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CLINICAL MANAGEMENT SYSTEM

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of

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BONAFIDE CERTIFICATE

Certified that this project report titled

CLINICAL MANAGEMENT SYSTEM

Is Bonafide work of

Mr. K.R.RAJDEV (Reg. No: 71202621029)

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.

19/5/05
Project Guide

Head of the Department

We examined the Candidate with University Register No. 71202621029
in the project Viva-Voce examination held on 23-06-2005

Internal Examiner

External Examiner 23/6/05

ABSTRACT

The main objective of this project 'CLINICAL MANAGEMENT SYSTEM' is to deliver information management system for hospital. This system replaces the current manual entry to computerized mode. It was initially developed to maintain inpatient details, outpatient details, maintain information about doctors and track the stock details.

The Internet, the greatest direct-to-customer medium has thrown up incredible new possibilities for the hospitality industry. This system was designed to make over the Internet, cut operating cost. But currently the system is going to be implemented on the intranet over the hospital.

This document discusses advanced feature of the project like automatic stock update. Integration of single user mode to multi-user environment systems, implementation of client-server technology. It discusses various interfaces like inpatient detail maintenance, outpatient detail maintenance, stock updating, and supplier detail maintenance. It also gives a brief notes about the life cycle of the project and future enhancements.

ACKNOWLEDGEMENT

At this pleasing moment of having successfully completed the project work, I wish to acknowledge my sincere gratitude and heartfelt thanks to our beloved Principal **Dr.K.K.Padmanabhan** for having given me the adequate support and opportunity for completing this project work successfully.

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I extend my sincere thanks to **Mr.A.MuthuKumar M.C.A, M.Phil,** Project Coordinator, Department of Computer Science & Engineering for rendering us all the timely helps through out the project.

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TABLE OF CONTENTS

TITLE PAGE NO

TITLE PAGE NO

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

Clinical Management System aims at developing the information maintenance tool specially suited for hospitals that handle Patient, Doctor and Stock details.

This application is an external product developed by the concern in order to track the various activities involved in a hospital and its management. This tool includes both the inpatient and the outpatient details and the functions that are performed regarding the admission and the treatment.

Major Modules in Clinical Management System are

- Inpatient
- Outpatient
- Doctor
- Supplier
- Stock

1.1.2 Project Scope

- Searching the records and generating reports
- Checking the availability of rooms for patients
- Checking the availability of doctors to fix appointment
- Summary of patient details is generated
- Summary of stock details is generated

1.2 ORGANIZATION PROFILE

Kaveri Infosys, is the Indian strategic partner of the Infosys, Inc. Chicago. IL. U.S.A. Kaveri Infosys is one of the leading providers of Windows-based software solutions for the healthcare continuum. Incorporated in November 1995 and situated in Chennai.

Vision

Great product Great place Great people

Focus

The company has been totally focused on software development for the healthcare industry. It has all along been a leading provider of integrated software system for healthcare automation services. They are committed to provide error free software through continual improvement. They maintain highly competent human resources so that the customer's requirements are always met.

Services

The Company is currently providing software product development and research and development services to their Principal InfoSys, Inc., US. The future plan will include offering services across the entire spectrum of technology-based services.

They improve the relationship among Patients, Provider and insurers by delivering quality products and services to managed healthcare services continuum and enabling them to expedite the availability of high quality, cost-effective and on time medical services.

Products

Kaveri Infosys solutions are designed to eliminate fragmentation of information management through a revolutionary systems architecture that accommodates unique clinical, financial and administrative business processes found in various segments of the ambulatory and post-acute continuum. Kaveri Infosys healthcare software suites include:

a. **MedSys Ambulatory/Acute** applications for physicians, rehab/therapy facilities for small hospitals
b. **HomeSys Post-acute** solutions comprised of long-term care, home healthcare and hospice configurations.

CHAPTER 2

SYSTEM REQUIREMENT AND SPECIFICATION

The Software Requirements Specification is a technical specification of requirements for the software product. The goal of software requirements definition is to completely and consistently specify the technical requirements for the software products in a concise and unambiguous manner.

The Software Requirements Specification is based on the system definition high-level requirements specified during initial planning are elaborated and more specific in order to characterize the features that the software product will incorporate .the requirement specification is primarily concerned with functional and a performance aspect of the software product and emphasis is placed on specifying product characteristics is placed on specifying product characteristics without implying how the product will provide those characteristics.

Desirable properties of a Software Requirement Specification

- Correct
- Complete
- Consistent
- Unambiguous
- Functional
- Verifiable
- Traceable.

2.1 HARDWARE REQUIREMENTS

• Processor	:	Intel Pentium
• Processor	:	500 MHZ
• Memory	:	256 MB RAM
• Hard Disk	:	20 GB

2.2 SOFTWARE REQUIREMENTS

• Operating System	:	Windows 2000/xp/NT Server
• Programming Language	:	JSP, Servlet, Java
• Scripting Language	:	Java script
• Database Server	:	Microsoft SQL Server 2000
• Web Server	:	Tomcat 4.1

2.3 SOFTWARE OVERVIEW

2.3.1 J2EE and Its Features

Information Technology Departments had always sought ways to create core effective computer applications. One approach is client/server architecture, which uses a two-tier architecture where client side software requests from server side software. Common Gateway Interface technology was a technology that was adopted by many co-operations. But CGI technology addressed the problem of interfacing web clients with co-operate infrastructure. But this technology was not scalable to meet the dramatic increase in the number of clients who needed to access corporate resources. Thus J2EE came into existence.

Client/server architecture exploded from two-tier architecture to a multi-tier architecture, where a client's request to a server generates requests to the other servers that are connected together through a backbone network. Sun Microsystems has tried to define the function of a java application server clearly that all implementations play on the level field. J2EE supports multi tired architecture rather different from a standalone, monolithic application. Applications that run in their servers typically have separate parts for clients, business logic and database. A tier is an abstract concept that defines a group of technologies that provides one or more services to its clients. A client is concerned about sending a request for service and receiving results from service. The middle tier is the J2EE server that does the calculations and the processing. The third tier is the database server.

