School Management System (ScMS)

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Abstract

The School Management System (ScMS) is an electronic solution to the current manual file system that is practiced in most of the Malaysian schools. ScMS is a web-based information system that enables school administrators in particular principals, senior assistants and teachers to manage resources, processes and co-ordinate routine school activities. It helps to cut down on bureaucratic red tape and enables the transfer of data at a much faster rate. In the outdated manual file system, there is no central repository on student or staff particulars. Retrieving data from the manual files is both tedious and cumbersome. Developing a computerized information system helps to reduce teachers' workload by automating most of the routine processes. The School Management System can speed-up retrieval of student data, staff data, summarize attendance and analyze students' results. It can even generate absentee report. In a nutshell, the ScMS when fully utilized would not only be a time saving efficient system but also improve productivity and bring about far-reaching benefits to the overall administration of schools. In the final analysis, greater efficiency in administration would facilitate more effective teaching and learning.

Acknowledgement

First and foremost, I would like to express my sincere thanks to my project supervisor, Mr Ang Tan Fong for his valuable advice, constructive ideas and patience throughout my project. There were many times I had made appointment with him which were outside his normal working hours. To all these requests he agreed without any complaints. I really do appreciate such sacrifices for the sake of guiding his students in particular me. This project would not have been a success without his assistance and constant guidance. He made sure my project meets all the requirements and achieve a reasonable standard.

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Chapter 1: Introduction

1.1 Overview
1.2 Project Objective
1.3 Project Scope
1.4 Project Limitation
1.5 Expected Outcome
1.6 Project Schedule
1.7 Report Organization

Chapter 1: Introduction

The School Management System (ScMS) is a web-based information system designed to automate many of the manual and routine work that is carried out in schools. The new system aids in easy transfer of information and brings more efficiency in school administration. Furthermore, it speeds up retrieval of student data, staff data, analyze results and even generate absentee report.

1.1 Overview of ScMS

The School Management System is a web based smart system where information is available immediately to all stakeholders with the appropriate security access. Administrators in particular principals and senior assistants get the most accurate information to make effective decision. For the teachers, ScMS is a time saving device and they can now concentrate much of their valuable time on teaching and learning. ScMS makes it possible to generate attendance records, make grade analysis, report cards and reports in just a few clicks.

1.2 Objectives

- To study the current school administration system and to ascertain its suitability in the context of the latest information technology era.

- To examine the productivity and efficiency of the staff in carrying out their daily tasks using the current system and make predictions and comparison on how it could be improved using the proposed computerized school management system.
- To examine how the monthly and end-of-semester assessment are recorded in manual documents (report cards and forms) and try to automate this process so that administrative work load could be reduced.
- To automate the present manual system of marking attendance.
- To recommend a computerized smart school management system(ScMS) to the school.

1.3 Project Scope

ScMS Application is divided into three main modules, namely Staff Module, Student Module and System Module . Each of these modules contain other sub modules. The Staff Module consists other sub modules namely staff biodata, staff training, assign subject, classroom attendance, assigned co-curriculum and assigned classroom. The Student Module comprise student biodata, student activity, student subject, parent biodata and student discipline. The System Module consists of other sub modules such as grade type, discipline category, co-curriculum, course list, staff category and subject list. These **three** Modules help to automate many of the functions or work carried out by these departments. A few other functions such as book aid scheme, collection of miscellaneous fees, preparing lesson plans and

timetabling are not included in ScMS and therefore beyond the scope of this project. A manual display of timetables is attempted. Users in particular teachers, school administrators and parents are given different passwords to gain access to the system. The project scope gives emphasis to the following:

- Development of an Attendance Module that allows teachers to check, summarize and analyze attendance records for a day, month or a semester.
- Development of an Assessment Module which enables class teachers to record, grade, rank , analyze marks and display marks of different subjects
- Development of a Discipline Module which enables the Senior Assistant to record , review and monitor students with discipline problems.
- Development of a Co-curriculum Module which allows school administrators to monitor not only the co-curricular activities but also to view members' list and find out the position held by a particular student.
- Development of a Training Module which allows administrators to seek information on the qualification, courses attended, present salary and other personal details of a particular teacher or staff. It would enable administrators to identify suitable teachers for a particular course or a particular post.

1.4 Project Limitation

The flow of documents and information in a school is rather large. It would take more than a year to fully automate the administrative processes and procedures that are at work in a school. The ScMS system produced covers only three main modules namely Staff Module, Student Module and System Module,

1.5 Expected Outcome

The expected outcomes for ScMS includes the following:

- Able to change the password from time to time to increase security
- Input and update the monthly test and exam result into the database
- Send exam results to the user/parents with matching student ID numbers
- Generate daily, monthly and yearly attendance reports
- User-friendly graphical user interface that is easy-to-use
- New students and teachers would be able to register and insert their personal particulars.
- The school administrator is able to identify teachers who had undergone training on a particular field or who need further training.

1.6 Project Schedule

In planning for the ScMS, a project schedule was designed for the development of the system. This is important so that the system can be implemented according to the time given. The project schedule is the operating timetable of the project. It serves as the .fundamental basis for monitoring and controlling project activity. In a project environment, paper scheduling function is important because projects lack the continuity of day-to-day operations and often present much more complex problem of coordination. [Meredith & Mantel, 1995]

The proposed project will be carried out in two stages where each stage has to be completed within a period of three and a half months. The work involved in the first stage is the project planning, research, analysis and design. The next stage involves the actual development of the system, testing and system implementation.

Figure 1.1 in the next page shows the project schedule. The project was scheduled using Gantt Chart. Gantt Chart is chosen because it can be prepared to help schedule tasks. They show when tasks should begin and end , what tasks can be run concurrently and what tasks must proceed serially.

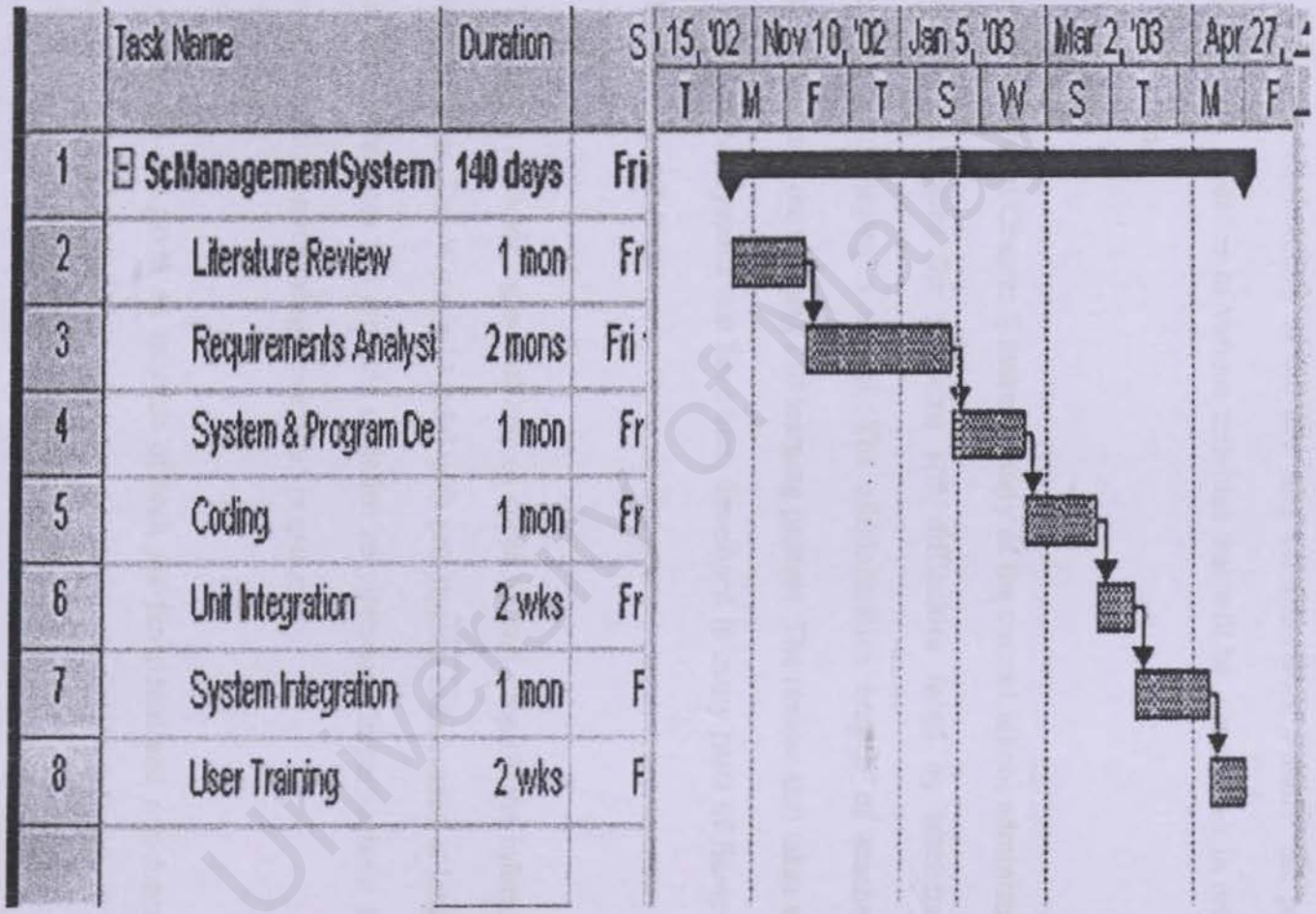


Figure 1.1 : Project Schedule

1.7 Report Organization

Chapter 1 gives a brief overview regarding ScMS. There are certain purposes, objectives and scope that must be fulfilled while developing this system in order for the system to meet the requirements of the user and administrators. Finally, the project schedule serves as a guideline of various activities that will be carried out in order to complete this project.

The literature review in Chapter 2 makes a study of the current school administration in the country. It traces the problems and difficulties faced by teachers and administrators in managing a school. The administrative burden of teachers in particular has affected the teaching and learning process. The review also takes a look at a few smart school systems that have been developed in many parts of Europe and The United States of America.

Chapter 3 looks at methodologies that help to speed up and simplify the information development process. The Waterfall Model with prototyping is discussed at length. It also deals with techniques that are used to define requirements. In particular it shows how relevant information regarding the system is gathered.

Chapter 4 explains and gives an analysis of both the functional and non-functional requirements of the system.

Chapter5 looks at the system design where it documents the process of program design, input form design, graphical user interface design and database design.

Chapter 6 deals with the hardware configuration as well as explains about the system implementation. It refers to transferring previously planned module and algorithm into instruction at can be run using ORACLE tools.

Chapter 7 makes sure the system is functioning according to the specified requirements and specification.

Chapter 8 evaluates the end results, problems and solutions, system constraints and future enhancements, suggestions and the summary of the whole project.

Chapter 2 : Literature Review

2.1 Analysis Studies
2.2 Review on Latest Technologies

Chapter 2 :Literature Review

The aim of review is to make a study of previous research effort within the country as well as outside the country on smart way of managing the school administration by computerizing the management process. The Ministry of Education within the last 2 years has vigorously and enthusiastically embarked on two projects. One is to produce courseware to aid in smart school teaching and learning. The other is to develop an efficient computerized management system. In fact, the Smart School Project which incorporates an efficient school management system is one of the targeted seven multimedia applications for rapid development of Malaysia's Multimedia Supercorridor. Both of these projects have been tendered to private companies such as Telecom and lesser known companies. In early 2003 about thirty selected schools were trying out a smart school system built by a foreign company on a trial basis. The system on trial had many drawbacks. Firstly. it had many foreign elements and was not customized to the Malaysian environment. Secondly, the cost is exorbitant. It would cost the Ministry of Education millions of ringgit if the Government decides to purchase this system. There is therefore an urgent need to quickly develop a smart school system which would not only be cost effective but also suit to the Malaysian curriculum. The proposed ScMS if implemented would be able to replace the outmoded manual school administration system. A sophisticated computer information system would be able to revolutionize our education system.

2.1 Analysis Studies

To analyze the present system we need to take a look at how a school is managed. The management team in school is made up of the Principal, Senior Assistants, Head of Department, Teachers and Office Staff to a lesser extent. According to Ronald F. Campbell, "Administration has as its central function the enhancement of teaching and learning". There have been frequent complaints that principals, senior assistants and in particular teachers have been bogged down by administrative duties. It seems then the present administrative tools which are based on the file processing system are grossly inadequate to meet the needs of the 'knowledge-based' environment. School supervision and management not only involves curricular activities like teaching but it also includes co-curricular activities. These activities have to be monitored on a day-to-day basis and their progress documented. The success of a school largely depends upon the ability of the principal in organizing and administering the school. Using the traditional file processing system definitely slows down the administration of an institution. In fact, the school principal holds the primary key. Outstanding performance of a school very much depends on the school principal or headmaster.

2.1.1 Current Process Flow (Manual System)

There is no one particular school system that is practised in the country. Generally the

teachers as well as the principals have to keep record of pupils. Pupils' records are kept in registers, report cards, card 001/002 (pupil record cards) and record books. Teachers' record on the other hand is kept in separate files. Information is not kept in a central database. Analysis of data pertaining to ranking in class, standard, grade, total scores, attendance etc are still done manually. There is repetition of tasks (data duplication).Valuable time is spent in record keeping rather than in teaching. Retrieval of data is tedious and time consuming.

2.1.1.1 Teacher Records

In the current manual system, teacher records are kept in separate files and locked in cabinets in the main school office. If the Principal needs to look at the record of a particular teacher, then he needs to physically take out the files from the cabinets where it is kept. This involves time and delay in retrieving teacher information. Furthermore, keeping records of teacher files both present and past occupy valuable space. Such record keeping hampers the decision making process. The Ministry of Education, State Education Department and the District Education Offices time and again ask the teachers to fill up their personal and academic details. The overworked teachers have to comply by filling up these forms many times. Again valuable teacher time is used to do such routine jobs. If a central database system could be established, then teacher details could be sent by just a click of a mouse.

2.1.1.2 Student Record

Student records and reports reflect a similar scenario. Class name lists, exam results, report of pupils who face disciplinary action, lists of eligible students for book aid scheme, list of students who did not pay miscellaneous fees and various other reports have to be typed and copies made so that these name lists or reports could be sent to various departments which require them. If an error or an update had to be done, then the required data have to be retyped once more. Time is also spent on sending the reports to their place of destination or to the post office to post the reports. Such a practice is surely a waste of time as many man-hours are lost.

2.1.1.3 Exam Results

Presently, exam results are received by the State Education Offices and distributed to the various schools. This means all school principals have to come to the State capital to collect their results. This entails time and money. It also means schools in remote areas might face a delay in obtaining their results. Such delays in announcing national examination results should be avoided by all means in this computer era. " As the nation enters the twenty first century, schools would need a method for structuring information, promoting and preserving organizational learning and developing the staff as knowledge workers so that knowledge is both used and continues to be created".

