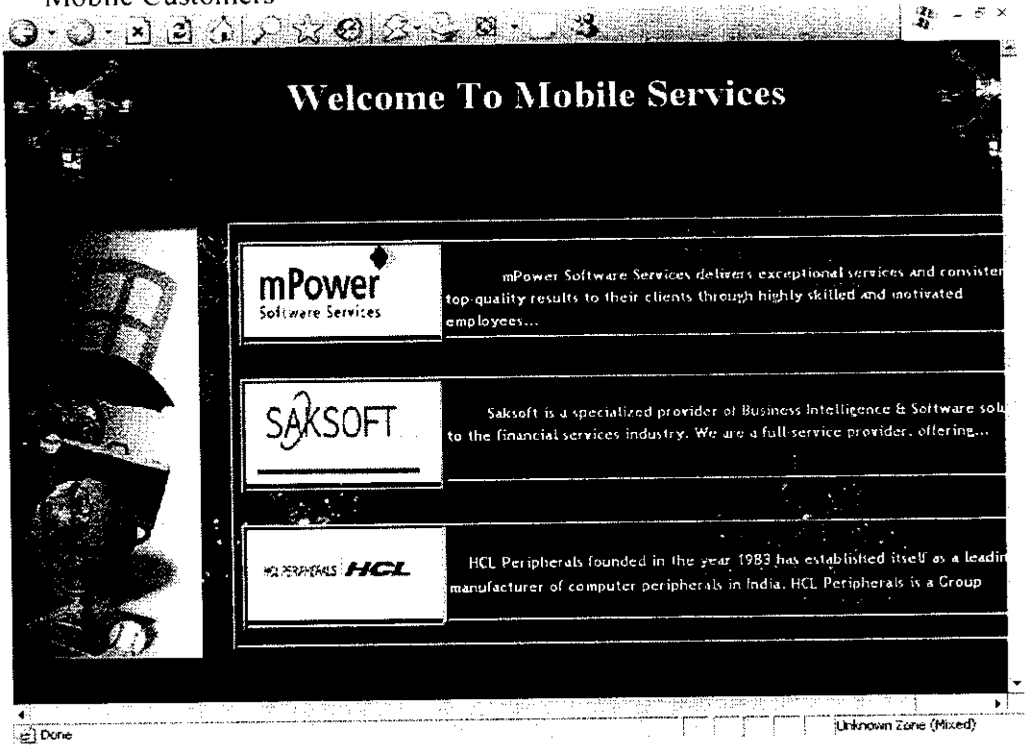
2002 / 2003 — 86 — kongu

2005 / 2006 — 87 — Annamalai university / Madras university

BE / ME — dharu@yahoo.com — 9858974784

Figure 7.12 User Profile

Mobile Customers



Welcome To Mobile Services

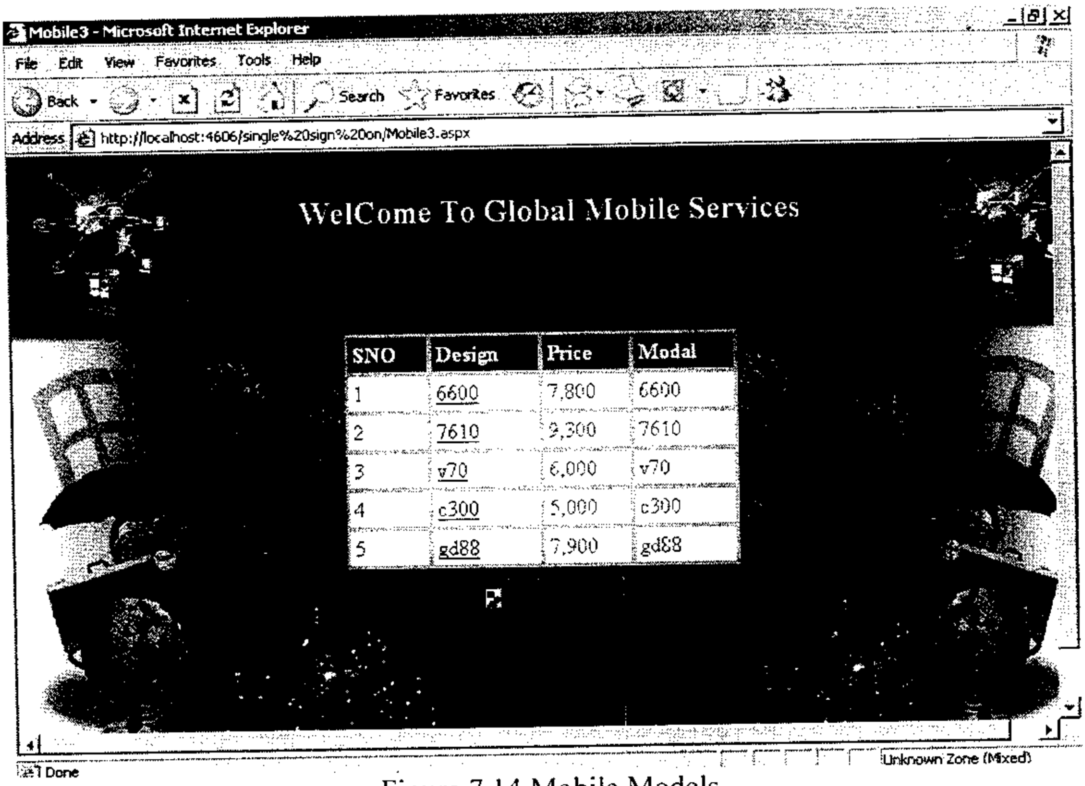
mPower Software Services delivers exceptional services and consiste top-quality results to their clients through highly skilled and motivated employees...