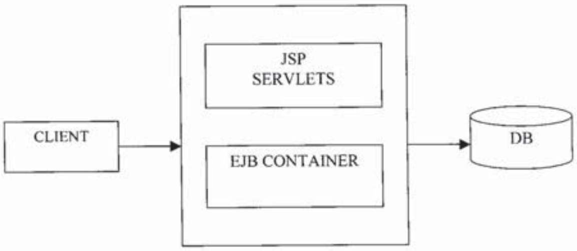


Fig 2.1 J2EE ARCHITECTURE

The applications are designed to handle thousands of users simultaneously 24 hours a day, 7 days a week without any downtime. J2EE is a versatile technology because application components built using J2EE are able to communicate with each other behind the scenes using standard communication methods such as HTTP, SSL, HTML, RMI & IIOP. Java Beans, Java Servlets and Java Server Pages are core components of J2EE.

2.3.2 JAVA SERVLETS

Servlets are modules that run inside request / response – oriented services and extend them in some manner.

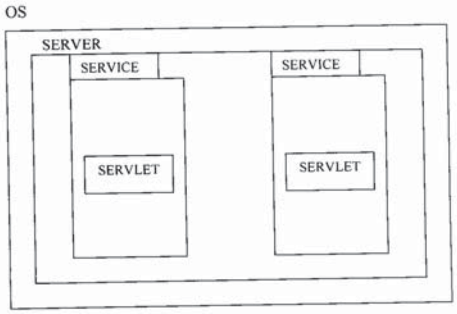


Fig 2.2 JAVA SERVLETS

A servlet can call on other services and servlets to satisfy a request. They can be moved from one servlet engine to another. Servlets handle request/respond operations in an extremely clean, simple and efficient manner. In the java-programming model, the business logic is handled by java beans and the presentation logic by the servlet or java server pages. Servlets greatly improve portability, as they do not have to be recompiled for different OS.

2.3.3 JAVA SERVER PAGES (JSP)

JSP makes the pages easier to edit with the standard HTML authoring tools. JSP also enables java expressions and code to be intermixed with HTML tags and text. JSP is a server-side program that is similar in design and functionality to a java servlet. A JSP is an HTML page with embedded servlet code that is surrounded by <% and %> tags. The servlet code, sometimes-called scriptlet can use predefined variables:

- Request: the servlet request.
- Response: the servlet response.
- Out: the output writer
- In: the input reader

2.3.4 JAVA DATABASE CONNECTIVITY (JDBC)

JDBC is Sun Microsystems standard SQL database access interface providing uniform access to a wide range of relational database. It consists of a set of classes and interfaces written in the java programming language.

Establishing a connection involves two steps:

1. Loading the driver
2. Making the connection

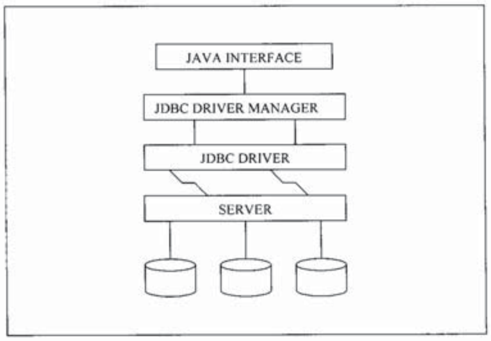


Fig 2.3 JAVA DATABASE CONNECTIVITY

Loading Driver and Making the Connection

A one-line code for JDBC-ODBC bridge driver is used for loading the driver. To connect to the DBMS an appropriate driver is used with the help of code. JSBC driver manager plays a key role in facilitating connection with the required Database by loading the appropriate driver. Java coding is written to accomplish these tasks.

2.3.5 ENTERPRISE JAVA BEAN (EJB)

An EJB is a component of the J2EE architecture that primarily provides business logic to a J2EE application and interacts with other server side J2EE components. EJB is written in the java programming language, which is EJB, is OS and platform independent.

DATABASE DESIGN

Home Health Care Management System uses Microsoft SQL Server 2000 as its Backend. Microsoft Extends the Performance, reliability, quality and ease- of-use of Microsoft SQL Server version 7.0. Microsoft SQL Server 2000 includes several new features that make it an excellent database platform for large-scale online transactional processing (OLTP), data warehousing, and e-commerce Application.

Fundamentals of SQL Server 2000 Architecture

- Online Transaction Processing (OLTP) systems must be capable of handling thousands of orders placed at the same time.

- Increasing numbers of corporations are implementing large Web sites as a mechanism for their customers to enter orders, contact the service department, get information about products, and for many other tasks that previously required contact with employees. These sites require data storage that is secure, yet tightly integrated with the Web.
- Organizations are implementing off-the-shelf software packages for critical services such as human resources planning, manufacturing resources planning, and inventory control. These systems require databases capable of storing large amounts of data and supporting large numbers of users.
- Organizations have many users who must continue working when they do not have access to the network. Examples are mobile disconnected users, such as traveling sales representatives or regional inspectors. These users must synchronize the data on a notebook or laptop with the current data in the corporate system, disconnect from the network, record the results of their work while in the field, and then finally reconnect with the corporate network and merge the results of their fieldwork into the corporate data store.
- Managers and marketing personnel need increasingly sophisticated analysis of trends recorded in corporate data. They need robust Online Analytical Processing (OLAP) systems easily built from OLTP data and support sophisticated data analysis.
- Independent Software Vendors (ISVs) must be able to distribute data storage capabilities with applications targeted at individuals or small workgroups. This means the data storage mechanism must be transparent to the users who purchase the application. This requires a data storage system that can be configured by the application and then tune itself automatically so that the users do not need to dedicate database administrators to constantly monitor and tune the application.

Database Architecture

Microsoft® SQL Server™ 2000 data is stored in databases. The data in a database is organized into the logical components visible to users. A database is also physically implemented as two or more files on disk.

When using a database, you work primarily with the logical components such as tables, views, procedures, and users. The physical implementation of files is largely transparent. Typically, only the database administrator needs to work with the physical Implementation.

Each instance of SQL Server has four system databases (**master**, **model**, **tempdb**, and **msdb**) and one or more user databases. Some organizations have only one user database, containing all the data for their organization. Some organizations have different databases for each group in their organization, and sometimes a database used by a single application. For example, an organization could have one database for sales, one for payroll, one for a document management application, and so on. Sometimes an application uses only one database; other applications may access several databases.