2.1.2 Similar System available in the Internet

The onset of Information Technology has penetrated every aspect of our life and the way we run our schools is no exception. A number of smart systems have been

developed in many parts of the world in recent years. We need to look at some of these systems. PowerSchool Student Information System from Apple is a leading web-based student information system implemented in some of the schools in U.S.A and Canada. PowerSchool purports to give administrators and teachers the ability to easily and cost-effectively manage student records and further give parents real-time access to track their children's progress. PowerSchool's capabilities include the basics such as transcripts, report cards, attendance, discipline as well as specialized capabilities including parental access to real time grades on the internet. This means that not only administrators but also parents, teachers and students have access to real-time data. PowerSchool allows parents to know how their children are doing on a continual basis by using the internet or PowerSchool's automated telephone system.

Figure 2.1: PowerSchool Homepage

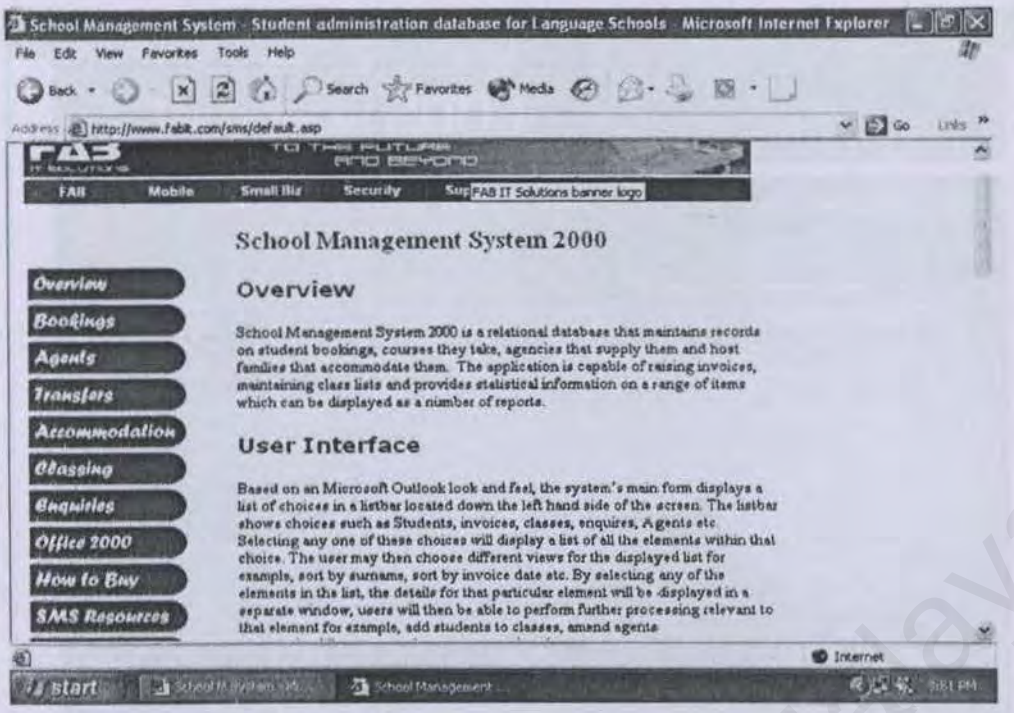


Figure 2.2 : School Management System 2000

The United Kingdom too has come out with its own computerized management system. It is called School Management System 2000 and it is a relational database that maintains records on student bookings, courses they take, agencies that supply them and host families that accommodate them. Other interesting features include Enquiry Tracker, Classing Module, Teachers, Booking form and numerous wizard.

Windsor 2003 is another smart school management system. Windsor 2003 boasts of a major breakthrough in the way schools are administered. Its eye-catching features include Visual Attendance for teachers, Visual Student Profile, eMail-out and student picture ID cards.

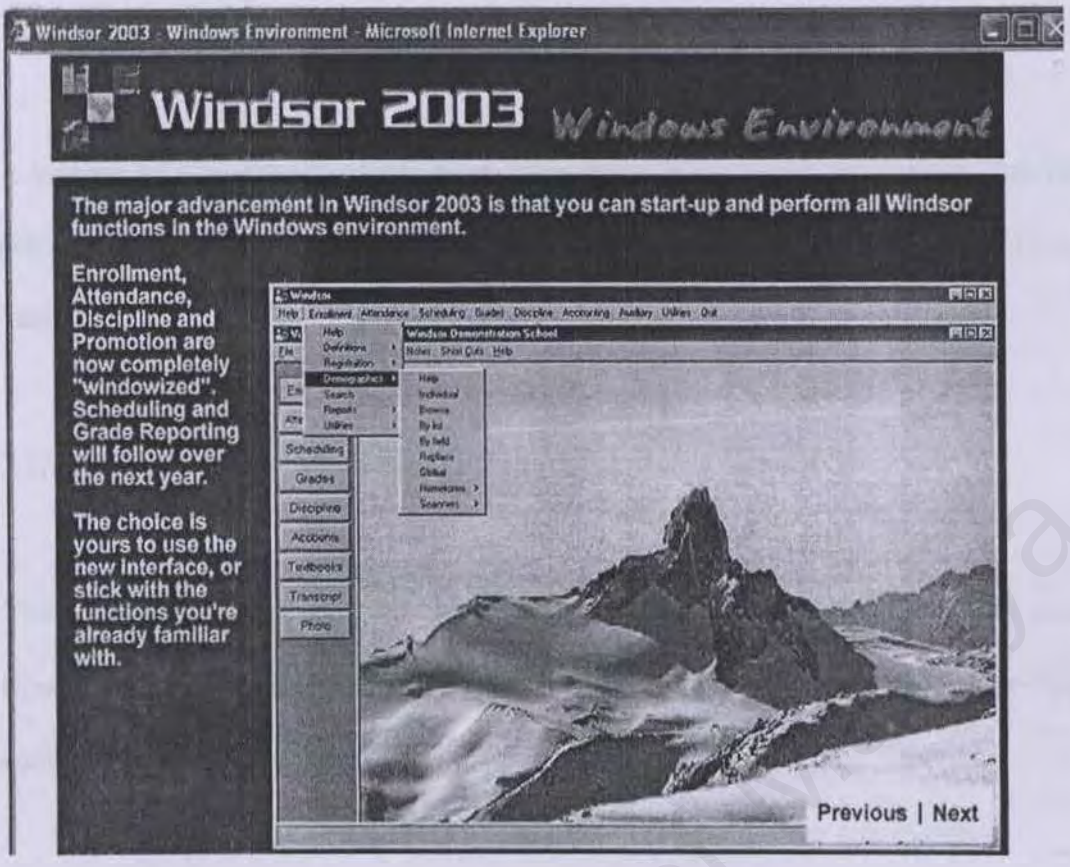


Figure 2.3 : Windsor 2003

2.1.3 Conclusion

The management systems in foreign countries are quite different in relation to system requirements and needs. The multiracial society and the Ministry of Education in Malaysia are unique and therefore the proposed ScMS would adhere strictly to the needs of the Malaysian society.

Providing efficient and prompt services to all the stakeholders(teachers, students, principals and administrative staff) are essential to the nation's growth. ScMS will bring the 'state-of-art' information system to the education field in Malaysia.

2.2 Review of Latest Technologies

A number of new developments have taken place in computer technology that have helped not only to build better operating systems but also better and efficient databases.

2.2.1 Client-Server Architecture

The client/server architectural model is a distributed system model which shows how data and processing are distributed across a range of processes. The major components of this model are:

- A set of stand-alone servers which offer services to other sub-systems.
- A set of clients that call on the services offered by servers.
- A network which allows the clients to access these services

Clients may have to know the names of the available servers and the services that they provide. However, servers need not know either the identity of clients or how many clients there are. Clients access the services provided by the server through remote procedure calls.

The client-server approach can be used to implement a repository-based system where the repository is provided as a system server. Sub-system accessing the repository are clients. Normally, however, each system manages its own data. Servers and clients exchange data for processing. This can result in performance problems

when large amounts of data are exchanged. However, as faster networks are developed, this problem is becoming less significant.

The most important advantage of the client-server model is that it is a distributed architecture. Effective use can be made of networked systems with many distributed processors. It is easy to add a new server and integrate it with the rest of the system.

2.2.1.1 Advantages of Client Server

Client/server is an open system. It offers organizations the ability to distribute processing and data across networks using powerful graphical workstations, servers and mainframes, the client/server enables right rightsizing, the selection and location of computing resource according to the needs of the individuals and work groups. One of the prime benefits of a client/server system is a lower cost. Another is increased productivity from the individual to the corporation that results from better access to information and the distribution resources through the corporation. Additional benefits of client/server include:

- Interoperability - key components (client/server/network) work together
- Scalability – any of the elements may be replaced when the need to either grow or reduce processing for that element dictates without major impact on the other elements.
- Adaptability – new technology may be incorporated into the system.
- Cost effectiveness – using less expensive MIPs that are available on each platform insures affordability
- Data Integrity – entity, domain and referential integrity are maintained on

the database server.

- Performance – performance may be optimized by hardware and process
- Security – data security is centralized on the server

2.2.1.2 Disadvantages of Client Server

Although client/server computing provides innovative solutions for a number of businesses, it may not be the right solution for all the flexibility of client/server system and the complexity of networking require careful strategic planning up front.

Other disadvantages are:

- The hardware, software and communication technology is neither mature nor entirely stable, nor easy to assemble.
- Because client/server is not well understood it is frequently sold inappropriately or oversold to management and unsatisfied expectations result
- Support cost can run three times the prices of the system hardware and software
- Redesign and reprogramming are not trivial exercises.
- Backup and recovery in a client/server environment can be expensive
- The more the distributed the system, the greater its vulnerability
- Client/server is an evolving technology and as such there is no standardization

In theory, client server looks great; it allows an organization to rapidly create graphical applications that reflect changing business needs. Underneath the surface, however are unexpected costs that can make client/server systems more expensive to operate than centralized host-based systems are.

2.2.2 Web Server

2.2.2.1 Apache Web Server

Apache server is a powerful yet flexible web server. It is compliant with HTTP/1.1 and implements the latest protocols including HTTP/1.1 (RFC 2616). Apache Web Server is highly configurable as it is open source code and extensible with third-party modules and can be customized by writing 'modules' using the Apache module API. Moreover, it provides full source and comes with an unrestrictive license.

Apache web server runs on Windows NT/9x, Netware 5.x, OS/2 and most versions if UNIX as well as several other operating systems. The web server is actively being developed and encourages user feedback through new ideas, bug reports and patches. The features of Apache Web Server include DBM databases for authentication, customizable responses to errors and problem, multiple Directory Index directives and unlimited flexible URL rewriting and aliasing. It is compatible with Windows 2000, NT, Linux, Netware 5.0 (with Service Pack 5), 5.1 (with Service Pack), UNIX, BSD, HP MPE/iX 6.0 or higher and TPF version 4.1 PUT09.

However there are limitations in Apache Web Server. To corporate web server customers, the fact that Apache is free can be a drawback signifying a lack of the explicit or implied accountability they get with vendor products. Its flexibility also can be a double edge sword. Apache is easy to setup, but for those who try to extend it had better know what they are doing. Where there is not a lot of expertise available, customers may also prefer to see features that come together and have been tested together rather than

search them out from multiple sources on the Internet. The lack of software support for Apache has been confined to online resources.

2.2.2.2 Internet Information Server (IIS) v5.0

Internet Information Service 5.0 (IIS) is the Windows 2000 Web Service that makes it easy to publish information on the internet for the Internet. It is completely integrated with Windows NT Directory Services and includes Crystal reports, a visual reporting tool. Internet Information Server 5.0 has many new features to enables user to create a scalable and flexible web application. It allows administrators to configure servers, sites, virtual directories, subdirectories and files individually. It also includes crash protection that allows users to run multiple applications reliably. Moreover, IIS includes tools to analyze and manage web server content and supports multiple web sited on one IP address.

2.2.2.3 Netscape Enterprise Server

The Netscape Enterprise Server software runs on a representative collection of operating systems: AIX, Digital Unix, HP_UX, Irix, Solaris and Windows NT. It provides a powerful development environment that support development of web- based application that can be run on the Internet, an intranet or an extranet. Netscape Enterprise Server's content management allows user to create their own Netshares, personal home directories

using an interesting method that provides services including link management, web publishing, agent services and access and version control.

Like most other server programs, Netscape Enterprise Server supports dynamic application development including CGI and Netscape's own version of application program interface: Netscape Server API (NSAPI). Netscape Enterprise Server supports the Java Servlet API for Server-side applications. A Netscape product called liveware runtime environment is included in Netscape Enterprise Server and allow user to write server-side scripts that among other things, provide connectivity to databases, including Oracle, Sybase and Infomix. It's ODBC conformance means that Netscape Enterprise Server provides connectivity to other database sources as well.

2.2.3 Operating System

2.2.3.1 Unix

Unix is an increasingly popular operating system and it is traditionally used on minicomputers and workstations in the academic community. Unix is now available on personal computer and the business community has started to choose Unix for its openness.

Unix can run on multiple platforms and the minimum requirements are vary depending on platform chosen. There are several advantages about Unix that enables it to become one of the popular operating system among large organization. These include

using an interesting method that provides services including link management, web publishing, agent services and access and version control.

Like most other server programs, Netscape Enterprise Server supports dynamic application development including CGI and Netscape's own version of application program interface: Netscape Server API (NSAPI). Netscape Enterprise Server supports the Java Servlet API for Server-side applications. A Netscape product called liveware runtime environment is included in Netscape Enterprise Server and allow user to write server-side scripts that among other things, provide connectivity to databases, including Oracle, Sybase and Infomix. It's ODBC conformance means that Netscape Enterprise Server provides connectivity to other database sources as well.

2.2.3 Operating System

2.2.3.1 Unix

Unix is an increasingly popular operating system and it is traditionally used on minicomputers and workstations in the academic community. Unix is now available on personal computer and the business community has started to choose Unix for its openness.

Unix can run on multiple platforms and the minimum requirements are vary depending on platform chosen. There are several advantages about Unix that enables it to become one of the popular operating system among large organization. These include

- **High performance** – Unix is the choice for high performance network applications. It will outperform other operating system when running on equivalent hardware. Yahoo, USWest and Xooms.com use Unix as their main server's operating system because of its ability to handle network traffic with high performance.
- **High reliability** – Unix is extremely robust because the new file system optimizes disk input and output for high performance. It also ensures reliability for transaction-based application such as databases.
- **Good development environment** – Unix includes an extensive collection of development tools such as C/C++, Java, HTTP, Perl and Python. All of these are free, come in full source code and are included in the installation.

Although Unix can be considered one of the popular operating system but it also has a few disadvantages such as

- **Expensive** – Unix is very expensive compared to other operating system. All Unix machines are also very expensive because it is specially designed only for Unix.
- **User friendliness** – The interface in Unix is based on command-line interface (CLI) and it requires user to type specific command in order to execute any applications or instructions. Many users are not familiar with CLI, so it is quite difficult for them to use Unix. Although Unix had developed a few Graphical User Interface (GUI) but it is still not as complete and friendly as the Windows Desktop.