Saksoft is a specialized provider of Business Intelligence & Software sol to the financial services industry. We are a full-service provider, offering...

HCL Peripherals founded in the year 1983 has established itself as a leadir manufacturer of computer peripherals in India. HCL Peripherals is a Group

Figure 7.13 Mobile Customers

Mobile Models


Mobile3 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address
Done
Unknown Zone (Mixed)

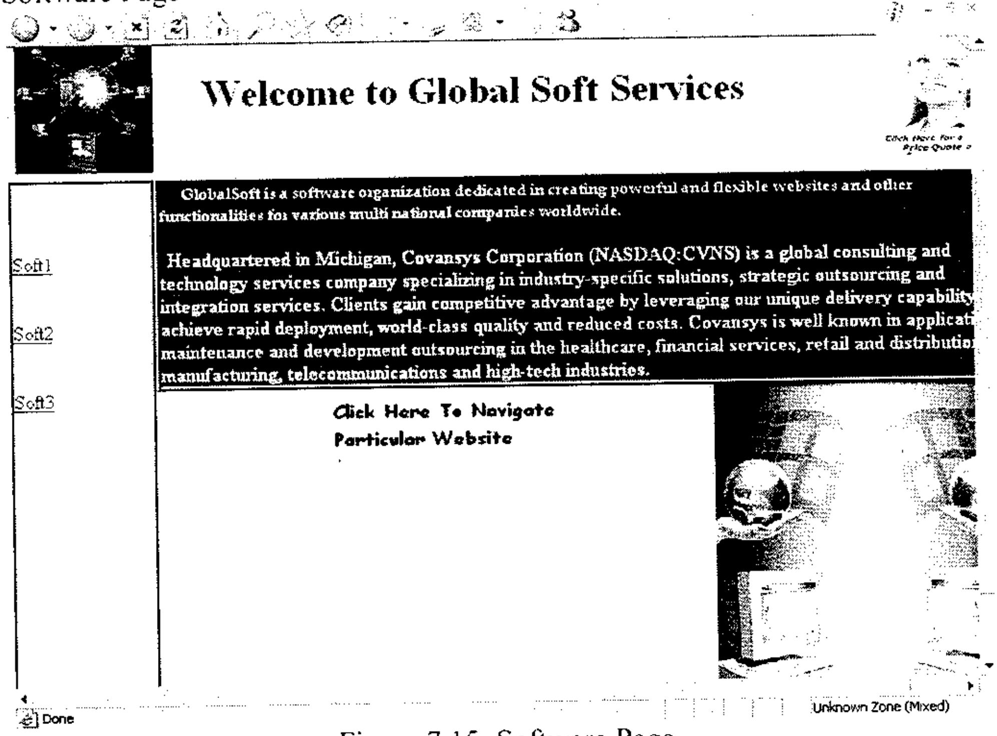
http://localhost:4606/single%20sign%20on/Mobile3.aspx

WelCome To Global Mobile Services

SNO	Design	Price	Modal
1	6600	7,800	6600
2	7610	9,300	7610
3	v70	6,000	v70
4	c300	5,000	c300
5	gd88	7,900	gd88

Figure 7.14 Mobile Models

Software Page



Welcome to Global Soft Services

GlobalSoft is a software organization dedicated in creating powerful and flexible websites and other functionalities for various multi national companies worldwide.