It is not necessary to run multiple copies of the SQL Server database engine to allow multiple users to access the databases on a server. An instance of the SQL Server Standard or Enterprise Edition is capable of handling thousands of users working in multiple databases at the same time. Each instance of SQL Server makes all databases in the instance available to all users that connect to the instance, subject to the defined security permissions.

When connecting to an instance of SQL Server, your connection is associated with a particular database on the server. This database is called the current database. You are usually connected to a database defined as your default database by the system administrator, although you can use connection options in the database APIs to specify another database. You can switch from one database to another using either the Transact-SQL USE database name statement, or an API function that changes your current database context.

SQL Server 2000 allows you to detach databases from an instance of SQL Server, then reattach them to another instance, or even attach the database back to the same instance. If you have a SQL Server database file, you can tell SQL Server when you connect to attach that database file with a specific database name.

Features of SQL Server 2000

- Internet Integration

  The SQL Server 2000 database engine includes integrated XML support. It also has the scalability, availability, and security features required to operate as the data storage component of the largest Web sites. The SQL Server 2000 programming model is integrated with the Windows DNA architecture for developing Web applications, and SQL Server 2000 supports features such as English Query and the Microsoft Search Service to incorporate user-friendly queries and powerful search capabilities in Web applications.

- Scalability and Availability

  The same database engine can be used across platforms ranging from laptop computers running Microsoft Windows® 98 through large, multiprocessor servers running Microsoft Windows 2000 Data Center Edition. SQL Server 2000 Enterprise Edition supports features such as federated servers, indexed views, and large memory support that allow it to scale to the performance levels required by the largest Web sites.

- Enterprise-Level Database Features

  The SQL Server 2000 relational database engine supports the features required to support demanding data processing environments. The database engine protects data integrity while minimizing the overhead of managing thousands of users concurrently modifying the database. SQL Server 2000 distributed queries allow you to reference data from multiple sources as if it were a part of a SQL Server 2000 database, while at the same time, the distributed transaction support protects the integrity of any updates of the distributed data. Replication allows you to also maintain multiple copies of data, while ensuring that the separate copies remain synchronized. You can replicate a set of data to multiple, mobile, disconnected users, have them work autonomously, and then merge their modifications back to the publisher.

- Ease of installation, deployment, and use

  SQL Server 2000 includes a set of administrative and development tools that improve upon the process of installing, deploying, managing, and using SQL Server across several sites. SQL Server 2000 also supports a standards-based programming model integrated with the Windows DNA, making the use of SQL Server databases and data warehouses a seamless part of building powerful and scalable systems. These features allow you to rapidly deliver SQL Server applications that customers can implement with a minimum of installation and administrative overhead.

- Data warehousing

  SQL Server 2000 includes tools for extracting and analyzing summary data for online analytical processing. SQL Server also includes tools for visually designing databases and analyzing data using English-based questions.

Tables can be created in two ways.

1.SQL Query Analyzer.
2.SQL Enterprise Manager.

Microsoft SQL Server 2000 SQL Query Analyzer is a graphical tool that allows you to:

- Create queries and other SQL scripts and execute them against SQL server databases.
- Quickly create commonly used database object from predefined scripts.
- Quickly copy existing database objects.
- Debug and Execute stored procedures.
- Debug query performance problems.
- Quickly insert, update, or delete rows in a table.(Open Table Window)

Microsoft SQL Server Enterprise Manager is the primary administrative tool for Microsoft SQL Server 2000 and provides a Microsoft management Console (MMC)-Compliant user interface that allows user to:

- Define groups of servers running SQL Server.
- Register Individual servers in a group.
- Configure all SQL Server options for each registered server.
- Create and administer all Server databases, objects, logins, users and permissions in each registered server.
- Define and execute all SQL Server administrative tasks on each registered server.

Design and test SQL statements, batches and scripts interactively by invoking SQL Query Analyzer

2.4 SPECIFICATION

Platform Specification

Operating System

An Operating System is a Collection of Computer program that control, how the computer works. It can also be defined as the software, which acts as a traffic cop, directing requests and information to add from the various devices within a single PC. The OS handles disk requests (read and write) keyboard translations, memory accesses, peripheral accesses and much other function.

Windows 9x

Windows 9x is a desktop operating system. It runs on Intel/Cyrix/AMD processors. It support file system FAT32 (NRWF), VFAT (NRWF). Also integrated with DOS for command line interface and explore for graphical user interface. It supports multimedia applications and Internet applications. Generally it is used as the operating system.

Windows NT

This is a network operating system. This is based on the Client-Server architecture. Benefits of Windows NT are;

- More intuitive interface.
- Better multitasking and multithreading.
- Clients can be attached to workstations.
- Plug-and-play technology.
- Higher level of security.

Windows 2000/NT Server

Microsoft Windows 2000/NT server 4.0 is a multipurpose server operating system. A multipurpose operating system integrates a variety of network services.

The services it provides are designed to address customer requirements and are managed in a single way. It offers a complete end-to-end solution. It gives the ability to exploit the popularity of compatible third party products and such application as Java Server pages, for dynamic content web pages or Server for specialized database tasks and web server for web services.

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

The existing system maintains the information about the patients, doctors and the stock manually. This may lead to manual errors; high time consumption, low performance and the data cannot be quickly retrieved.

Disadvantages

- Manual errors
- High time consumption
- Low performance
- Data retrieval is slow

3.2 PROPOSED SYSTEM

The proposed system automates the information maintenance, which will be of great advantage in terms of efficiency, accuracy and consistency. This also avoids repetition of the same data for different purposes.

This project aims at developing the information maintenance tool specially suited for hospitals that handle Patient, Hospital, Doctor and Stock details. This application is an external product developed by the concern in order to track the various activities involved in a hospital and its management.

Advantages of Proposed System:

- Effective information maintenance
- Effective data retrieval
- Faster execution
- Best use of resource
- Better patient care

3.3 PROTOTYPING

Planning the software development process involves several important considerations. The most important consideration is to define a product life cycle.