- **Installation problems** – Many users will face problem during installation because the installation process needs the concept of disk partitioning and mounting of the systems, which are relatively an advanced concept for new user. The users also have to know the details of the graphics adapter card and monitor in order to provide the information the installation project requires.
- **Difficult to configure and maintain** – Unix is difficult to configure and maintain because it requires the users to type a set of specific commands for configuration and maintenance. The configuration is not guided with any Wizard or GUI interface

2.2.3.2 Windows 2000

Windows 2000 is the latest commercial version of Microsoft evolving Windows operating system (although a new version, Windows XP is now available). Previously called Window NT 5.0, Microsoft emphasizes that Windows 2000 is evolutionary and "Built on technology". Windows 2000 is designed to appeal to small business and professional users as well as to the more technical and larger business market for which the NT was designed. For many Windows 95 and Windows 98 users, Windows 2000 may be regarded as a step to take when purchasing their next computer.

The Windows 2000 product lines consist of four products:

- Windows Professional, aimed at individuals and businesses of all sizes. It includes security and mobile use enhancements. It is the most economical choice

- Window 2000 Server, aimed at small-to-medium size businesses. It can function as a Web Server and/or a workgroup (or branch office) server. It can be part of a two-way symmetric multiprocessing system. Nt 4.0 servers can be upgraded to this server.
- Windows 2000 Advanced Server, aimed at being network operating system and/or an application, including these involving large databases. This server facilitates clustering and load balancing. NT 4.0 servers with up to eight-way SMP can upgrade to this product.
- Windows 2000 Datacenter Server designed for large data warehouses, online transaction processing (OLTP), Econometric analysis and other applications requiring high speed computation and large databases. The Datacenter Server supports up to 16-way SMP and up to 64 gigabytes of physical memory.

Windows 2000 is reported to be more stable (less apt to crash) than Windows 98/NT systems. A significant new feature is Microsoft's Active Directory, which among other capabilities, enables a company to set up virtual private networks to encrypt data locally or on the network and to give users access to shared files in a consistent way from any computer network.

Notable features of the Windows 2000 products are:

- A fully customizable administrative console that can be based on tasks rather than files, applications or users.

- A new file directory approach called Active Directory that lets the administrator and other users view every file and application in the network from a simple point-of-view.
- Dynamic Domain Name Server (DNS), which replicates changes in the network using the Active Directory Service (WINS) whenever a client is reconfigured.
- The ability to create, extend or mirror a disk volume without having to shut down the system and to back up data to a variety of magnetic and optical storage media.
- A distributed file system (DFS) that lets user see a distributed set of files in a single file structure across departments, divisions or an entire enterprise. Close integration with and support for Microsoft's Message Queue Server, Microsoft Transaction Server and Internet Information Server (IIS).

2.2.3.3 Linux

Linux is a Unix like operating system that was designed to provide personal computer users a free or very low cost operating system compare to traditional and usually more expensive Unix system.

Linux is a remarkably complete operating system, including a graphical user interface, on X Windows System, TCP/IP, the Emacs editor and other components usually found in a comprehensive Unix system. Unlike Windows and other proprietary systems, Linux is publicly open and extensible by contributors. Because it conforms to the portable

operating system Interface standard user and programming interfaces, developers can write programs that can be ported to other operating system.

2.2.4 Database Server

A database is a collection of data that is organized so that it's contents can be easily accessed, managed and updated. The most prevalent type of database is the relational database, a tabular database in which data is defined so that it can be reorganized and accessed in a number of different ways. A distributed database is one that can be dispersed or replicated among different points in a network. An object oriented programming database is one that is congruent with the data defined in object classes and subclasses.

2.2.4.1 Database Management System (DBMS)

A Database Management System (DBMS) is a program that lets one or more computer users create and access data in a database. DBMS also ensures the integrity and security of the data. The most typical DBMS is a relational database management system (RDBMS). A standard user and program interface is the Structured Query Language (SQL).

A DSMS can be thought of as a file manager that manages data in database rather than files in file systems. A DBMS is usually an inherent part of a database product. Microsoft

Access is a popular example of a single or small-group user DBMS. Microsoft's SQL Server is an example of a DBMS that serves database request from multiple (client) users.

2.2.4.2 Oracle

Oracle platform is available for multiple operating systems and research proved that Oracle runs great on Unix. Oracle is more standards-based as well with a set of neat features. Oracle databases are as powerful as the users want them to be. Oracle is able to efficiently utilize hardware platform and manage multiple high-speed processors, clustered servers, high bandwidth connectivity and fault tolerant storage technology. Java application can run perfectly with combination of Oracle database.

Oracle also provides the users with more power and flexibility with the database to meet the user requirements. Oracle is able to handle a rapidly expanding amount of users and data gracefully.

One of the disadvantages is oracle has weird concept and names as well. As a results, users have to undergo specialized training or knowledge to be more familiar with oracle database management; even the experts of DBMS, like Microsoft SQL Server and Microsoft Access. Oracle needs a costly start-up solution of database management. Besides, total ownership is high for Oracle.

2.2.4.3 MySQL

MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL), the most popular language for adding, accessing and processing data in a database. MySQL is noted mainly for its speed, reliability and flexibility. It works best when managing the content and not executing transactions.

The MySQL relational database system is fully multi-threaded using kernel threads, provides application interfaces (API) for C, C++, Java, Perl and PHP allow for many column types and offer full operator and function support in the SELECT and WHERE parts of queries.

2.2.4.4 Microsoft SQL Server 2000

As database grows and become more complex, there is some point when a Microsoft Access database should be upsized to a Microsoft SQL Server database. This is to optimize database and application performance, scalability, security, reliability and availability. The following reviews on different areas in SQL server.

- High performance and scalability – SQL server can support very large database up to on terabytes in contrast to only 2 gigabytes for Access. SQL server is well integrated with Microsoft NT thus make it works efficiently on the platform. Besides SQL Server 2000 can run in the stand-alone laptop computer running Windows 95/98.

- Increased availability – dynamic backup can be carried out while the database is being used. Users do not need to exit from the database to do backup. Hence the database can be available at all times.
- Improved security – SQL server integrates with Windows NT that user only needs single log-on to the network and database. A user cannot use SQL Server without accessing to the network first. This results in better security and eases the administrator.
- Immediate recoverability – When a system suddenly breaks down, SQL server database can have automatic recovery mechanism that recovers the database to the last state of consistency without administrator intervention.
- Reliable distributed data and transactions – SQL servers supports atomic transactions without transactions logging. This guarantees that all changes performed within a transaction are either committed or rolled back.
- Server-based processing – SQL server is designed as a client/server database residing on a server. It reduces network traffic by processing database queries first before sending them to clients. Processing is always done on the server-stored procedures and triggers are also supported to be processed on the server.

2.2.5 Database Access Technology

2.2.5.1 OLE DB

OLE DB is Microsoft's strategy low-level application program interface (API) for access to different data sources. OLE DB includes not only the Structured Query Language (SQL) capabilities of the Microsoft-sponsored standard data interface Open Database Connectivity (ODBC) but also includes access to data other than SQL data.

As a design from Microsoft's Component Object Model (COM), OLE DB is a set of methods (in earlier days, these might have been called *routines*) for reading and writing data. The objects in OLE DB consist mainly of a data source object, a session object, a command object, and a row set object. An application using OLE DB would use this request sequence.

- Initialize OLE
- Connect to a data source
- Issue a command
- Process the results
- Release the data source object and uninitialize OLE

OLE DB once stood for "Object Link Embedding" and "DB" database. However, Microsoft no longer ascribes these meanings to the letters "OLE" and "DB"

2.2.5.2 ODBC (Open Database Connectivity)

Open Database Connectivity (ODBC) is an open standard application-programming interface (API) for accessing a database. By using ODBC statements in a program, you can access files in a number of different databases, including Access, dBase, DB2, Excel,

and Text. In addition to the ODBC software, a separate module or driver is needed for each database to be accessed. The main proponent and supplier of ODBC programming support is Microsoft.

ODBC is based on and closely aligned with The Open Group Standard Structured Query language (SQL) Call-level Interface. It allows programs to use SQL request that will access databases without having to know the proprietary interfaces to the databases. ODBC handles the SQL request and converts it into a request the individual database system understands.

ODBC was created by SQL Access Group and first released in September 1992. Although Microsoft Windows was the first to provide an ODBC product, versions now exist for UNIS, OS/2, and Macintosh platform as well.

In the never distributed object architecture called Common Object Request Broker Architecture (CORBA), the Persistent Object Service (POS) is a superset of both the Call-level Interface and ODBC. When writing programs in the Java language and using the Java Database Connectivity (JDBC) application program interface, you can use a product that includes a JDBC-ODBC "bridge" program to reach ODBC-accessible database.

2.2.5.3 ADO.NET

From an architect's perspective ADO.NET represents the abstract design concepts used to build the data access classes within the .NET Framework. There were several main design goals driving ADO.NET:

- Explicit and factored object model. ADO..NET is designed to be a simple to use object model in w hich the developer has c omplete control over how to control data source connectivity, command execution, and data manipulation.
- Disconnected data cache model. N-tier programming and XML Web service architecture require that applications can participate in a disconnected, loosely coupled manner. ADO. NET provides a comprehensive caching data model for marshalling data between applications or services and then to optimistically update the original data sources or source.
- XML support. XML is the key to building interoperable applications and more robust data processing models. XML support has been built directly into the NET Framework, ADO.NET leverages this implementation by providing a seamless interaction with XML in a relational manner or in a native XML manner.
- Leverage existing ADO knowledge. Although the ADO.NET object model is different from the existing ADO model,, the basic constructs are the same. The ADO.NET object model consists of provider, connection and command objects. Thus current ADO developers should be able to efficiently migrate to ADO.NET

From a developers perspective ADO.NET represents the concrete implementation of classes inside the .NET Framework used for data access.

2.2.5.4 Java Database Connectivity (JDBC)

Java database connectivity (JDBC) is an application programs interface (API) specification-connecting programs written in java to the data in popular database. The application program interface lets you encode access request statements in Structured Query Language (SQL) that are then passed to the program that manages the database. It returns the result through a similar interface.

JDBC is very similar to the SQL Access Group's Open Database Connectivity (ODBC) and with a small bridge program, you can use the JDBC interface to access the databases through the ODBC interface.

2.2.6 Programming Language

2.2.6.1 C++

C, the predecessor to C++, has become one of the most popular programming languages. Originally designed for the system programming, C enables programmers to write efficient code and provide a close access to the machine C compilers found on practically every UNIX system are now available with most operating system.

C++ represents a significant extension of C abilities. We might then consider C to be a subset of C++. C++ supports essentially every desirable behavior and most of the undesirable ones of its predecessor, but provides general language improvements as well as adding Object Oriented Programming capabilities. User can simply create structured code that uses only C++ non-Object Oriented Programming features.

C++ have many features of the C language, such as efficiency, closeness to the machine, and a variety of built in types. A number of new features were added to C++ to make the language even more robust, many of which are not used by novice programmers. Most of these features can be summarized by two important design goals: strong compiler type checking and a user-extensible language.

C++ also enables programmers to incorporate new types into the language, through the use of classes. A class is a user-defined type. The compiler can treat new types as if they are one of the built-in types. This is a very powerful feature. In addition, the class provides the mechanism for data abstraction and encapsulation, which is the key to object oriented programming.

2.2.6.2 VB.Net

To rapidly built enterprise Web applications, developers must rely on business logic that is scalable, robust, and reusable. Over the past several years, object-oriented programming has emerged as the primary methodology for building systems that meet

these requirements. Using object-oriented programming languages helps make large-scale systems easier to understand, simpler to debug, and faster to update.

To enable Visual Basic developers to benefit from object-oriented design and to simplify the development of enterprise Web applications, full object-oriented language features, including implementation inheritance will be supported in the next version of Visual Basic – Visual Basic.NET. With these new language features, Visual Basic .NET will deliver all the power required to quickly and effectively develop enterprise-critical applications while maintaining the instant accessibility that has made it the world's most popular development tool.

Visual Basic .NET will provide a first class object-oriented programming language with new features such as implementation inheritance, overloading, and parameterized constructors. Additionally, developers will be able to create highly scalable code with explicit free threading and highly maintainable code with the addition of modernized language constructs like structured exception handling.

Visual Basic will provide all the language characteristics that developers need to create robust, scalable distributed Web applications with the following new features:

New object-oriented programming features

- Inheritance

- Overloading
- Parameterized Constructors

Additional modernized language features

- Free Threading
- Structured Exception Handling
- Strict Type Checking
- Shared Members
- Initializers

Visual Basic is now a first class object-oriented programming language. Using Visual Basic .NET, developers will be able to create highly scalable code with explicit Free Threading. The code they write will be highly maintainable with the addition of modernized language constructs like Structured Exception Handling. Visual Basic will provide all the language characteristics that developers need to create robust, scalable distributed Web applications.

2.2.6.3 Java

Java is a programming language designed for use in the distributed environment of the Internet. It was designed to have the "look and feel" of the C++ language, but it is simpler than C++ and enforces on object oriented programming model. Java can be used to crate complete applications that may run on a single computer or to be

distributed module or applet for use as part of a web page. Applets make it possible for a web page user to interact with the page.

The major characteristics of Java are:

- The programs created are portable in the network. The source program is compiled into what Java calls byte code, which can be run anywhere in a network or a server or client that has Java Virtual Machine. The java Virtual Machine interprets the byte code into code that will run on real computer hardware. This means that individual computer platform differences such as instructions lengths can be recognized and accommodated locally just as the page is being executed. Platform-specific versions of program are no longer needed.
- The code is robust, here meaning that unlike program written in C++ and perhaps some other language, Java objects can contain no references to data extended to themselves or other known objects. This ensures that an instruction cannot contain the address of data storage in another application or in the operation system itself, either of which would cause the program and perhaps the operating system itself to terminate or "crash". The Java Virtual machine makes a number of checks one each object to ensure integrity
- Java is object oriented, which means that among other characteristics on object can take advantage of being part of a class of objects and inherit code that is common to the class. Objects ate thought of as "nouns" that a user might relate to than the traditional procedure "verbs". A method can be thought of as one of the objects capabilities or behaviors

- In addition to being executed at the client rather than the Server, a Java applet has other characteristics designed to make it run fast.
- Relative to C++, Java is easier to learn

2.2.7 Web Development Tools (Authoring Tools)

2.2.7.1 Visual Interdev

Visual Interdev is Microsoft's development tool for building a dynamic, data-driven Web site. Whereas Microsoft's Front Page is an HTML editor aimed at letting non – programmers build the pages for a web site. Visual Interdev provides the tools for programmer to build a Web site. (Front Page and Interdev are said to interoperable). Visual Interdev offers a user interface similar to those for Visual Basic, Visual J++ and Visual Studio. Using Visual Interdev, one can assemble pages that use Microsoft's ActiveX technologies including Active Server Pages (ASP) technologies. The developer can build and insert ActiveX control or Java applet. Visual Interdev includes a HTML editor and support for dynamic HTML. The web site can be integrated with server programs written in any language and access to almost any database using Microsoft's Universal Data Access including ActiveX Data Objects, Open Database Connectivity and OLE Database.