Headquartered in Michigan, Covansys Corporation (NASDAQ:CVNS) is a global consulting and technology services company specializing in industry-specific solutions, strategic outsourcing and integration services. Clients gain competitive advantage by leveraging our unique delivery capability achieve rapid deployment, world-class quality and reduced costs. Covansys is well known in applicat maintenance and development outsourcing in the healthcare, financial services, retail and distributio manufacturing, telecommunications and high-tech industries.

Click Here To Navigate Particular Website

Figure 7.15 Software Page

User Profile

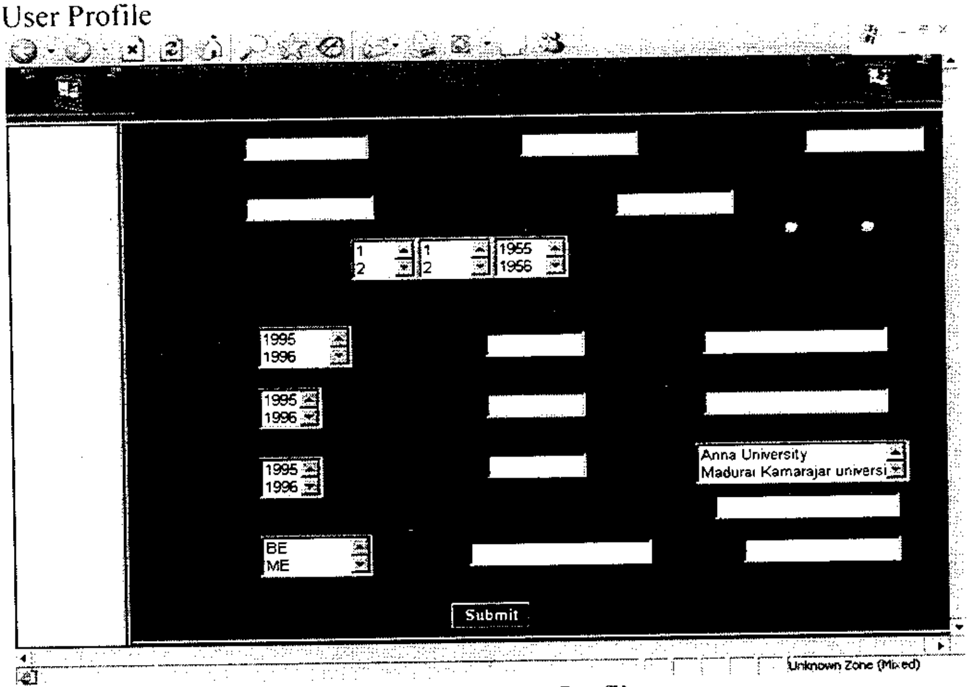
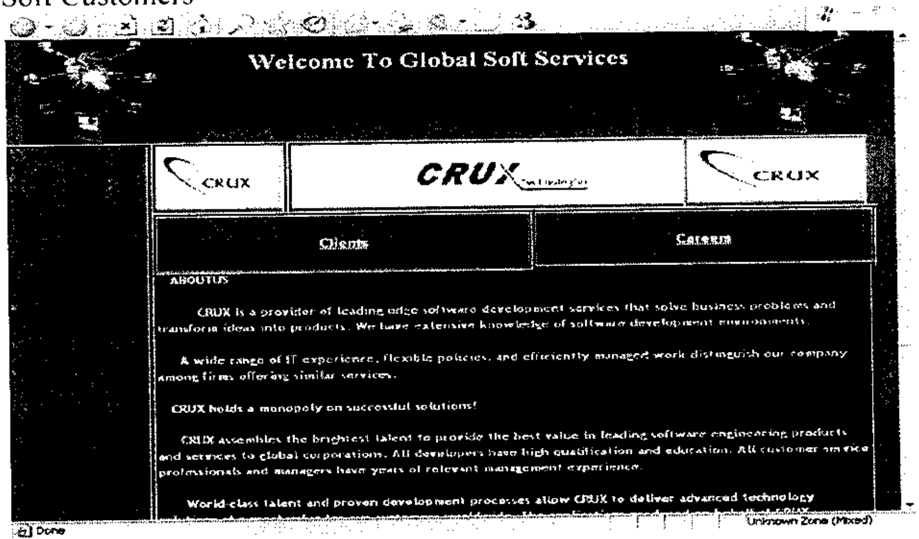