The software life cycle encompasses all activities required to define, develop, test, deliver, operate, and maintain a software product. Different models emphasize different aspect of the life cycle, and no single life-cycle model is appropriate for all software products. Life-cycle models used are the phased model, the cost model, the prototype model and the successive versions model.

The Prototype Life-cycle Model

Prototype is a mock-up or model of a software product. A prototype incorporates components of the actual product. Typically, a prototype exhibits limited function capabilities, low reliability, and inefficient performance.

There are several reasons for developing a prototype:

- To illustrate input date formats, message, reports, and interactive
- Dialogues for the customer. This is used to explain various processing option to the customer and to gain better understanding of the customer's needs.
- To explore technical issues in the proposed product.

The nature and extent of prototype to be performed on particular software is dependent on the nature of the product. New versions of existing products can most likely be developed using the phased life-cycle model with little or no prototyping. Development of a totally new product will probably involve some prototyping during the planning and analysis phase or iterating through a series of successive designs and implementations may develop the product.

CHAPTER 4

SYTEM DESIGN

4.1 DESIGN PRINCIPLES

The process of design involves "conceiving and planning out in mind" and "making a drawing, pattern, or sketch of". In software design, there are three distinct types of activities: external design, architectural design detailed design. Architectural design and detailed design are collectively called internal design.

External design of software involves conceiving, planning out, and specifying the externally observable characteristics of a software product. These characteristics include user displays and report formats, external data sources and data sinks, and the functional characteristics, performance requirements and high-level process structure for the product. External design begins during the analysis phase and continues into the design phase. Requirements definition is concerned with specifying the external, functional and performance requirements for a system. External design is concerned with refining those requirements and establishing the high level structural view of the system.

Internal design involves conceiving, planning out and specifying the internal structure and processing details of the software product. The goals of internal design are to specify internal structure and processing details, to record design decisions and indicate why certain alternatives and trade-offs were chosen, to elaborate the test plan, and to provide a blueprint for implementation, testing and maintenance activities. The work products of internal design include a specification of architectural structure, the details of algorithms and data structures, and data structures, and the test plan.

Design of Clinical Management System

Clinical management system is designed in the way that it maintains the information of hospitals and makes better use of that information. This system is designed for information maintenance specially suited for hospitals that handle Patient, Hospital, Doctor and Stock details.

4.2 ARCHITECTURAL DESIGN

Architectural Design is concerned with refining the conceptual design of the system, identifying internal processing functions, decomposing high level functions into sub functions, defining internal data streams and data stores and establishing relationships and interconnections among functions, data streams and data stores.

4.2.1 Clinical Management System – Module Overview

CMS consists of six modules

- Inpatient Module
- Outpatient Module
- Doctor Module
- Supplier Module
- Stock Module

Inpatient Module

The inpatient is designed to take care of all the activities functions pertaining to Inpatient Management. This module automates the day-to-day administrative, which leads to a better patient care. It provides comprehensive data pertaining to Admission of Patients & Ward Management and the details about the doctor who is attending the patient.

Outpatient Module

The Outpatient serves as an entry point to schedule an appointment with the Hospital Resident Doctor or Consultant Doctor for Medical Consultations and diagnosis. This module supports doctors to take better and timely consultation decisions by providing instant access to comprehensive patient information. Patient visits are divided into New, Follow-up and Review.

Doctor Module

The doctor deals with the details about the doctors in the hospital and helps us to know whether they are specialist or general doctors and if they are specialists means, in which field such as surgery, cardio, neuro etc. It also helps us to know the availability of doctors in a hospital and their visiting time also. This module also helps to understand whether the doctor is regular or visiting doctor.

Supplier Module

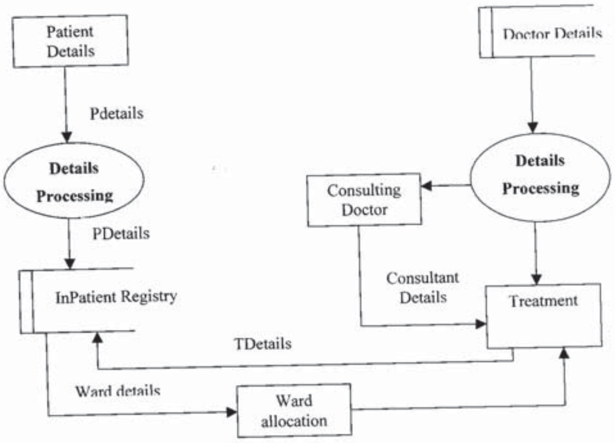
The supplier details deals with the purchase of various items such as medicines and other items to the departments in the hospital from the various other suppliers. It maintains the details about the suppliers.

Stock Module

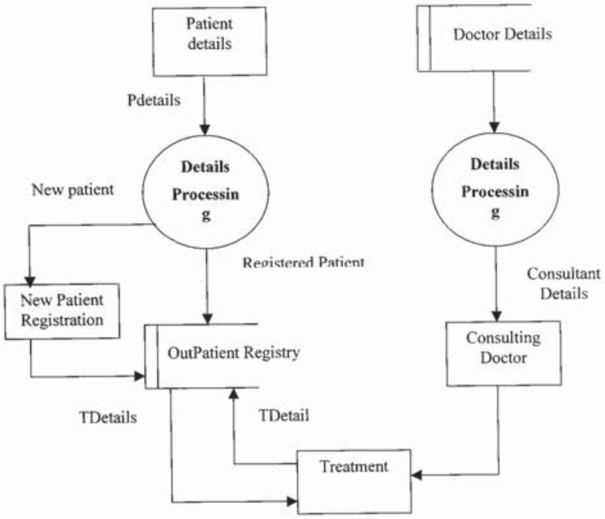
The stock details deals with the stock in departments of the hospital such as general store and drug store. This module helps to know the stock details and we can reorder the items accordingly.

4.3 DATA FLOW DIAGRAM

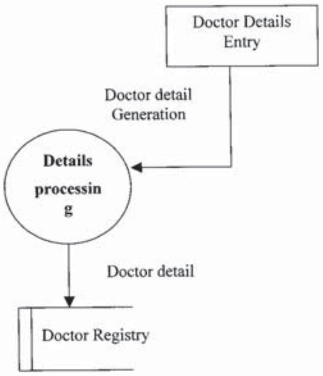
Data flow diagram is commonly used during problem analysis and design. A DFD shows the flow of data through a system. It views the system as a function that transforms the inputs into desired outputs. A DFD aims to capture the transformation that takes place within a system into output data so that eventually the output data is produced. The agent that performs the transformation of data from one state to another is called a process (Bubble).