2.2.7.2. Microsoft Front Page

Microsoft Front Page adds value to creating Web application by adding the visual components that us missing from Visual Interdev. Microsoft Front Page enables users to quickly generate HTML and save a lot of time and frustration spent on getting complicated HTML page layout properly adjusted. After the page is created, users can edit the HTML source code to create the dynamic content on the page while relying on the HTML tags to quickly generate the look and feel of the page.

2.2.7.3 Visual Studio .NET Professional

Visual Studio .NET enables developers to build the next generation of Internet applications today. Providing the most modern and feature-rich development environment, Visual Studio .Net provides developers with the tools for integrating solution across operating systems and languages. With Visual Studio .NET , developers can easily convert existing business logic into reusable XML Web Services, encapsulating processes and making them available to applications on any platform. Developers can easily incorporate any number of Web Services that are cataloged and available in many independent UDDI directories, providing a strong foundation of services and business logic for their applications.

Using XML, an industry standard technology for describing data, Visual Studio .NET developers can build high-performance data-driven applications. Developers can use built-in ADO.NET tools that target a variety of databases, including SQL Server, Oracle, or any other XML source. With intrinsic support for XML, ADO.NET enables

developers too share data across disparate computing platforms. Additionally, Visual Studio .NET includes the Microsoft Data Engine (MSDE), a 100% SQL Server-compatible database that provides programmers with a viable development database and natively supports XML for maximum interoperability.

Visual Studio .NET allows programmers to create and deploy critical server-based business logic. Historically, server-based programming has been tedious to code, pone to error, and difficult to test. With Visual Studio .Net, developers can visually compose middle-tier Components Designer (VCD). The VCD enables developers to drag and non-visual objects such as message queues, timers, and event logs, to a design surface, automatically discovering all necessary server-based resources and configuring required components. Finally, producing Web applications requiring critical changes can be altered using the new Dynamic Properties feature, letting developers simply update XML files without requiring a full recompilation of the application.

Visual Studio .NET makes it simple to create solutions that span any device. With it's powerful WYSIWYG designer for Web pages, HTML IntelliSense, and Style Sheet Editor, Visual Studio .NET helps developers feel comfortable authoring complex Web solutions while leveraging Visual XML designers and XML IntelliSense for drag and drop creation and manipulation of data. With automatically generated client-side validation code, Web developers can rest assured that their applications works in Internet Explorer and Netscape, reducing the amount of JavaScript code necessary to write.

Windows developers will find the new Window forms to be intuitive and efficient as they construct code using any .NET language, including Visual Basic .NET or Visual C# .NET. With Visual Inheritance, developers can greatly simplify the creation of Window applications by centralizing in parent forms the common logic and user interface for their entire solution. Using control anchoring and docking, programmers can provide resizable forms automatically without code, while the in-place menu editor enables developers to visually author menus directly from within the Forms Designer.

Visual Studio .NET continues to set the benchmark for developer productivity. With the single unified Integrated Development Environment (IDE) for all languages, including Visual Basic .NET, Visual C++ .NET, and Visual C# .NET development organizations can take advantage of a common toolbox, debugger, and task window, greatly reducing developer learning curve and ensuring that they can always choose the language most appropriate for their task and expertise. With IntelliSense statement completion and automatic syntax error checking, Visual Studio .NET informs developers when code is incorrect and provides immediate insight into class hierarchies and APIs. Using the Solution Explorer, developers can easily reuse code across projects and even build multi-language solutions that most effectively meet their business needs. And, thanks to the fully extensible IDE, developers can enjoy the benefits of a vibrant third party add-in and component vendor community that helps them further customizes and extends the environment to suit their needs.

With application wizards, projects templates, and example source code developers can rapidly create Windows, Web, and device applications with minimal up-front investment. Dynamic Help and the Microsoft Developer Network (MSDN) provide

assistance based on the current task and programming language, ensuring that developer are never at a loss for information on the net .NET platform or their language of choice. Visual Studio Macros, like VBA macros in Office, enable automation of routine tasks within the IDE further enhancing the overall productivity of Visual Studio developers.

Finally, developers cab choose from a set of modernized languages that gives them the most appropriate means to solve their business problems. Visual Basic .NET includes the familiar syntax. Visual Basic developers are accustomed to plus optional Object Oriented Programming features including inheritance and other optional power features including structured exception handling and free-threading.

Chapter 3: Methodology

3.1 Methodology
3.2 Techniques Used to Define Requirements

Chapter 3: Methodology

3.1 Methodology Characteristics

Many system development methodologies have been developed over the years. A system development methodology does not just provide a set of modeling techniques, it also defines the stages of a system development project, specifies the task to be carried out and the output expected from each stage, provides guidelines for project management and control.

Good methodology characteristics are

- Easy to use for an average analyst or programmer
- Covers all aspects of system development
- Relevant to the type of application being developed

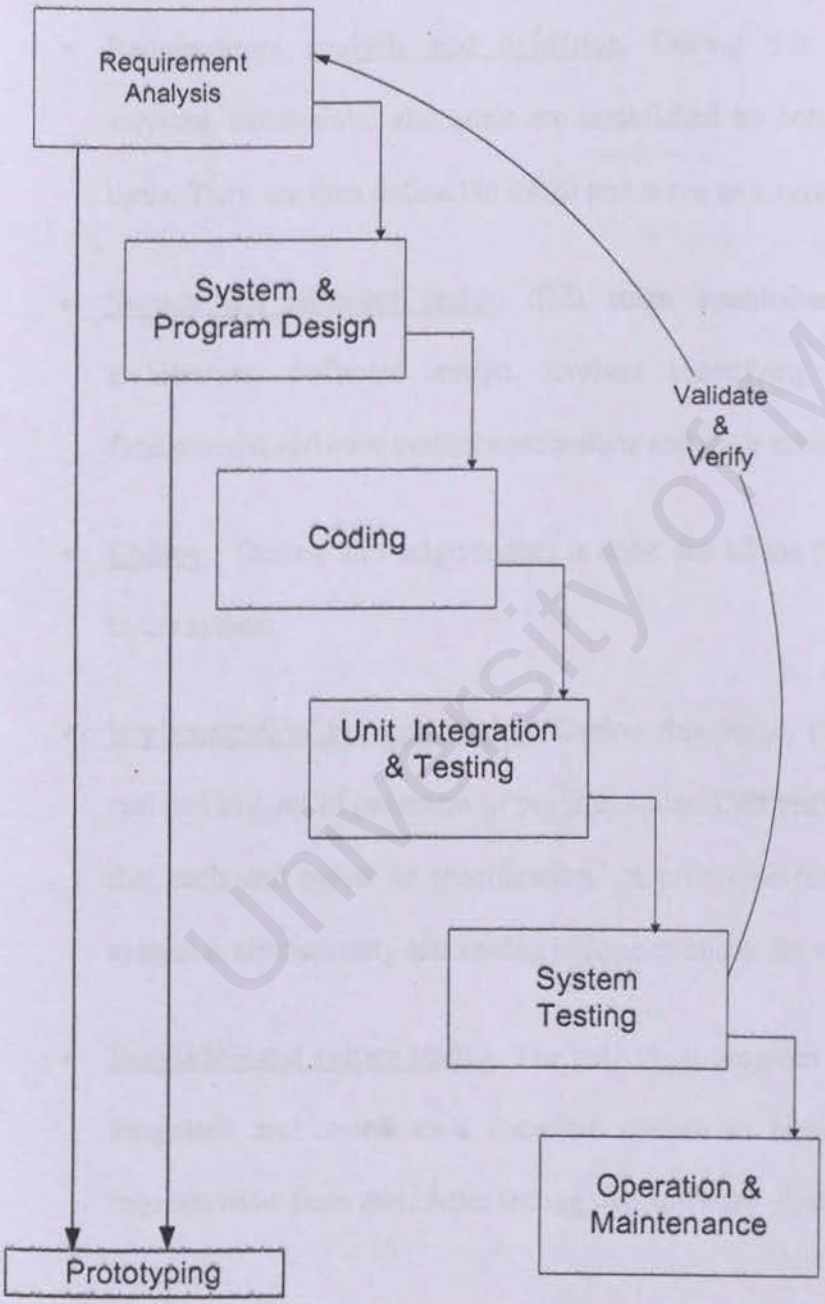
3.1.1 Software Process Model at ScMS

There are a number of different software process models used in software development. The software process model used in ScMS is called the Waterfall Model with Prototyping (Figure 3.1). This model consists of six stages that are depicted as cascading from one stage to another. Each stage ought to be completed before the start of the next stage. The six stages in building ScMS are requirements analysis, system and program design, Coding, Unit and Integration Testing, System testing and finally Operation and Maintenance. During the System Testing stage, the system has to be validated and verified to ensure if the system meets the requirements set earlier in the formal specifications.

Prototyping is a sub-process and a prototype is a working model of the actual system. During the early design stage a prototype would be built. The prototype would give the stakeholders a rough idea of the actual system.

Waterfall Model with Prototyping

Figure 3.1



3.1.2 The Development Cycle

The development cycle goes through six development activities. The six stages are as follows:

- Requirements analysis and definition. During this stage, the system's services, constraints and goals are established by consultation with system users. They are then defined in detail and serve as a system specification
- System and software design. This stage establishes an overall system architecture. Software design involves identifying and describing the fundamental software system abstractions and their relationship.
- Coding . During this stage coding is done for all the programs that are used in the system.
- Implementation and unit testing. During this stage, the software design is realized as a set of programs or program units. Unit testing involves verifying that each unit meets its specification. A prototype (software) of the actual system is almost ready and testing is done to check for errors.
- Integration and system testing. The individual program units or programs are integrated and tested as a complete system to ensure that the software requests have been met. After testing, the software system is delivered to the customer.

- Operation and maintenance. Normally this is the longest life cycle phase. The system is installed and into practical use. Maintenance involves correcting errors which are not discovered stages of the life cycle, improving the implementation of system units and enhancing the system's services as new requirements are discovered.

3.2 Techniques Used to Define Requirements

In determining the requirements for ScMS, a few techniques had been used. These include brainstorming, discussion, observation , interviews and questionnaires.

3.2.1 Brainstorming

Before the project can even begin, a brainstorming session with my project supervisor was held. The purpose of this session was to first understand and grab the overall concept behind the project at hand. The session was also used to define the project and draft out a few functions that the ScMS should have. This was a good way of planning for the next move.

3.2.2 Discussion

A number of discussions with a few teachers of Sekolah Menengah Taman Cannought, Cheras were held to define the system requirements. Besides helping me

A number of discussions with a few teachers of Sekolah Menengah Taman Cannought, Cheras were held to define the system requirements. Besides helping me to understand how the ScMS is going to work, the discussions had guided me to design parts where I can draft out the system interfaces more clearly.

3.2.3 Observation

A few visits were made to the school concerned to make personal observation on the existing system and the document flow that occurs within the school. This helped to draft out the context diagram of the organization.

3.2.4 Interviews

A total of six interviews were held with a number of staff members which included the Principal, Senior Assistant I, Senior Assistant II, Senior Assistant III and a senior teacher. These interviews were particularly important to collect valuable information, which enabled me to set the system requirements more clearly.

3.2.5 Questionnaires

A total of 80 sets of questionnaires were given out in to two selected schools in Hulu Langat District. The questionnaires were distributed to the teachers in

early November and the completed ones were collected on 15/12/2002. The completed questionnaires revealed valuable information that enabled me to pinpoint the system requirements more clearly. A sample questionnaire together with sample responses from five respondents are included in Appendix D. Out of the 80 respondents, more than 60 said that about 30 minutes were used daily to do routine administrative work. 65 respondents said that in a year they had to fill up personal and academic details four times in a year. As regards processing of exam marks 90% of the respondents affirmed that they calculated their marks using a calculator. All the respondents agreed that a computerized information system would help to speed up their administrative tasks and the saved time could be used to teach students and improve their academic performance . 90% of the respondents agreed an electronic information system would not only be of great help to the school administrators but also enable them to administer a school more efficiently.

Chapter 4: System Requirements Analysis

4.1 Functional Requirements
4.2 Non-Functional Requirements
4.3 Decision
4.4 Hardware Requirement

Chapter 4 : System Requirements Analysis

System requirements analysis enables the system engineer to specify software elements and establish design constraints that software must meet. A complete understanding of software requirements is essential to the success of a software development effort, no matter how well designed or well coded. A poorly analyzed and specified program will disappoint the user and bring sadness to the software developer. Requirements elicitation is an important part of this process of requirements analysis. Requirement identifies the "what" of the system and the design identifies the "how" of the system. Requirement analysis covers two main categories namely

- Functional Requirements
- Non-Functional Requirements

4.1 Functional Requirements

According to Ian Sommerville functional requirement is a statement of the service or functions that a system should provide, how the system reacts to particular inputs and how the system should behave in particular situations. The functional requirements for ScMs consist of three parts: Staff Module, Student Module and System Module. For the Staff Module, the functional requirements consist of other sub-modules such as staff biodata, staff training, classroom attendance, assigned subject, assigned co-curriculum and assigned classroom. For Student Module, the functional requirement

consists of other sub-modules such as student biodata, student subject, parent biodata and student discipline. For the System Module, the functional requirement consists of other sub-modules such as grade type, discipline category, co-curriculum, course list, staff category and subject list. An authentication module controls the access to the three main modules namely the Staff Module, Student Module and the System Module. Key functions of the ScMS can be shown through the different modules listed below.

4.1.1 Authentication

A user would be created when Oracle Tools are used. This means login User ID and password are already built in when Oracle program is used. User needs to key in a valid user name and password to be able to use the system.

4.1.2 Attendance Module

This module allows teachers to generate attendance report automatically. It enables the administration to monitor attendance and prepare warning letters.

4.1.3 Assessment Module

Marks scored in monthly and term tests are recorded in appropriate student files including report cards.

Results are analyzed, graded, ranked and performance reports generated automatically. Students can view their results.

4.1.4 Discipline Module

The history of student discipline problems can be viewed and disciplinary action undertaken is recorded systematically. Warning letters are generated and sent to parents or guardians.

4.1.5 Co-curriculum Module

Sports, Games and other co-curricular activities are recorded systematically by Senior Assistant III and he can track automatically on the effectiveness of these activities.

4.1.6 Staff Training Module

Staff details including academic qualifications and courses attended are recorded. The administration can ascertain the suitability of a teacher for a particular course. He can also know the expertise of each teacher.

4.2 Non-Functional Requirements Analysis

Non-Functional specification are the constraints under which a system must operate and the standards which must be met by the delivered system [Ian Sommerville, 1995]. The SsMS must ensure certain web application qualities like user-friendliness, correctness, functionality, reliability, efficiency as well as maintainability.