Figure 7.16 User Profile

Soft Customers



ABOUTUS

CRUX is a provider of leading edge software development services that solve business problems and transform ideas into products. We have extensive knowledge of software development environments.

A wide range of IT experience, flexible policies, and efficiently managed work distinguish our company among firms offering similar services.

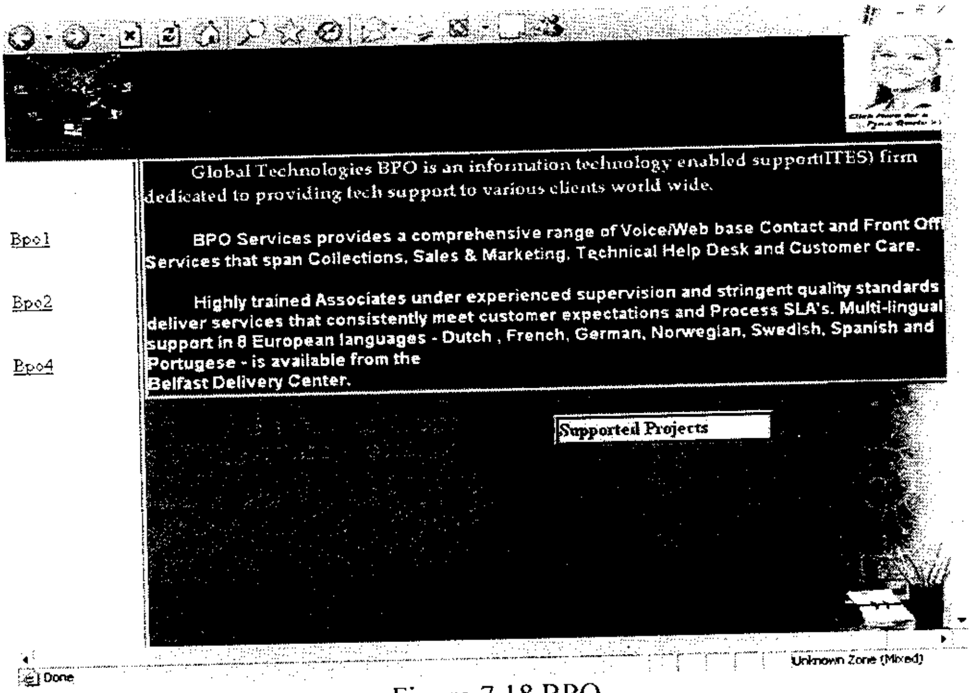
CRUX holds a monopoly on successful solutions!

CRUX assembles the brightest talent to provide the best value in leading software engineering products and services to global corporations. All developers have high qualification and education. All customer service professionals and managers have years of relevant management experience.

World-class talent and proven development processes allow CRUX to deliver advanced technology