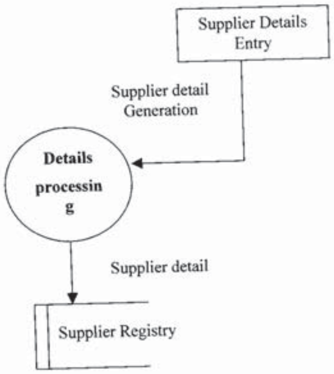
4.3.1 DFD for INPATIENT details



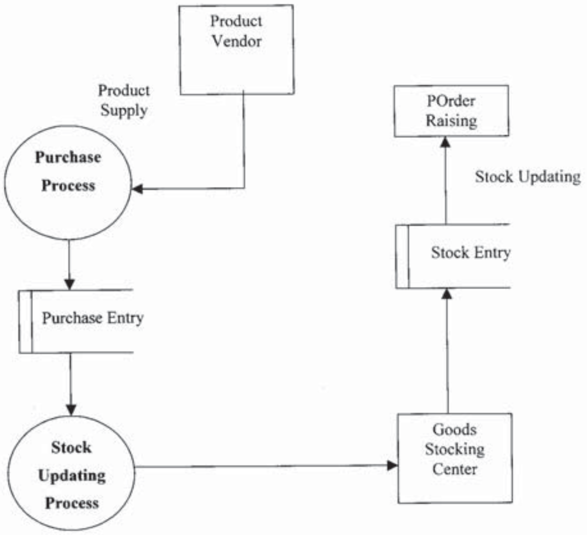
4.3.2 DFD for OUTPATIENT details



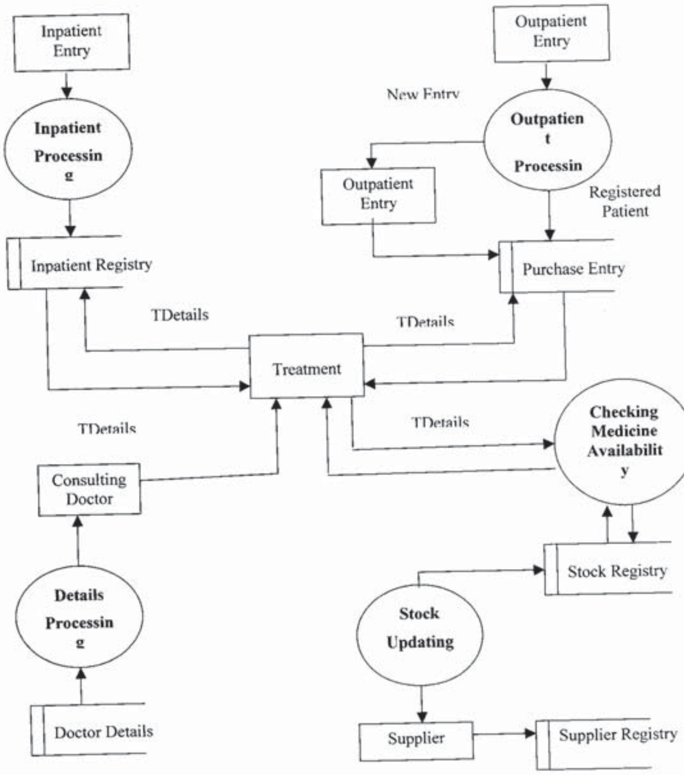
4.3.3 DFD for Doctor Details



4.3.4 DFD for Supplier Details



4.3.5 DFD for Stock Details



4.3.6 System Level Data Flow Diagram

4.4 TABLE DESIGN

4.4.1 Inpatient Table

Field Name	Key	Data type
ip_id	Primary Key	Varchar
Name		Varchar
gender		Varchar
Age		Int
address		Varchar
City		Varchar
State		Varchar
country		Varchar
doc_id	Foreign Key	Varchar
treat_reason		Varchar
type_admission		Varchar
date_admission		Varchar
Ward		Varchar
initialamount		Int

4.4.2 Outpatient Table

Field Name	Key	Data type
op_id	Primary Key	varchar
Name		varchar
gender		varchar
Age		int
address		varchar
City		varchar
State		varchar
country		varchar
doc_id	Foreign Key	varchar
treat_reason		varchar
app_date		datetime
app_time		varchar
earlier_visiting_date		datetime
consulting_fee		int

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4.4.3 Doctor Table

Field Name	Key	Data type
doc_id	Primary Key	varchar
Name		varchar
gender		varchar
Age		int
address		varchar
contact_number		int
specialization		varchar
Type		varchar
consult_day		varchar
consult_time		varchar

4.4.4 Supplier Table

Field Name	Key	Data type
Supp_id	Primary Key	varchar
request_no		int
item_no	Foreign Key	varchar
Name		varchar
Uprice		int
quantity		int
Uom		int
req_date		datetime
supplied_date		datetime

4.4.5 Stock Table

Field Name	Key	Data type
item_code	Primary Key	varchar
Supp_id	Foreign Key	varchar
item_desc		varchar
Uprice		int
Uom		varchar
Expiry_date		datetime
total_stock		int
current_stock		int

CHAPTER 5

SYSTEM TESTING AND IMPLEMENTATION

The system testing deals with the process of testing the system as a whole. This is done after the integration process. Moving through each module from top to bottom tests the entire system. The verification and validation processes are then carried out. The errors that occur at testing phase are eliminated and a well functioning system is developed.

Test case design focuses on a set of techniques, which meets all testing objectives, which are mentioned below.

1. Testing is a process of executing a program with the intent of finding an error.
2. A successful test is one that uncovers an as yet undiscovered error.

Testing demonstrates that software functions work according to specifications. In addition data collected from testing provides a good indication of software reliability and some indication of software quality as a whole.

Testing results are used for detecting errors. Critical modules are tested as early as possible. The following tests are carried out.