4.2.1 User-Friendliness

User interface design creates an effective communication medium between a human and a computer. Thus, it is essential to ensure that the interfaces fulfill user-friendliness requirements and do not cause any irritation to the users. Mande's three golden rules ought to be followed. They are

- Place the user in control
- Reduce the user's memory load

- Make the interface consistent

4.2.2 Correctness

A program or system must operate correctly or it provides little value to its users. Correctness is the degree to which the software performs its required function. Several testing would be carried out to ensure the application created is of the highest quality.

4.2.3 Functionality

Functionalities such as searching and retrieving capability from existing databases are incorporated into the application.

4.2.4 Reliability

Reliability is closely related to link processing, error recovery and user input validation and recovery. This quality is of paramount importance as it gives confidence to the users of the ScMS.

4.2.5 Efficiency

Efficiency is the ability of a process procedure to be called or accessed unlimitedly to produce similar outcomes at an acceptable speed. Quick response time performance and faster page generation speed give Scams greater efficiency.

4.2.6 Maintainability

According to Pressman maintainability is the ease with which a program can be corrected if an error is encountered, adapted if its environment changes or enhanced if the customer desires a change in requirements. As the system to be developed is built using Oracle Tools, it is believed that system faults can be detected and fixed quickly.

4.3 Platform, Database and Tools

4.3.1 Development Platform

To develop the ScMS, the Oracle Internet Platform is chosen because it has notable advantages. The Oracle 9i Database and Oracle 9i Application Server is driven by Oracle's ability to deliver a complete integrated internet software solution that lowers the total cost of computing. Using Oracle 9i technology provide customer's with the world's most comprehensive, scalable and reliable platform upon which to develop and deliver mission-critical e-business applications. Furthermore, using key database features such as Oracle 9i Real Application Clusters, companies can easily support increasingly large numbers of users on relatively inexpensive systems and significantly lower the cost per user as they grow.

Oracle 9i Database also offers unique features such as self-tuning and self management, a virtually zero data-loss solution and the industry's most validated security features. The Oracle 9i Application Server offers the industry's fastest, most complete and integrated J2EE-certified application server. Oracle 9i Application Clusters has revolutionized the fast growing application server market by being the first to integrate all the technology required to build and deploy e-business portals, transactional applications and web services in a single product.

In this platform Oracle 9i database is used to manage data, Oracle 9i Developer suite(Oracle 9iDS) is used to build applications and Oracle 9i Application

Server(Oracle 9iAS) is used to run the application. In fact the Oracle Internet Platform is a complete solution for building any type of application and deploying it to the web.

4.3.2 The Oracle Web Application Server(iAS)

Internet Application Server enables users using Web browsers to access HTML pages and data from Oracle databases. Cartridge or plug-ins are provided to execute PL/SQL code, Java and other programming language code. The way the web server works can be shown in the figure below.

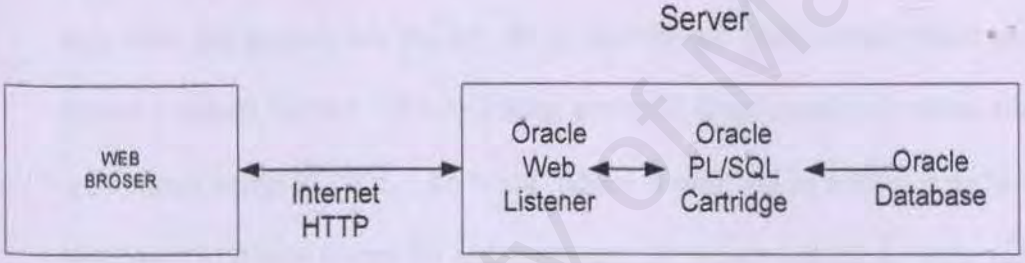


Figure 4.1: The way the web server sends and receives data

The Oracle 9i Application server is a scalable, secure middle tier application server and Form Services are an integral part of the 9i Application Server bundle, which provides the technology to fully realize the benefits of Internet computing. The Oracle 9i AS Form Services component of Oracle 9iAS handles all processing that is specific to Oracle 9i Forms application such as running the business logic defined in the Oracle 9i Forms application and providing the connection to the Oracle database. A Java applet provides the client user interface. The role of the Oracle Application Server can be made clearer by looking at the Oracle 9iAS Forms Services

Architecture. Figure 4.2 in the next page shows the three tiers that make up the Oracle 9*iAS* Forms Services architecture:

- The client tier contains the Web browser where the application is displayed.
- The middle tier is the application server where application logic and server software are used.
- The database tier is the database server where enterprise data is stored.

Before the Forms can be run, OC4J(Servlet Engine) must be initialized. It is only then the applets are loaded on to the canvas. This is also called as the Forms Listener Servlet. Oracle Forms are built from relational tables which are created using PL/SQL .To build tables a user has to follow a particular procedure to create a user ID and password. If a user wishes to gain access to his tables in the database, he must firstly log in his user ID and password. This is a security feature of Oracle 9*i*.

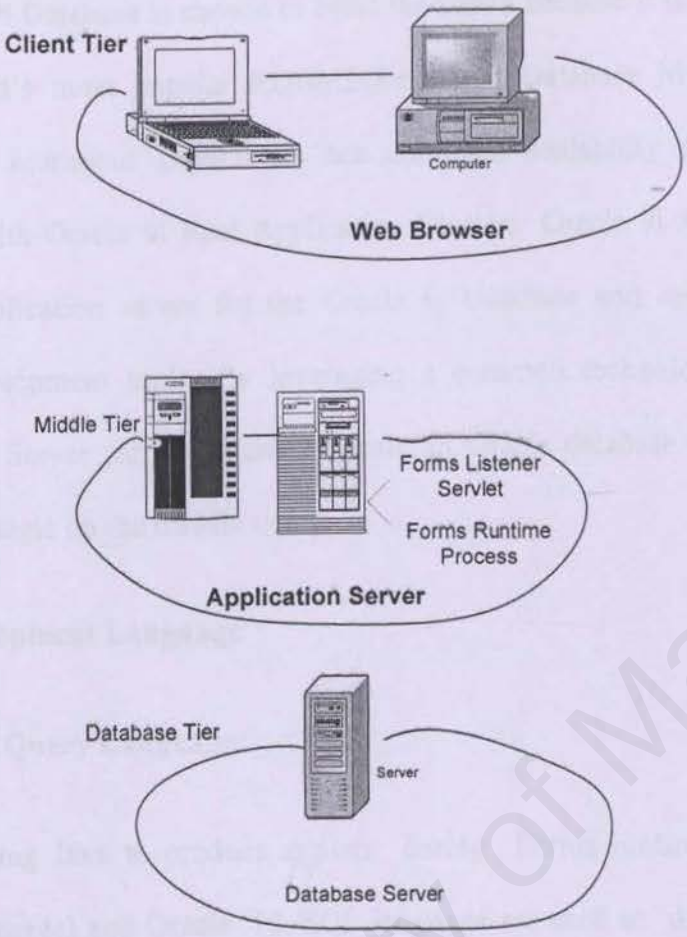


Figure 4.2 Oracle 9*iAS* Forms Services Architecture

The Forms runtime process plays two roles: when it communicates with the client browser, it acts as a server by managing requests from client browsers and it sends metadata to the client to describe the user interface; when it is communicating with the database server, it acts as a client by querying the database server for requested data.

4.3.3 Database

Oracle 9*i* Database

The Oracle 9i Database is chosen to build the ScMS because it is the latest generation of the world's most popular RDBMS(Relational Database Management System). Among the numerous capabilities are unlimited scalability and industry-leading reliability with Oracle 9i Real Application Clusters. Oracle 9i Application Server is the best application server for the Oracle 9i Database and applications built with Oracle development tools. By leveraging a common technology stack, Oracle 9i Application Server can transparently scale an Oracle database by caching data and application logic on the middle tier.

4.3.4 Development Language

Structured Query Language

Besides using Java to produce applets during Forms runtime, SQL (Structured Query Language) and Oracle PL/SQL language are used as development language. SQL is an ANSI Standard language for accessing database; SQL is used by the system to access, define and manipulate data in a database system like Oracle or Access. SQL is the preferred development tool as it can perform many functions. SQL can execute queries, retrieve data, insert, delete or update records in a database.

The Oracle PL/SQL language is also used as a development language to build ScMS. PL/SQL is Oracle's procedural language extension to SQL. The PL/SQL language includes object oriented programming techniques such as encapsulation, function overloading and information hiding. PL/SQL is commonly used to write data-centric programs to manipulate data in the Oracle database. PL/SQL is used to code procedures and triggers.

4.4 Hardware Requirement

The table 4.1 below shows the summary of the hardware and software requirements that have been considered for this project.

Table 4.1 : Hardware and Software Requirements

	Server Side	**Client Side**
Hardware Requirements	▪ Intel Pentium 3 processor with 450 MHz at minimum level ▪ Hard disk space with 60 GB ▪ 512MB RAM of memory	▪ Pentium 3 with 500 MHz ▪ Hard disk space with 20 GB ▪ 128MB RAM of memory ▪ Network connection through existing network configuration on modem
Software Requirements	▪ Microsoft Windows 2000 A dvanced S erver as the operating system ▪ Oracle database 9i	▪ Microsoft Windows XP ▪ Oracle 9iDS

Chapter 5: System Design

5.1 Architecture Design
5.2 System Functional Design
5.3 Database Design
5.4 User Interface Design

Chapter 5: System Design

System design is a multi-step process in which representations of the data structure, program structure, interface characteristics and procedural details are shown.

5.1 Architecture Design

Client-server architecture is generally divided into three distinct tiers – client, server and database. Components are built into each tier to fulfill its role and then tie together to form a final solution. In client/server database such as Oracle, split the DBMS and the applications accessing the DBMS into a "process" running on the server.

5.1.1 Client-Server Architecture

In a client-server database, the client application sends data request across the network. When the server receives a request, the server DBMS process retrieves the data from the database, performs the requested functions on the data(sorting, filtering, etc) and sends only the final query result(not the entire database) back via the network to the client. A client/server database is not affected when a client workstation fails. The failed client's in-progress transactions are lost but the failure of a single client does not affect other users.

Client/server databases are preferred for database applications that retrieves and manipulate small amounts of data from databases containing large numbers of records

because they minimize network traffic and improve response time. A client/server database environment is shown below.

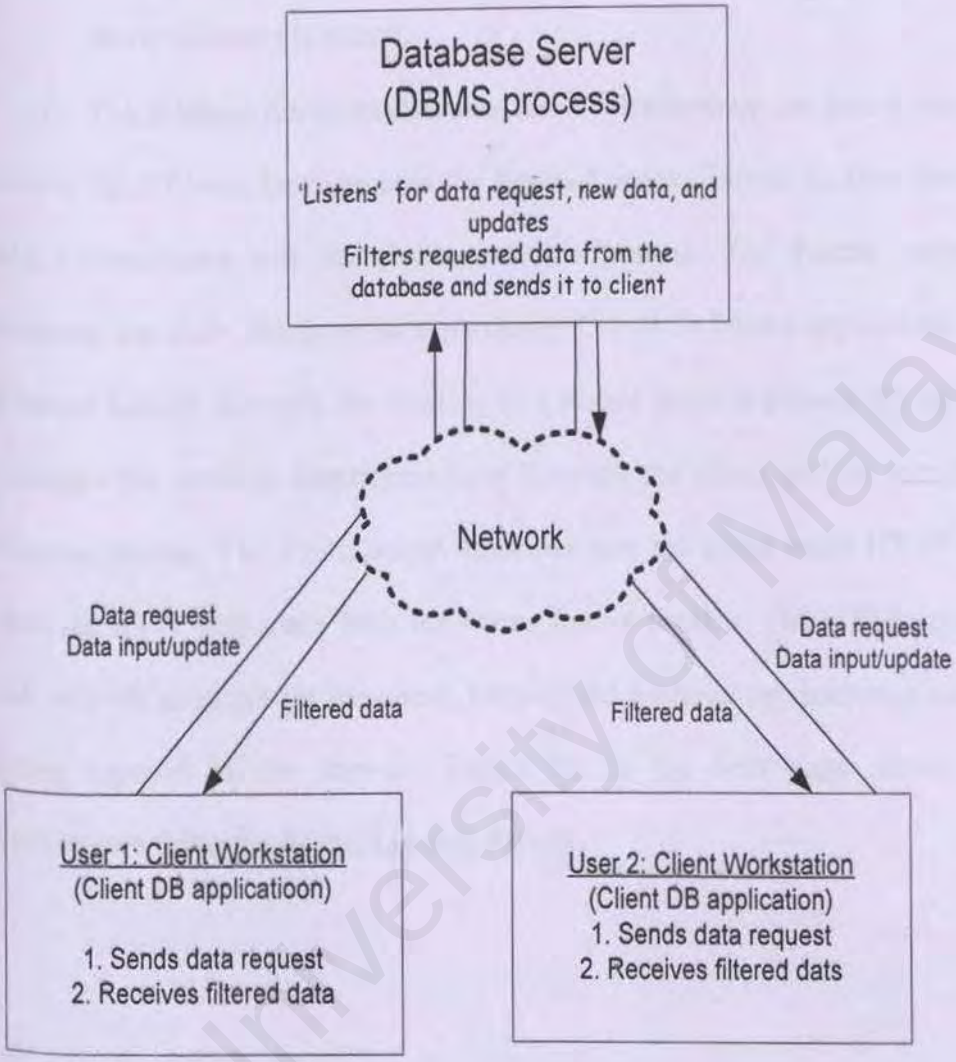


Figure 5.1 : Client –Server Database

The School Management System (ScMS) that is being designed makes use of Oracle 9iAS Forms Services Architecture which uses a three-tier architecture to deploy database applications. The three tiers that make up the Oracle Forms Services architecture includes:

- The client tier which contains the Web browser where the application is displayed.
- The middle tier is the application server where the application logic and server software is stored.
- The database tier is the database server where enterprise data is stored.

Oracle 9iAS Forms Services uses the Forms Listener Servlet (a Java Servlet) to start and communicate with the Forms runtime process. The Forms runtime is what executes the code contained in a particular Oracle 9*i* Forms application. The Forms Listener Servlet manages the creation of a Forms runtime process for each client and manages the network communications between the client and its associated Forms runtime process. The figure below illustrates how the client sends HTTP requests and receives HTTP responses from the Forms Server process. The HTTP Listener acts as the network endpoint for the client, keeping the other server machines and ports from being exposed at the firewall. Figure 5.2 in the next page shows the system architecture using the Forms Listener Servlet.