Figure 7.17 Soft Customers

BPO



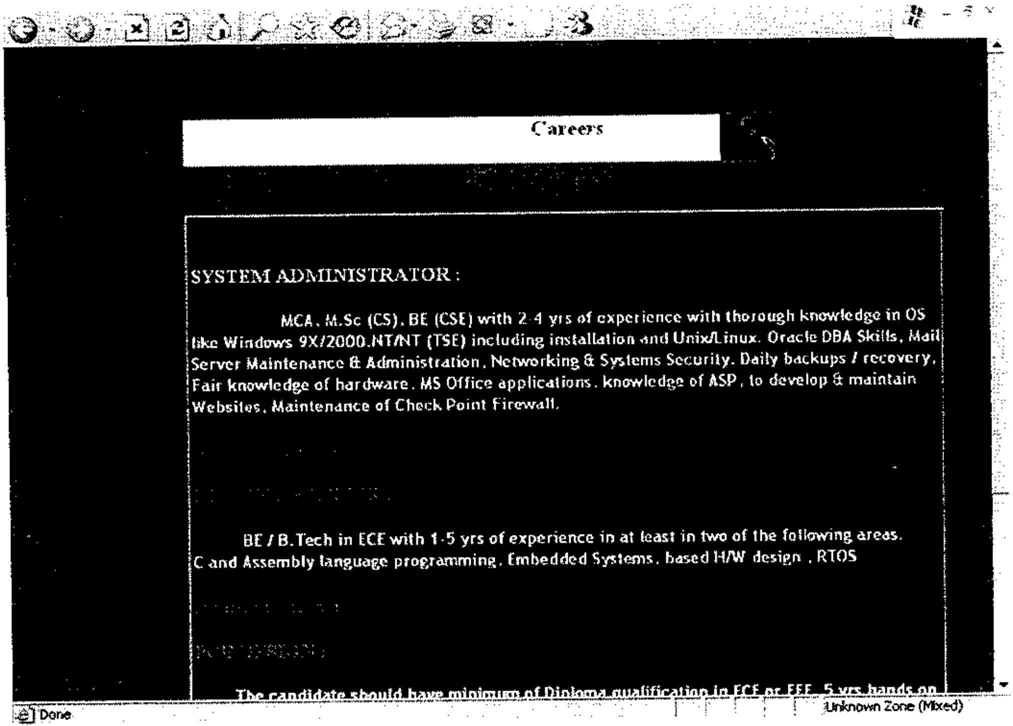
Global Technologies BPO is an information technology enabled support(ITES) firm dedicated to providing tech support to various clients world wide.

BPO Services provides a comprehensive range of Voice/Web base Contact and Front Off Services that span Collections, Sales & Marketing, Technical Help Desk and Customer Care.

Highly trained Associates under experienced supervision and stringent quality standards deliver services that consistently meet customer expectations and Process SLA's. Multi-lingual support in 8 European languages - Dutch , French, German, Norwegian, Swedish, Spanish and Portugese - is available from the
Belfast Delivery Center.

Figure 7.18 BPO

Careers



Careers

SYSTEM ADMINISTRATOR :

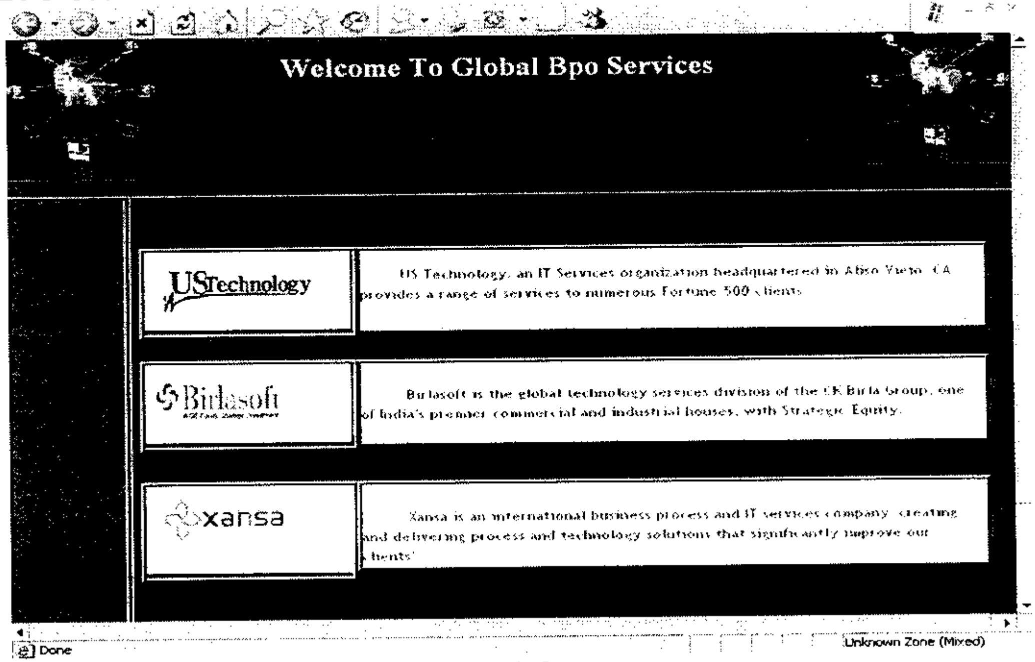
MCA, M.Sc (CS), BE (CSE) with 2-4 yrs of experience with thorough knowledge in OS like Windows 9X/2000.NT/NT (TSE) including installation and Unix/Linux. Oracle DBA Skills, Mail Server Maintenance & Administration, Networking & Systems Security. Daily backups / recovery, Fair knowledge of hardware. MS Office applications. knowledge of ASP, to develop & maintain Websites, Maintenance of Check Point Firewall.