5.1 TESTING METHODS

5.1.1 Unit Testing

It focuses verification efforts on the smallest unit of software design, the module. This is also known as **Module Testing.** The modules are tested separately. This testing is carried out during programming stage itself.

5.1.2 Validation Testing

Validation testing can be defined in many ways but a simple definition is that validation succeeds when the software functions in a manner that can be reasonably expected by the users.

After validation test has been conducted one of the two possible conditions exist

1. The function or the performance characteristics confirm to specification and are accepted
2. A derivation from specification is uncovered and a deficiency list is created.

5.1.3 Output Testing

After performing the validation testing the next step is output testing of the proposed system since no system is useful if it does not produce the required output in the specific format. Asking the users about the formats required by them tests the outputs generated or displayed by the system under consideration.

5.1.4 User Acceptance Testing

User acceptance of a system is a key factor for the success of any system. The system under consideration is tested for user acceptance by constantly keeping in touch with prospective system users at the time development and making changes whenever required.

5.2 IMPLEMENTATION

The implementation phase of software development is concerned with translating design specification into source code. The primary goal of implementation is to raise source code and internal documentation so that conformance of the code to its specification can be easily verified, and so that debugging, testing and modification are eased. This goal can be achieved by making the source code as clear and straightforward as possible. Simplicity, clarity and elegance are the hallmarks of good programs; obscurity, cleverness and complexity are indication inadequate design and misdirected thinking.

Source code clarity is enhanced by structured coding techniques, by good coding style, by appropriate supporting documents, by good internal comments and by the features provided in modern programming languages.

The goal structured coding is to liberalize control flow through a computed program so that the execution sequence follows the sequence in which the code is written. The dynamic structure of a program as it executes then resembles the static structure of the written text. This enhances readability of code, which eases understanding, debugging, testing, documentation and modification of programs. It also facilitates formal verification of programs. The structure coding techniques are as follows:

- Single entry, Single exit constructs
- Efficiency considerations
- Data Encapsulation
- Recursion

5.3 MAINTENANCE

Maintenance is the enigma of system development. It holds the software industry captive typing up programming resources. It could be described as the symmetric process of changing the software that is already in operation iq. order to prevent system failures and to improve the performance. Software maintenance involves keeping software interfaces simple and standard, paying particular attention to troublesome modules, replacing faulty components and generally planning to replace components that are ole, obsolete, faulty, or at risk for imminent failure.
There are several factors that require to be maintained. They are

- Hardware platforms change or become obsolete.
- Operating system change.
- Compiler change
- Language standard's change.
- Communication standard's change
- Graphical user interface change.
- Related application software package change.

Maintenance can be classified into

- Adaptive maintenance
- Perceptive maintenance

- Preventive maintenance
- Corrective maintenance

Adaptive Maintenance

It deals with adapting software change in the environment. It does not lead to changes in the system functionality.

Perceptive Maintenance

It mainly deals with accommodating new or changed users requirements. It also includes activities to increase the system performance or to enhance its user interface. The objective of perceptive maintenance should be to prevent failures and optimize the software.

Preventive Maintenance

Preventive maintenance concerns activities aimed at increasing the system's maintainability such as updating documentation adding comments, improving modular structure of the system.

Corrective Maintenance

This deals with the repair of faults found. Some of the major causes of maintenance problems are:

- Unstructured code
- Maintenance programmers having insufficient knowledge of the system and on application domain.

CHAPTER 6

CONCLUSION

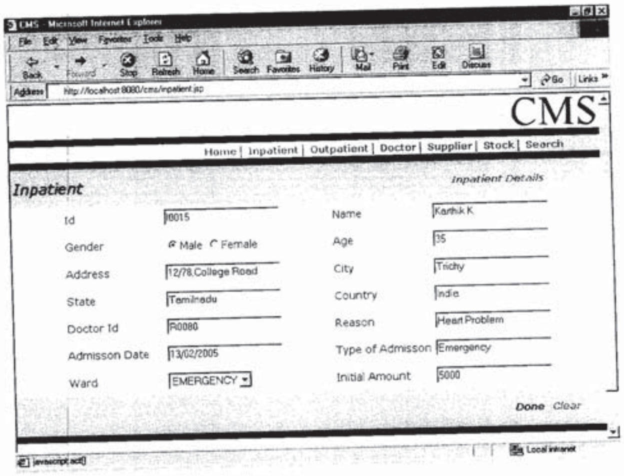
Clinical management system is developed in flexible manner; this can accomplish the modifications very easily. The system was tested with all possible samples of data performance proved to be much efficient. Data maintenance and manipulation is achieved practically.

The system was developed using an efficient architecture (J2EE) and a user-friendly environment is provided. For each session, the J2EE server generates unique session id and thus there is no bottleneck or process congestion.

The system can be future enhanced with the online booking for the doctors, enhancing the supplier and stock modules with more automation. The system can be hosted to the internet and thus making the client more visible to the world and making their services beneficial to the world.

APPENDIX – SCREEN SHOTS

Inpatient Data Entry Screen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Address http://localhost:8080/cms/inpatient.jsp
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Local intranet

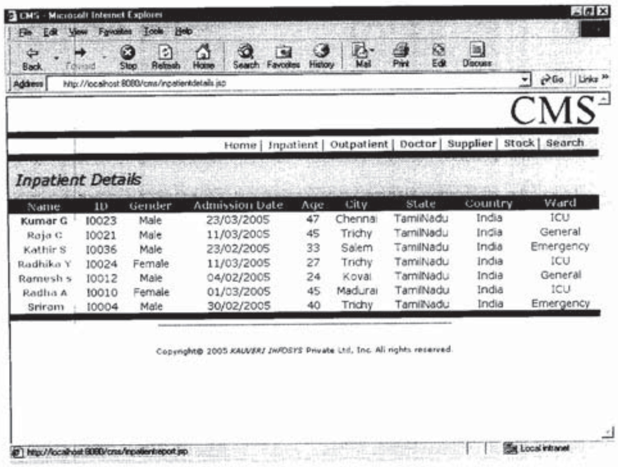
Inpatient

Inpatient Details

Id	I0015	Name	Karthik K
Gender	● Male ○ Female	Age	35
Address	12/78,College Road	City	Trichy
State	Tamilnadu	Country	India
Doctor Id	R0080	Reason	Heart Problem
Admisson Date	13/02/2005	Type of Admisson	Emergency
Ward	EMERGENCY	Initial Amount	5000