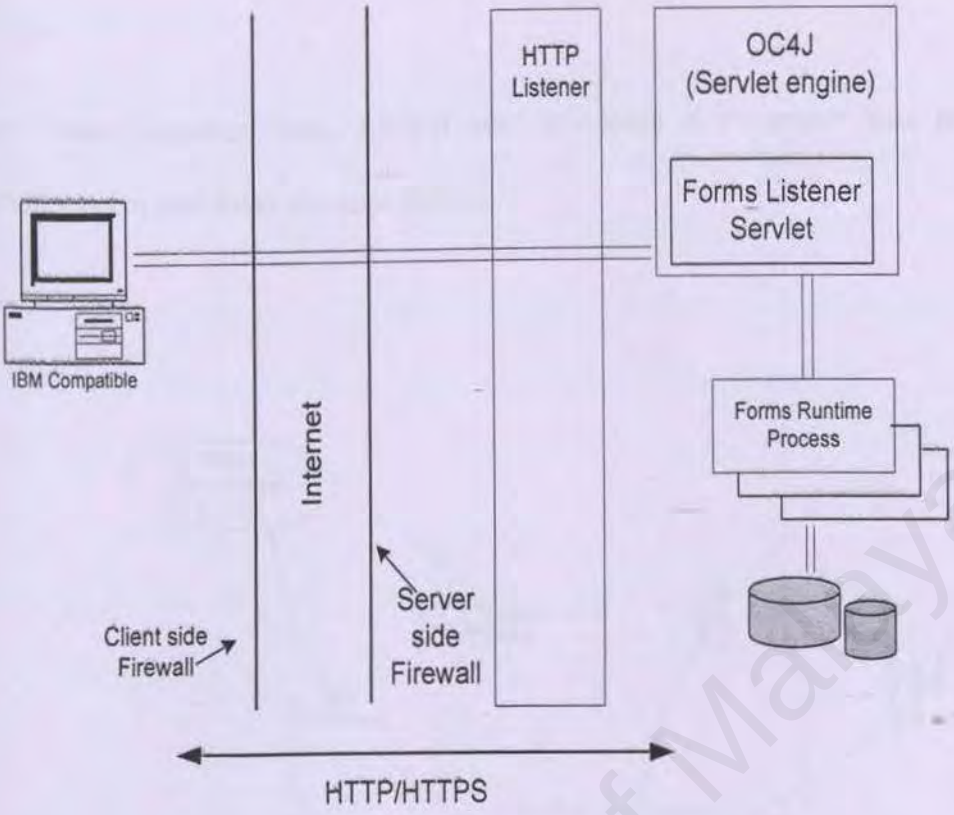


Figure 5.2 Architecture using the Forms Listener Servlet

5.2 System Functionality Design

5.2.1 Context Diagram

The context diagram in Figure 5.3 gives an overview of an organizational system that shows the system boundaries, external entities that interact with the system and the major information flows between the entities and the system. The interaction of the various entities that provide information to the ScMS is shown diagrammatically in the context diagram. The external entities consists of State Education Office, State/Federal Inspectorate, Parent-Teacher Association, Parents, Students, Kementerian Pendidikan Malaysia, New students, Curriculum Development Centre

and Pusat Kegiatan Guru. Almost everyday there is document flow between the ScMS system and these external entities.

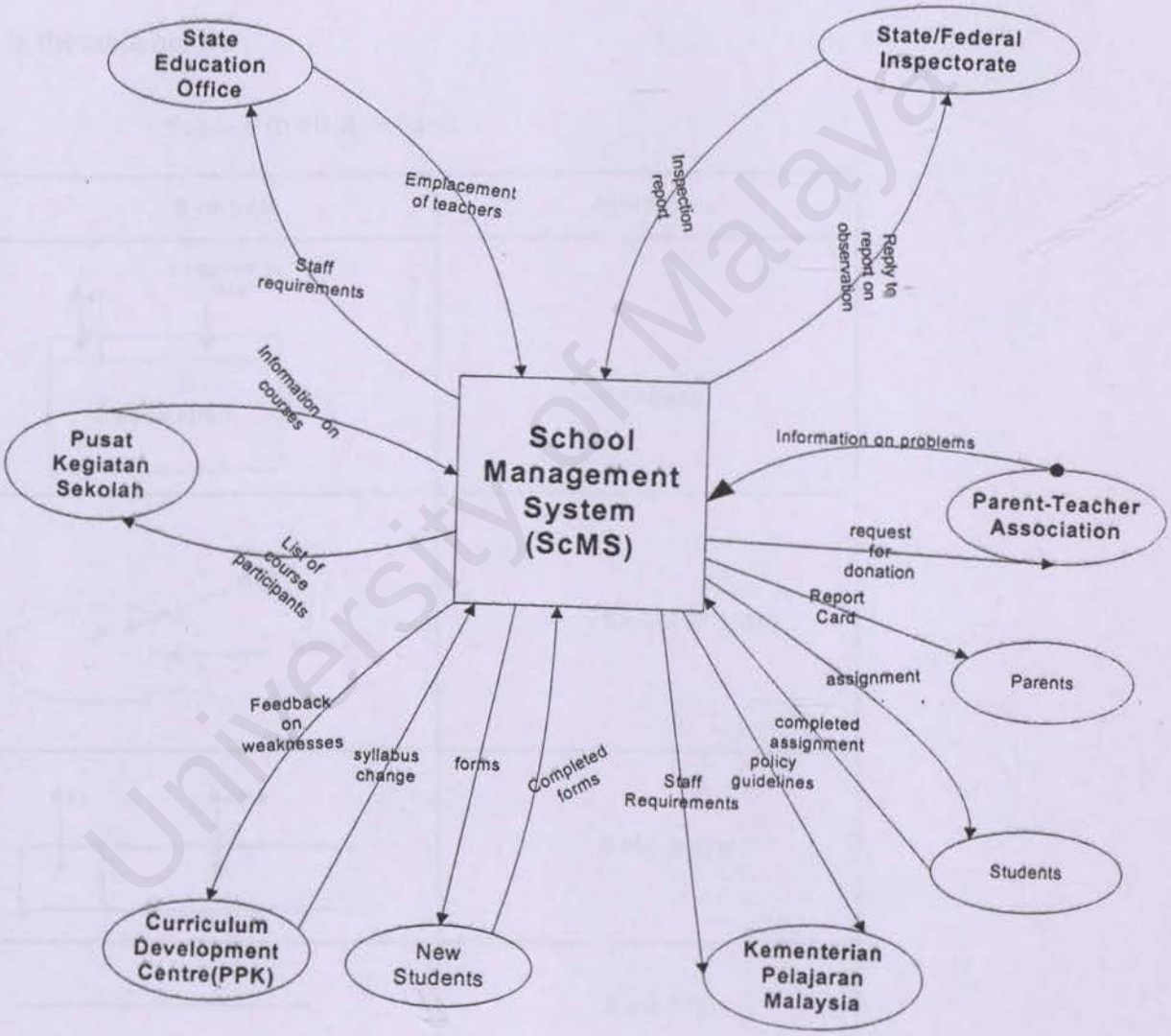


Figure 5.3 Context Diagram

5.2.2 Data Flow Diagram

Data Flow Diagrams are used not only to graphically depict the system's inputs, processes and outputs but also to describe the current physical system and the proposed ScMS. The symbols used follow the notations used in SSADM Version 4: A User's Guide by Malcolm Eva -1991(Page 77). The four elements namely process, data store, data flow and external entity together with their meaning and structure are given in the table below.

Table 1 (DFD Symbols)

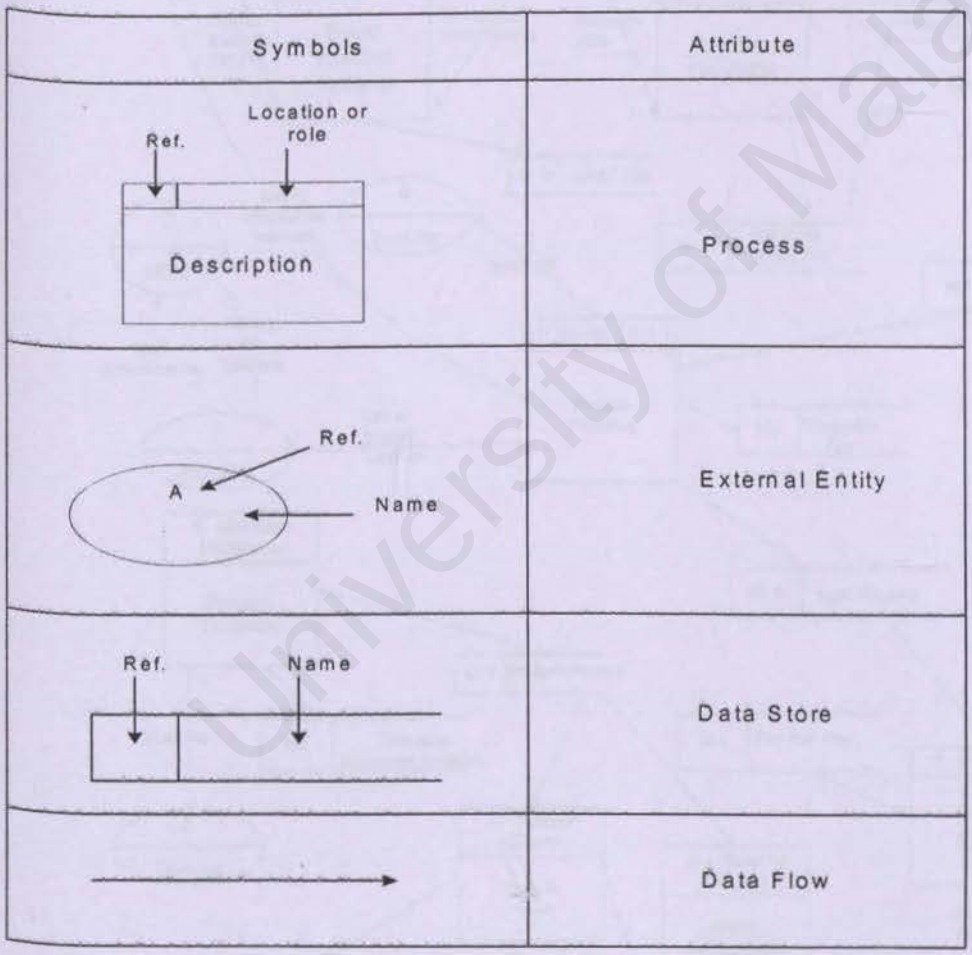


Figure 5.4 DFD Symbols

5.2.2.1 **Current Physical DFD**(Figure 5.5)

In the current physical DFD, the processes are shown. In fact it gives an overview the system's inputs, processes and outputs and shows the flow of data from the

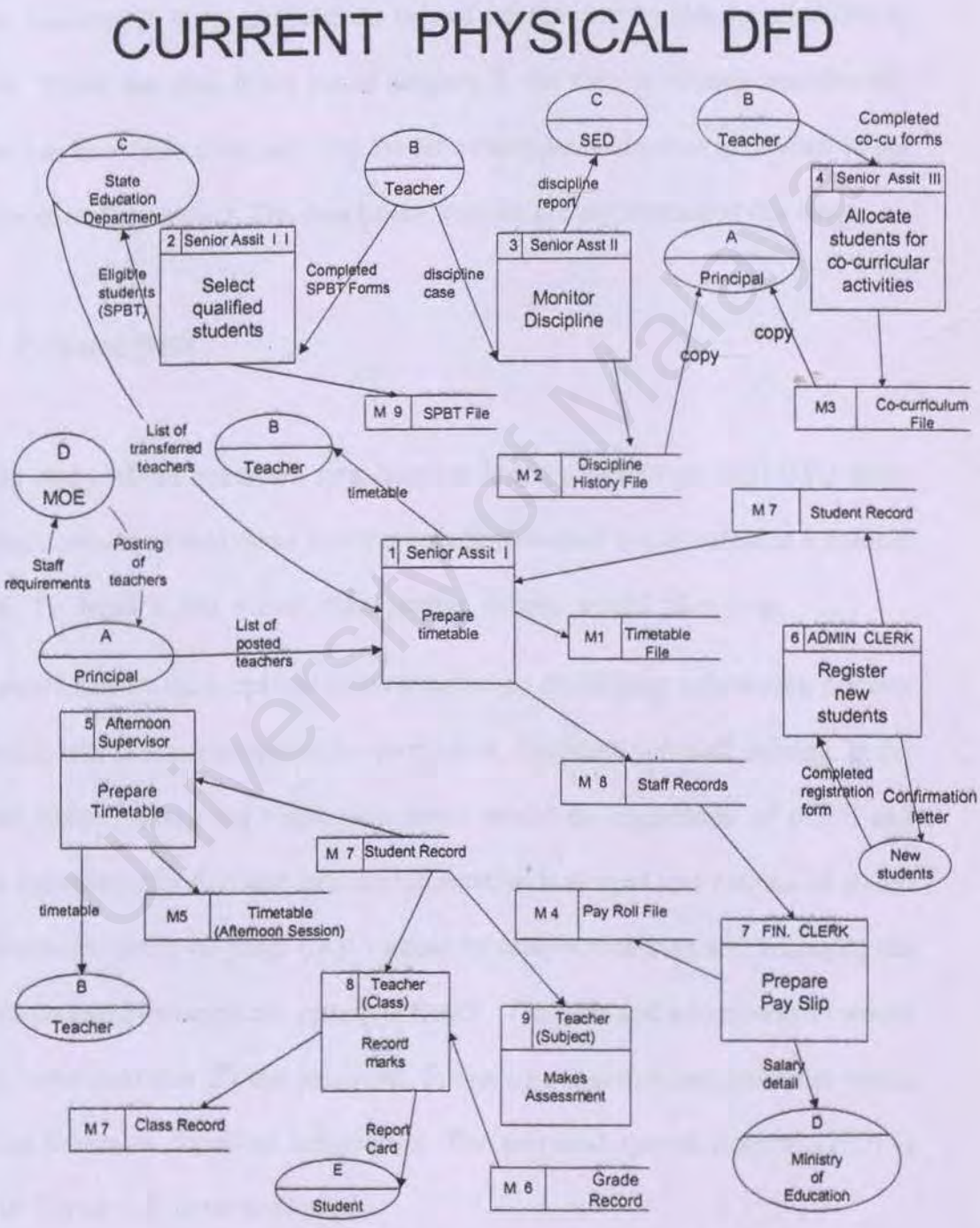


Figure 5.5 Current Physical DFD

source entities to the processes. Data that comes into a process is transformed in some way. Each process only shows the input it receives, the output it sends and the function it performs. For example in process 2 a teacher sends completed SPBT forms to Senior Assistant II. He in turn with the help of a committee decides the eligibility of a student. When the data flows out of process 2, the data is already transformed. Selection has now been done and only the list of eligible students is forwarded to the State Education Department. The data stores however are still manual at this stage.

5.2.2.2 Proposed DFD

A careful study of the document flow diagram and the current physical DFD show tremendous amount of data flows into the system, processed and is output in a number of ways. To build a full school management system would take long.