BE / B.Tech in ECE with 1-5 yrs of experience in at least in two of the following areas. C and Assembly language programming, Embedded Systems, based H/W design , RTOS

The candidate should have minimum of Diploma qualification in ECE or EEE, 5 yrs hands on

Figure 7.19 Careers

BPO Customers



Welcome To Global Bpo Services

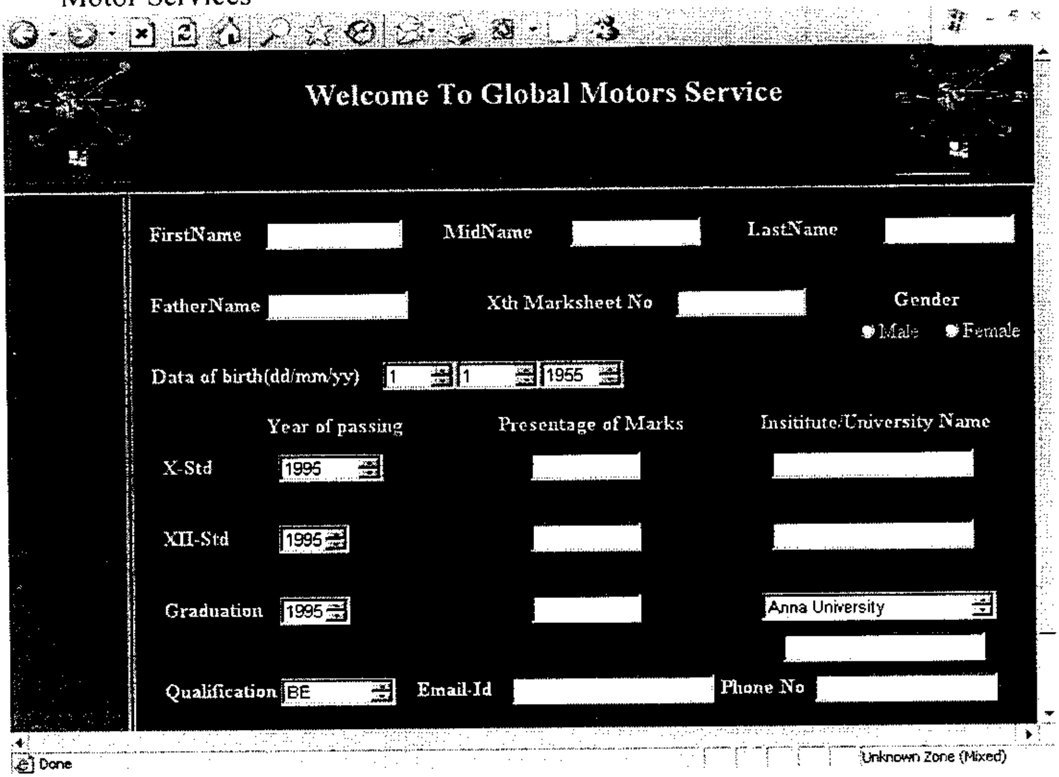
US Technology, an IT Services organization headquartered in Aliso Viejo, CA provides a range of services to numerous Fortune 500 clients.

Birlasoft is the global technology services division of the CK Birla Group, one of India's premier commercial and industrial houses, with Strategic Equity.