Done Clear

Inpatient Details Screen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http://localhost:8080/cms/inpatientreport.jsp
Local intranet

Inpatient Details

Name	ID	Gender	Admission Date	Age	City	State	Country	Ward
Kumar G	I0023	Male	23/03/2005	47	Chennai	TamilNadu	India	ICU
Raja C	I0021	Male	11/03/2005	45	Trichy	TamilNadu	India	General
Kathir S	I0036	Male	23/02/2005	33	Salem	TamilNadu	India	Emergency
Radhika Y	I0024	Female	11/03/2005	27	Trichy	TamilNadu	India	ICU
Ramesh s	I0012	Male	04/02/2005	24	Kovai	TamilNadu	India	General
Radha A	I0010	Female	01/03/2005	45	Madurai	TamilNadu	India	ICU
Sriram	I0004	Male	30/02/2005	40	Trichy	TamilNadu	India	Emergency

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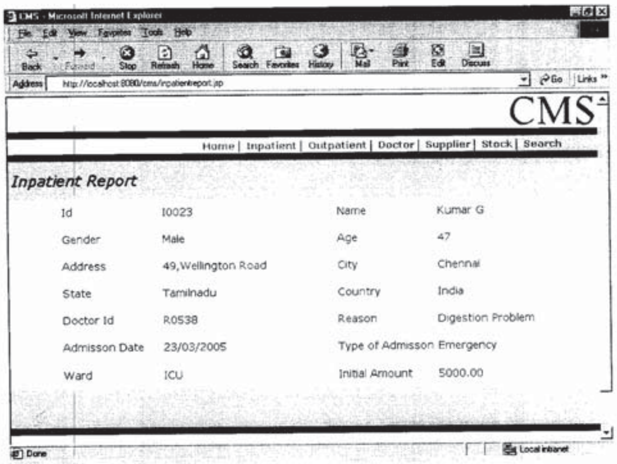
Inpatient Report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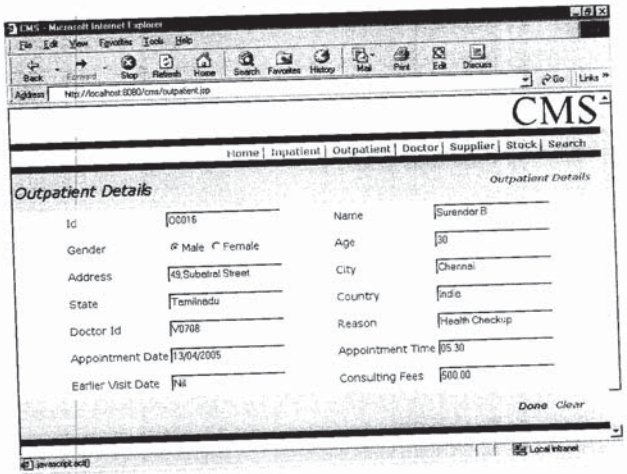
Local intranet

Inpatient Report

Id	I0023	Name	Kumar G
Gender	Male	Age	47
Address	49,Wellington Road	City	Chennai
State	Tamilnadu	Country	India
Doctor Id	R0538	Reason	Digestion Problem
Admisson Date	23/03/2005	Type of Admisson	Emergency
Ward	ICU	Initial Amount	5000.00

Outpatient Data Entry Screen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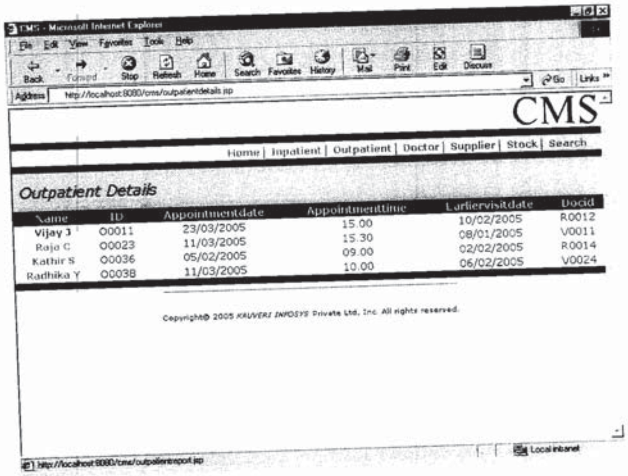
Local intranet

Outpatient Details

Id	O0016	Name	Surendar B
Gender	● Male ○ Female	Age	30
Address	49,Subetral Street	City	Chennai
State	Tamilnadu	Country	India
Doctor Id	V0708	Reason	Health Checkup
Appointment Date	13/04/2005	Appointment Time	05.30
Earlier Visit Date	Nil	Consulting Fees	500.00

Outpatient Details Screen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http://localhost:8080/cms/outpatientreport.jsp
Local intranet

Outpatient Details

Name	ID	Appointmentdate	Appointmenttime	Earliervisitdate	Docid
Vijay J	O0011	23/03/2005	15.00	10/02/2005	R0012
Raja C	O0023	11/03/2005	15.30	08/01/2005	V0011
Kathir S	O0036	05/02/2005	09.00	02/02/2005	R0014
Radhika Y	O0038	11/03/2005	10.00	06/02/2005	V0024