SCMs would narrow the scope and focus attention on developing information systems that include attendance, assessment, co-curriculum, discipline and staff training. In the proposed system, filling the registration forms would do registration of pupils and teachers systematically first and then the information is entered into automated record files. Structured Query language (SQL) would be used in accessing and managing the relational database management system in ScMS. Teachers and administrators would be given individual user ID and password. In this way unauthorized personnel would be denied access to classified information. The proposed system (logical DFD) is shown in Figure 5.6 in the next page.

PROPOSED SYSTEM

(LOGICAL DFD)

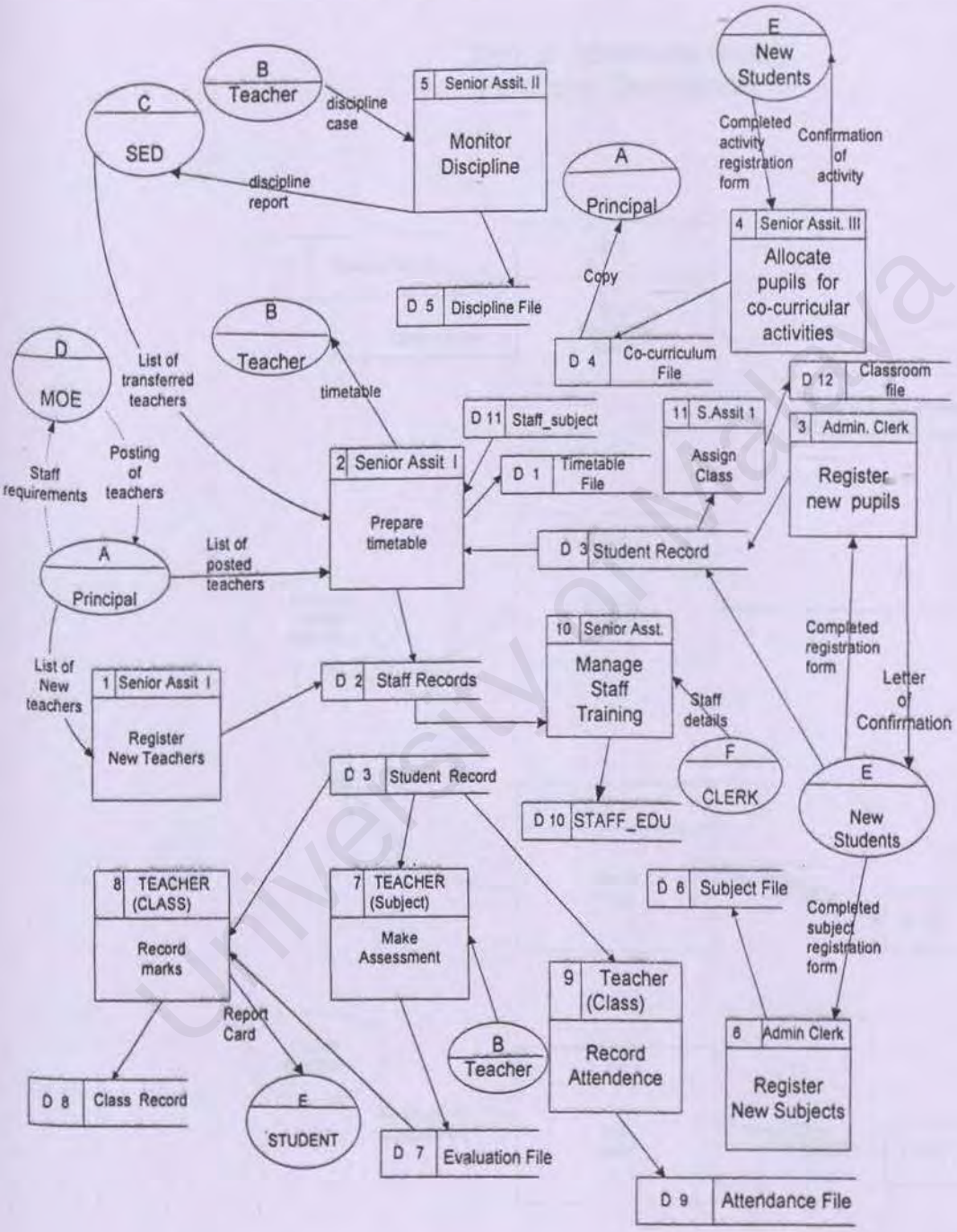


Figure 5.6 Proposed System

5.2.2.3 Leveling

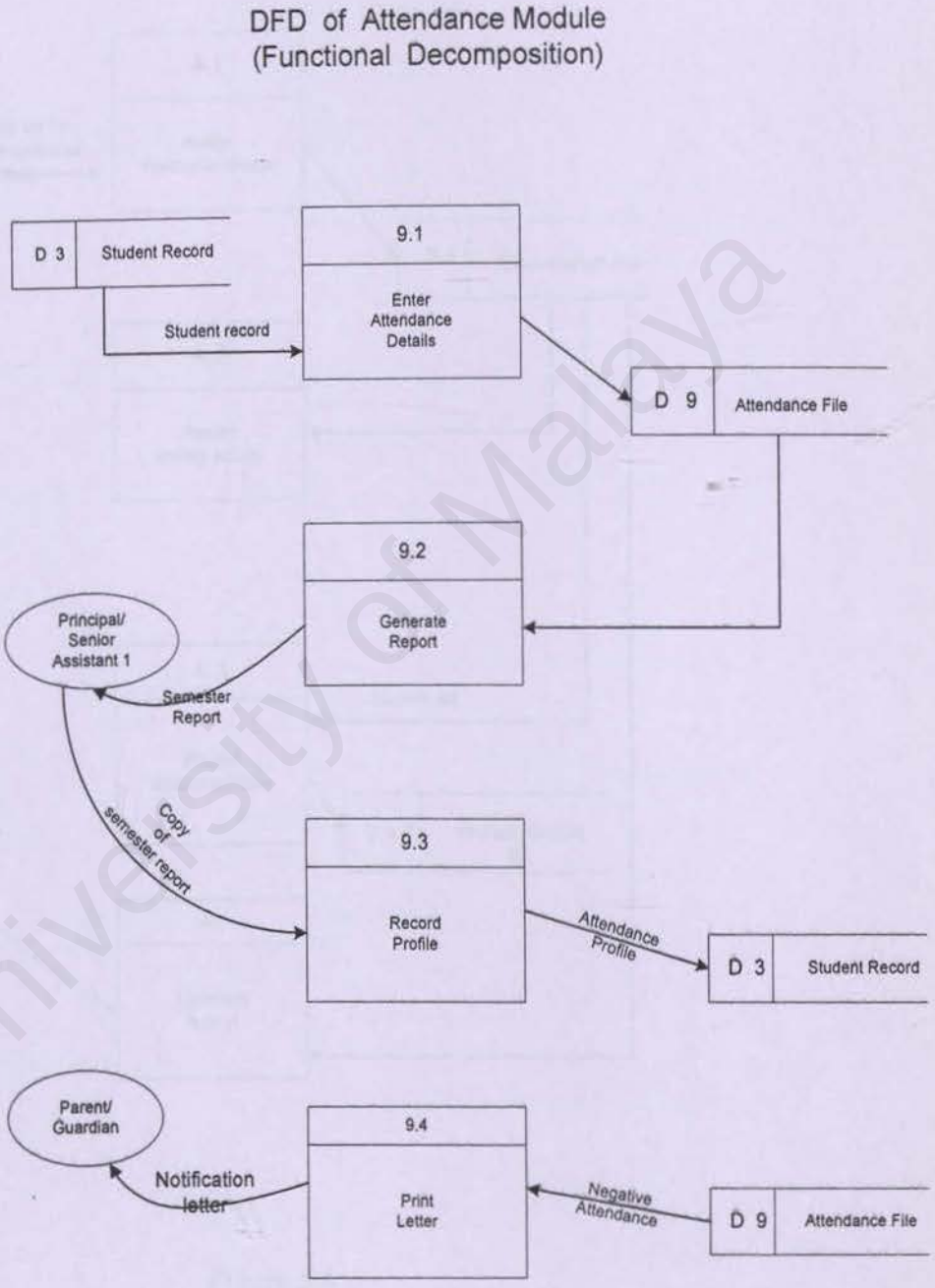


Figure 5.7

DFD of Co-curriculum Module
(Functional Decomposition)

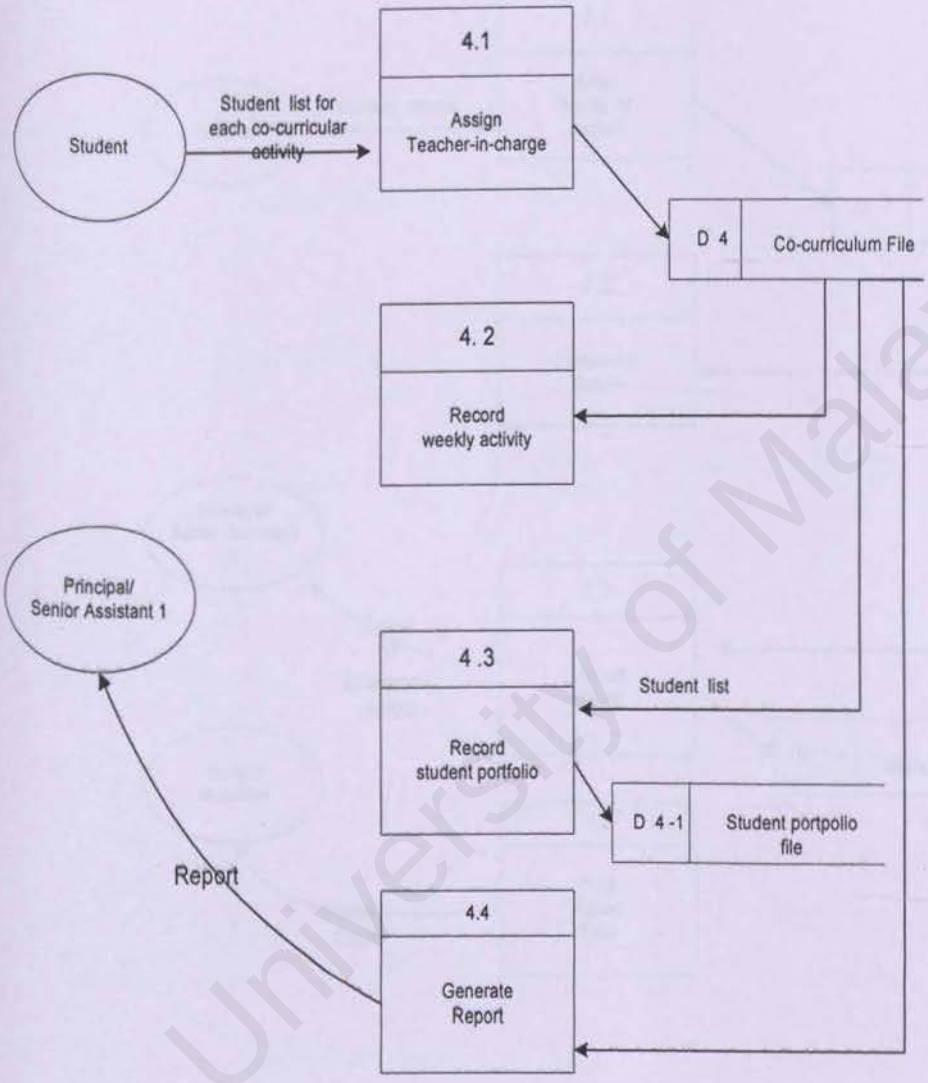


Figure 5.8

DFD of Assessment Module
(Functional Decomposition)

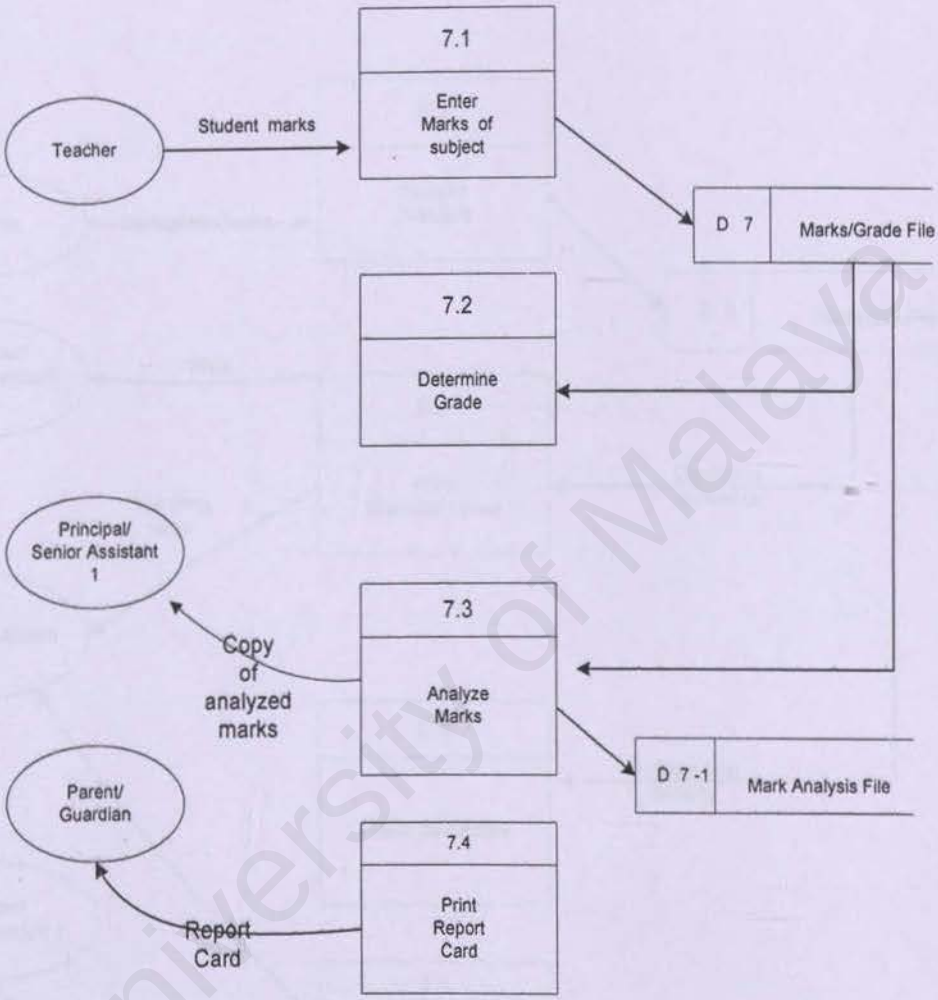


Figure 5.9

DFD of Discipline Module
(Functional Decomposition)