Xansa is an international business process and IT services company creating and delivering process and technology solutions that significantly improve our clients'

Figure 7.20 Customers

Motor Services



Welcome To Global Motors Service

FirstName MidName LastName

FatherName Xth Marksheet No

Gender

● Male ● Female

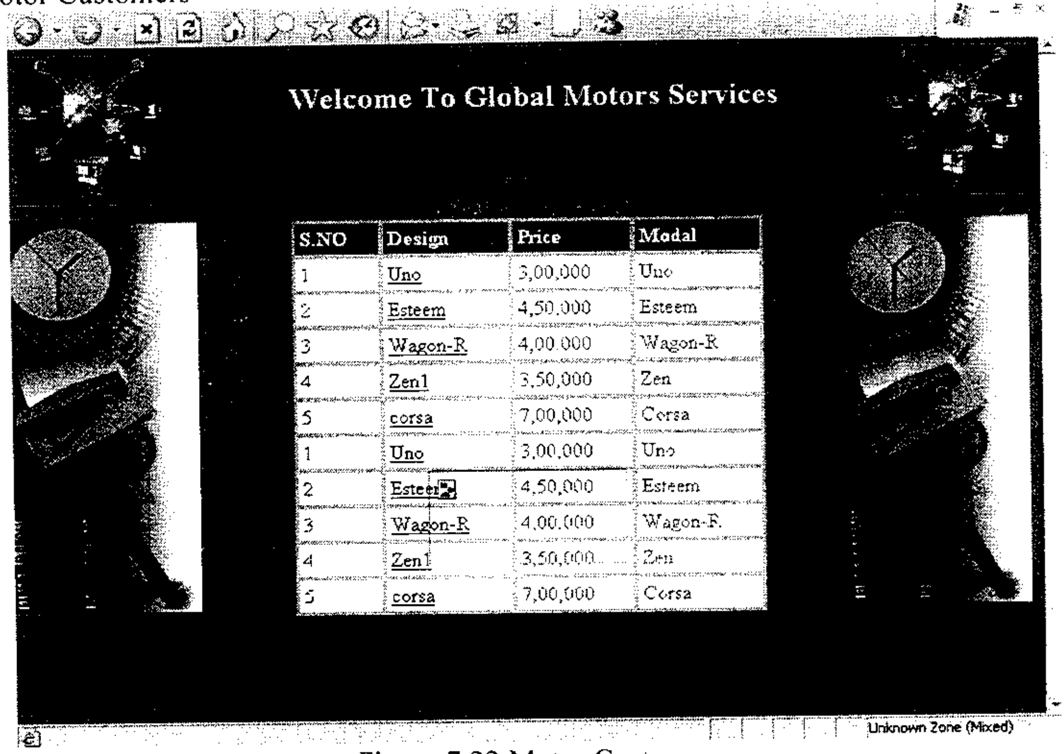
Data of birth(dd/mm/yy) 1 1 1955

	Year of passing	Presentage of Marks	Insititute/University Name
X-Std	1995		
XII-Std	1995		
Graduation	1995		Anna University

Qualification BE Email-Id Phone No

Figure 7.21 Motor Service

Motor Customers

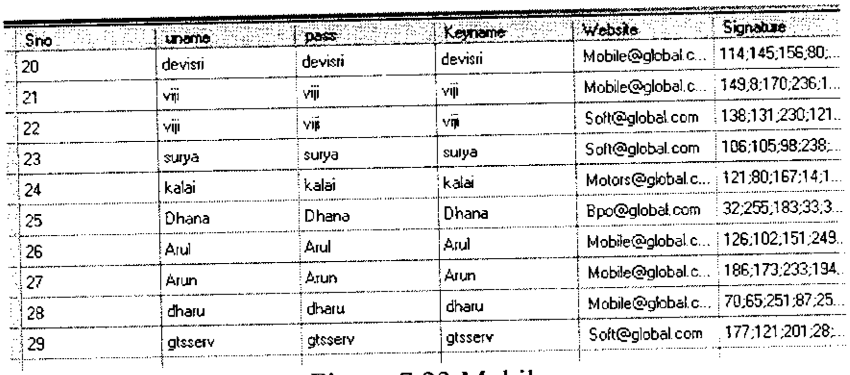


Welcome To Global Motors Services

S.NO	Design	Price	Modal
1	Uno	3,00,000	Uno
2	Esteem	4,50,000	Esteem
3	Wagon-R	4,00,000	Wagon-R
4	Zen1	3,50,000	Zen
5	corsa	7,00,000	Corsa
1	Uno	3,00,000	Uno
2	Esteem	4,50,000	Esteem
3	Wagon-R	4,00,000	Wagon-R
4	Zen1	3,50,000	Zen
5	corsa	7,00,000	Corsa