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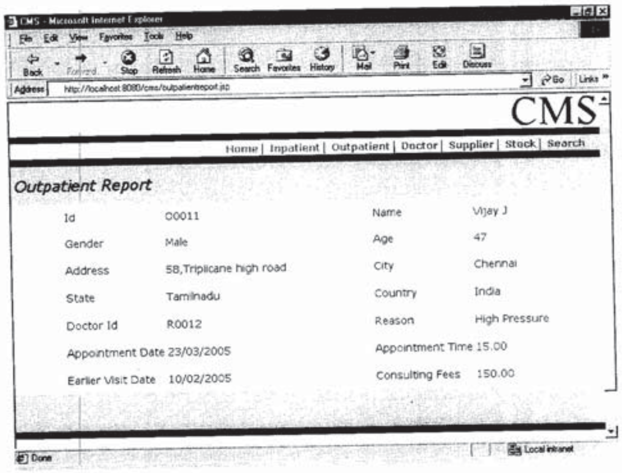
Outpatient Report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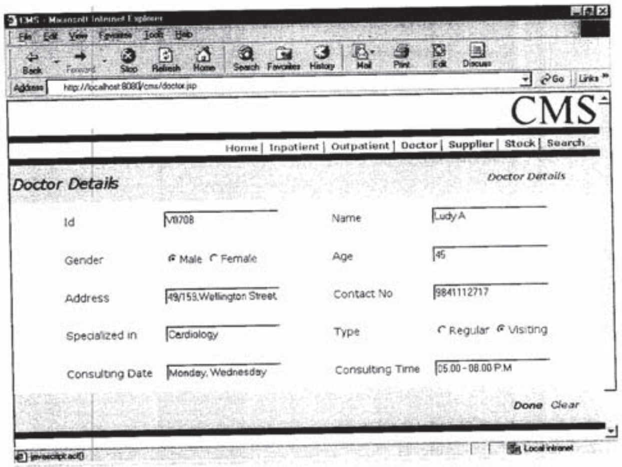
Local intranet

Outpatient Report

Id	O0011	Name	Vijay J
Gender	Male	Age	47
Address	58,Triplicane high road	City	Chennai
State	Tamilnadu	Country	India
Doctor Id	R0012	Reason	High Pressure
Appointment Date	23/03/2005	Appointment Time	15.00
Earlier Visit Date	10/02/2005	Consulting Fees	150.00

Doctor Data Entry Screen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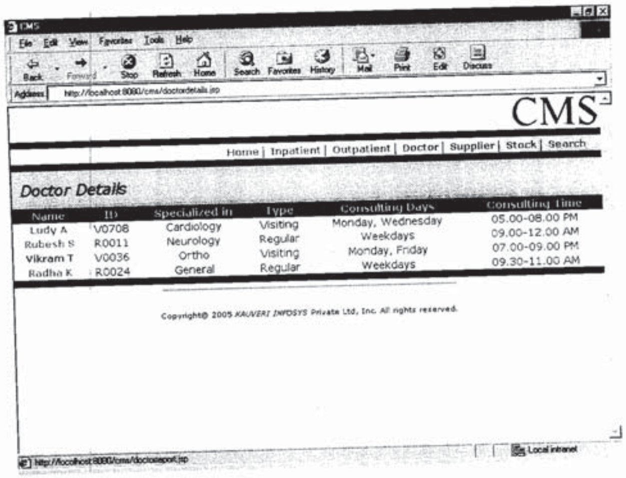
Doctor Details

Doctor Details

Id	V0708	Name	Ludy A
Gender	● Male ○ Female	Age	45
Address	49/159,Wellington Street	Contact No	9841112717
Specialized in	Cardiology	Type	○ Regular ● Visiting
Consulting Date	Monday, Wednesday	Consulting Time	05.00 - 08.00 P.M

Done *Clear*

Doctor Details Screen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Local intranet

Doctor Details

Name	ID	Specialized in	Type	Consulting Days	Consulting Time
Ludy A	V0708	Cardiology	Visiting	Monday, Wednesday	05.00-08.00 PM
Rubesh S	R0011	Neurology	Regular	Weekdays	09.00-12.00 AM
Vikram T	V0036	Ortho	Visiting	Monday, Friday	07.00-09.00 PM
Radha K	R0024	General	Regular	Weekdays	09.30-11.00 AM

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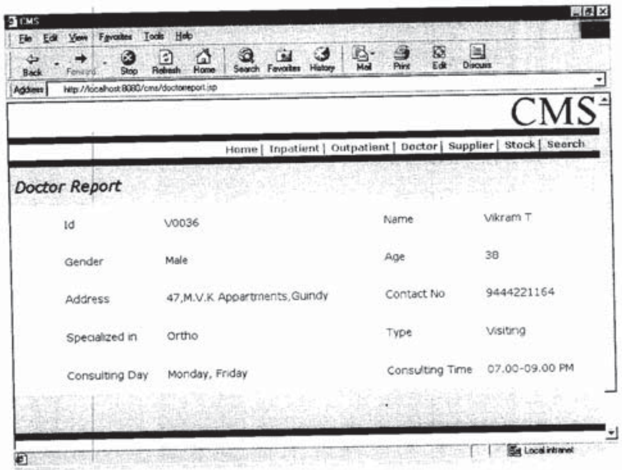
Doctor Report Form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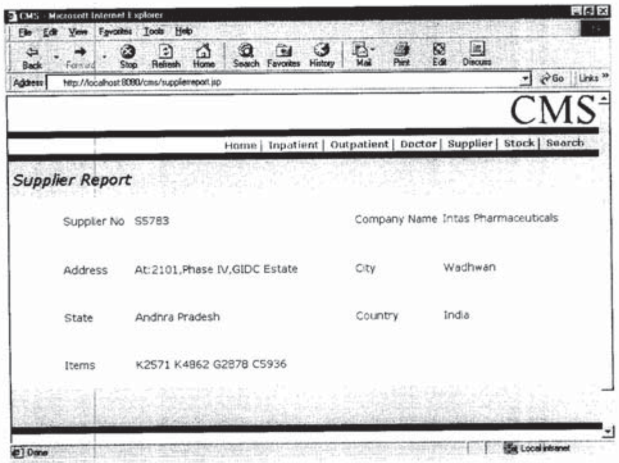
Local intranet

Doctor Report

Id	V0036	Name	Vikram T
Gender	Male	Age	38
Address	47,M.V.K Appartments,Guindy	Contact No	9444221164
Specialized in	Ortho	Type	Visiting
Consulting Day	Monday, Friday	Consulting Time	07.00-09.00 PM

Supplier Report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Local intranet

Supplier Report

Supplier No	S5783	Company Name	Intas Pharmaceuticals
Address	At:2101,Phase IV,GIDC Estate	City	Wadhwan
State	Andhra Pradesh	Country	India
Items	K2571 K4862 G2878 C5936		

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Tata McGraw Hill, 2000

[2] Er. V. K. Jain, "Java Server Pages and Servlets"

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