Figure 7.22 Motor Customers

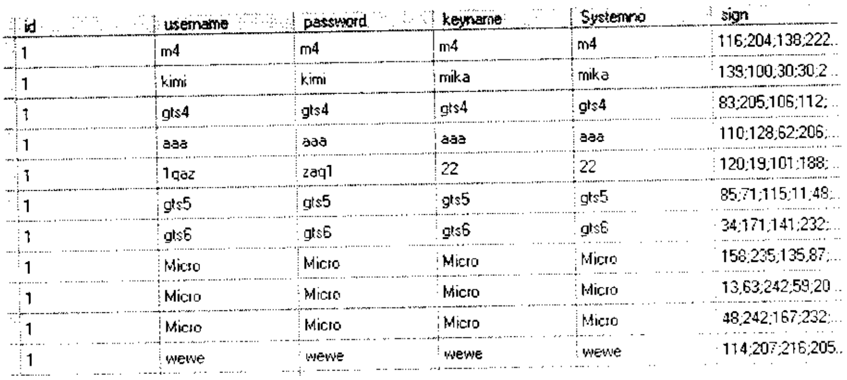
Report 1:



Sno	uname	pass	Keyname	Website	Signature
20	devisri	devisri	devisri	Mobile@global.c...	114;145;156;80;...
21	viji	viji	viji	Mobile@global.c...	149;8;170;236;1...
22	viji	viji	viji	Soft@global.com	138;131;230;121...
23	surya	surya	surya	Soft@global.com	106;105;98;238;...
24	kalai	kalai	kalai	Motors@global.c...	121;80;167;14;1...
25	Dhana	Dhana	Dhana	Bpo@global.com	32;255;183;33;3...
26	Arul	Arul	Arul	Mobile@global.c...	126;102;151;249...
27	Arun	Arun	Arun	Mobile@global.c...	186;173;233;194...
28	dharu	dharu	dharu	Mobile@global.c...	70;65;251;87;25...
29	gtsserv	gtsserv	gtsserv	Soft@global.com	177;121;201;28;...

Figure 7.23 Mobile

Report 2:



id	username	password	keyname	Systemno	sign
1	m4	m4	m4	m4	116;204;138;222...
1	kimi	kimi	mika	mika	139;100;30;30;2...
1	gts4	gts4	gts4	gts4	83;205;106;112;...
1	aaa	aaa	aaa	aaa	110;128;62;206;...
1	1qaz	zaq1	22	22	120;19;101;188;...
1	gts5	gts5	gts5	gts5	85;71;115;11;48;...
1	gts6	gts6	gts6	gts6	34;171;141;232;...
1	Micro	Micro	Micro	Micro	158;235;135;87;...
1	Micro	Micro	Micro	Micro	13;63;242;59;20...
1	Micro	Micro	Micro	Micro	48;242;167;232;...
1	wewe	wewe	wewe	wewe	114;207;216;205...

Figure 7.24 Motor

REFERENCES

The following are the books referred to develop this project work are listed below:

- ✓ MSDN Library Visual Studio 2005 Release.
- ✓ Jeff Prosise, "Programming Microsoft .NET", Microsoft Press
- ✓ Ed Robinson, Michael Bond, Ian Oliver, Michael Bond, Ian Oliver Ed Robinson, "Upgrading Microsoft Visual Basic 6.0 to Microsoft Visual Basic .NET", Microsoft Press
- ✓ John Connell, "Coding Techniques for Microsoft(r) Visual Basic(r) .NET", Microsoft Press
- ✓ Visual Basic .NET Black Book
- ✓ Addison-Wesley, "A Programmers Guide to .NET"
- ✓ VB.Net Complete Reference (2005), McGraw Hill-
- ✓ Wrox . "Visual Basic 2005 Programmer's Reference"

The following are the Website references to develop this project work are listed below:

- ✓ www.microsoft.com
- ✓ www.wikipedia.com
- ✓ www.wikibooks.com
- ✓ www.petri.co.il/kb.htm