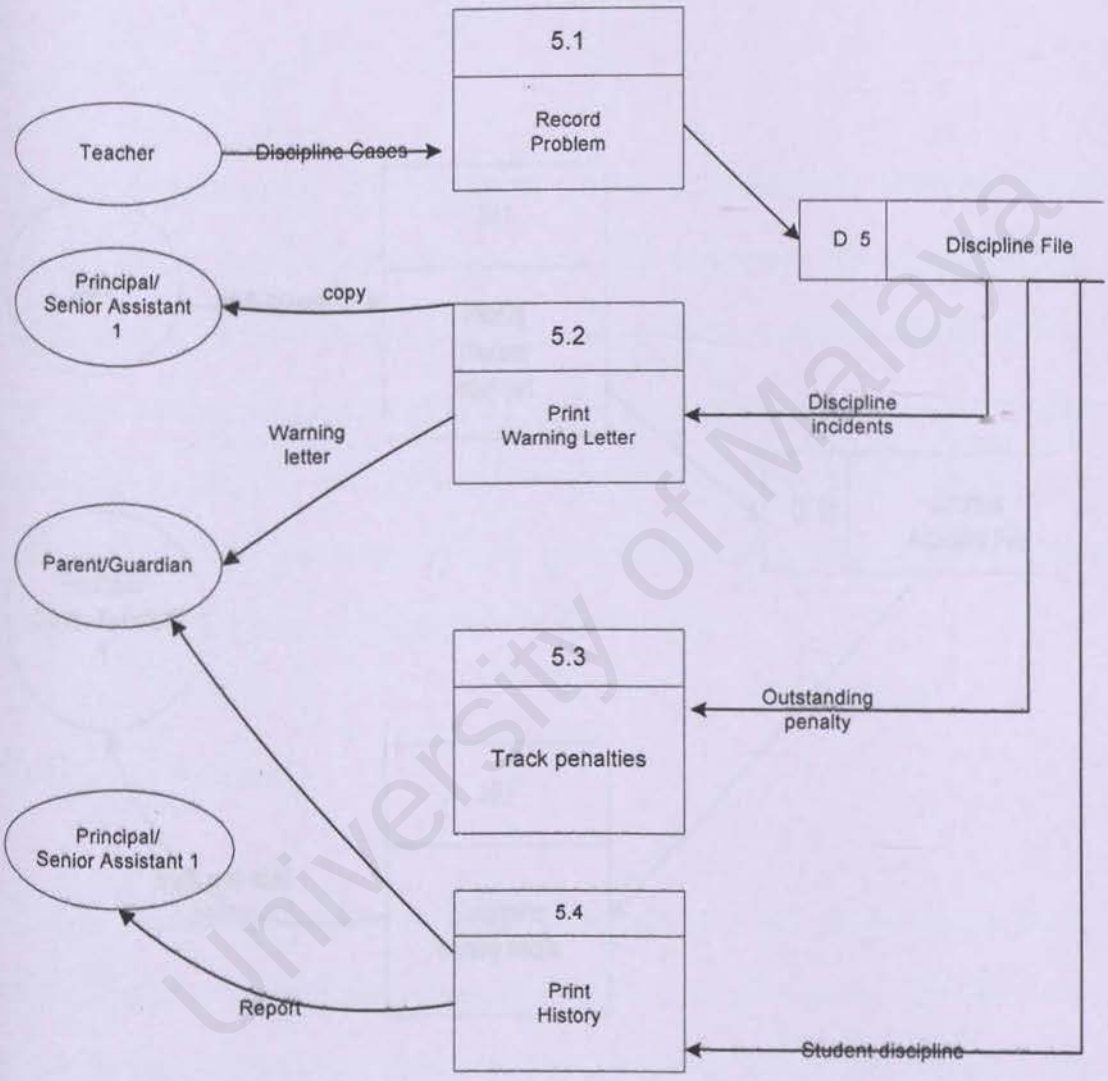


Figure 5.10

DFD of Staff Training Module
(Functional Decomposition)

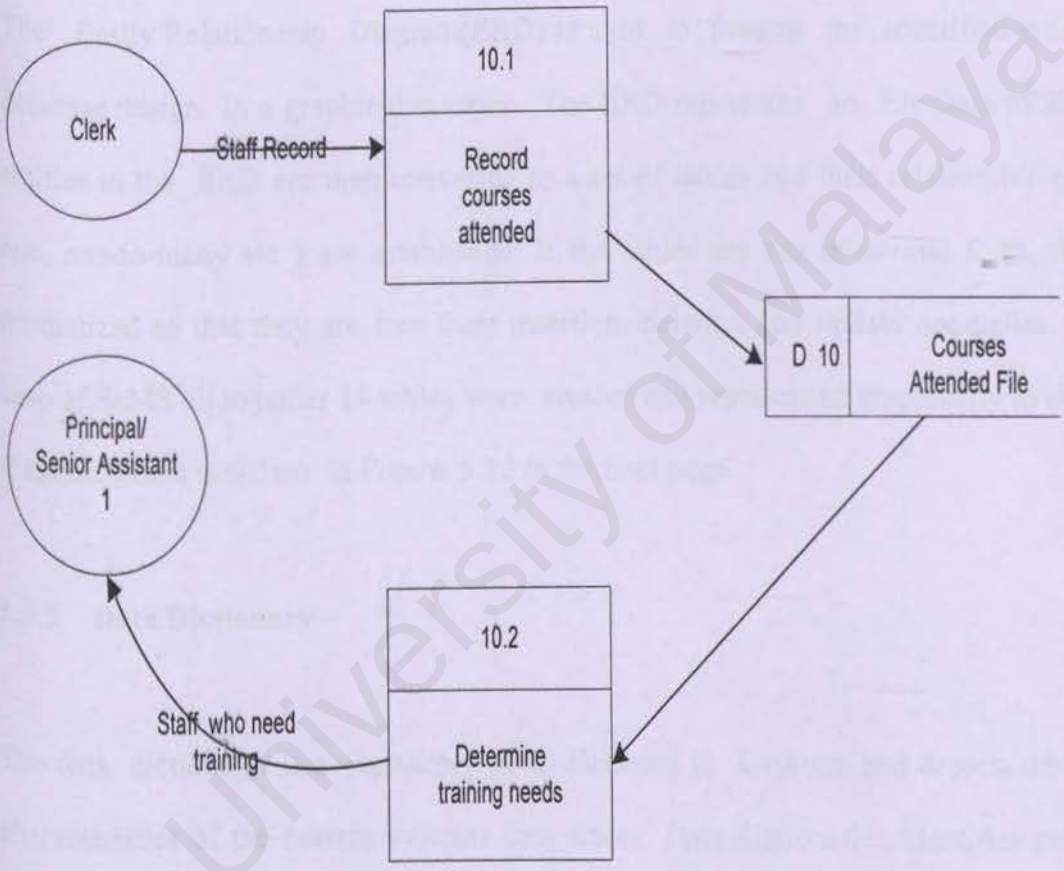


Figure 5.11

5.3 Database Design

Database design is concerned with identifying the business entities relevant to the application and how they are related to one another. Database design is concerned with identifying the attributes needed for each of the entities

5.3.1 ERD Diagram

The Entity Relationship Diagram(ERD) is used to present the identified entities in database design in a graphical manner. The ERD represents an ER Data Model. The entities in the ERD are then converted to a set of tables and their relationship (one-to-one, one-to-many etc) are established. If the tables are not in normal form, they are normalized so that they are free from insertion, deletion and update anomalies. In the case of ScMS all together 18 tables were created and represented graphically in the ERD diagram which is shown in Figure 5.12 in the next page.

5.3.2 Data Dictionary

The data dictionary is a repository of all elements in a system and depicts the logical characteristics of the current systems data stores. Data dictionaries identifies processes where the data are used and where immediate access to information is needed. The data dictionary tables for the ScMS is depicted in nineteen tables from page 75 to page 82.

Entity-Relationship Diagram (ERD)
FOR ScMS

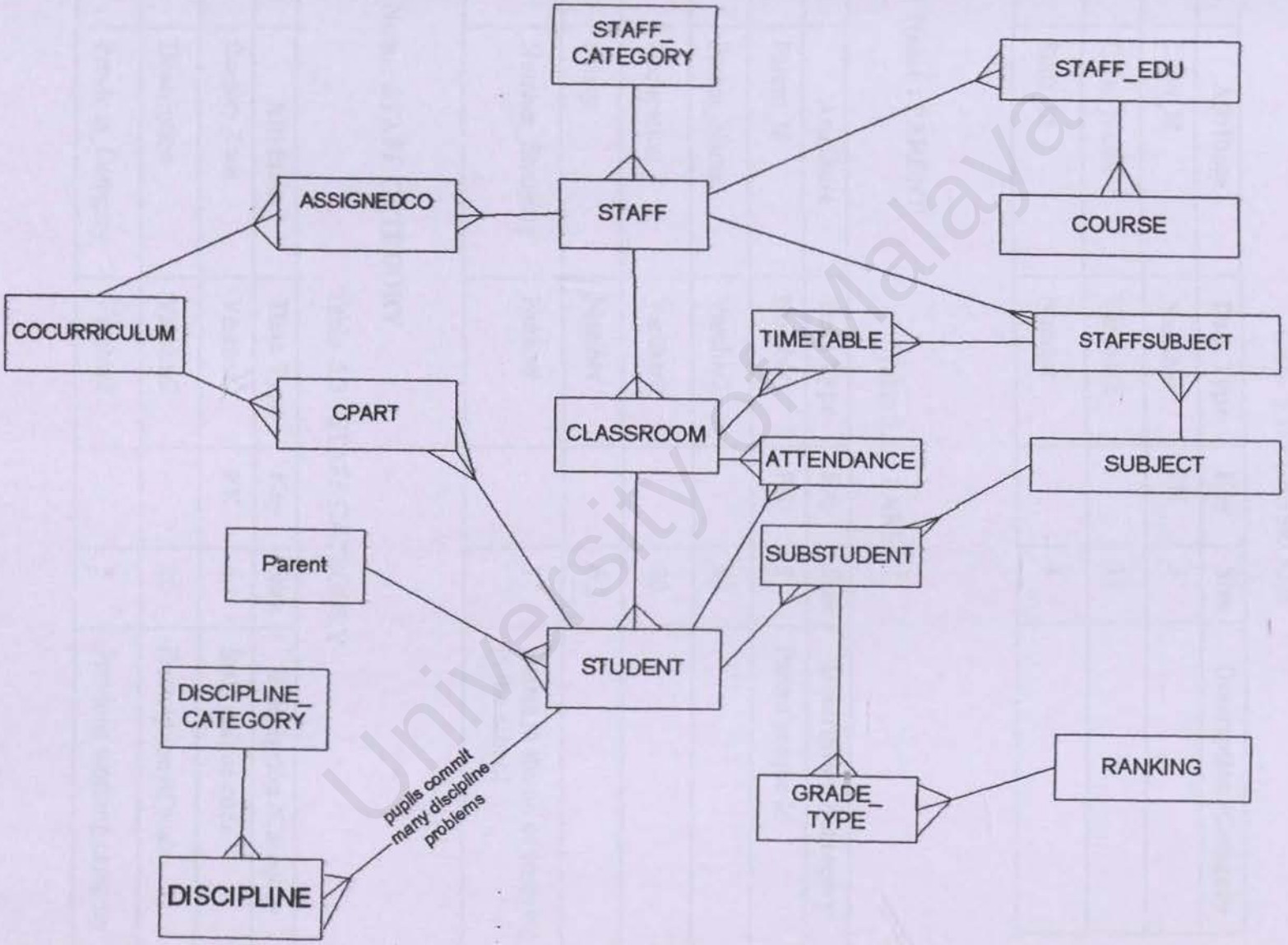


Figure 5.12

The data dictionary tables in ScMS are shown below:

Table Name : CLASSROOM

Table 5.1: CLASSROOM

No	Attribute	Data Type	Key	Size	Description /Category
1	Class_Id	**Number**	**PK**	3	
2	Class_Name	Varchar2		15	
3	Staff_Id	Number		4	

Table Name : PARENT

Table 5.2 : PARENT

No	Attribute	Data Type	Key	Size	Description /Category
1	Parent_Id	Number	**PK**	5	Parent unique Id
2	Parent_Name	Varchar2		20	
3	Occupation	Varchar2		20	
4	Salary	Number		6,2	
5	Number_Studying	Number		1	Refers to the no of studying in the school

Table Name: STAFF CATEGORY

Table 5.3 : STAFF CATEGORY

No	Attribute	Data Type	Key	Size	Description /Category
1	Category_Code	Varchar2	**PK**	6	Staff unique code
2	Description	Varchar2		20	Description of scale
3	Previous_Category	Varchar2		5	Previous working category

Table Name: STAFF

Table 5.4 : STAFF

No	Attribute	Data Type	Key	Size	Description /Category
1	Staff_Id	Number	PK	4	Staff unique Id
2	Staff_Name	Varchar2		20	
3	Category_Code	Varchar2		5	
4	Date_of_Birth	Date		6	
5	Parent_Age	Number		2	
6	Address	Varchar2		35	
7	Town	Varchar2		15	
8	Postcode	Varchar2		5	
9	State	Varchar2		10	
10	Qualification	Varchar2		20	
11	Present_Salary	Number		6,2	
12	Position	Char		10	Some teachers hold administrative jobs

Table Name: STUDENT

Table 5.5 : STUDENT

No	Attribute	Data Type	Key	Size	Description /Category
1	Student_Id	Number	**PK**	10	Student unique Id
2	Student_Name	Varchar2		20	
3	Date_of_Birth	Date		8	
4	Address	Varchar2		35	
5	Town	Varchar2		15	
6	Postcode	Varchar2		5	
7	State	Varchar2		10	
8	Parent_id	Number		5	
9	Special_fee	Varchar2		5	

Table Name : ASSIGNEDCO

Table 5.6 : ASSIGNEDCO

No	Attribute	Data Type	Key	Size	Description /Category
1	Activity_Id	Varchar2	**PK**	20	
2	Staff_Id	Number	**FK**	4	
3	Cocode	Varchar2	**FK**	2	
4	Date_Start	Date		6	
5	Date_End	Date		6	

Table Name : COCURRICULUM

Table 5.7 : COCURRICULUM

No	Attribute	Data Type	Key	Size	Description /Category
1	Cocode	Varchar2	**PK**	2	
2	Co_Type	Varchar2		2	
3	Co_curriculumName	Varchar2		20	

Table Name : CPART

Table 5.8 : CPART

No	Attribute	Data Type	Key	Size	Description
1	Student_Id	Varchar2	**FK**	10	
2	Staff_in_Charge	Varchar2		20	
3	Date_Start	Date			
4	Date_End	Date			
5	Position	Varchar2		15	Combo box

Table Name : **DISCIPLINE_CATEGORY**

Table 5.9 : DISCIPLINE CATEGORY

No	Attribute	Data Type	Key	Size	Description /Category
1	Dicipline_Code	Varchar2	**PK**	3	DS1 – Smoking DS2 – Stealing DS3 – Vandalism DS4 – Bullying
2	Description	Varchar 2		30	
3	Penalty	Varchar2		40	

Table Name : GRADE_TYPE

Table 5.10: GRADE TYPE

No	Attribute	Data Type	Key	Size	Description /Category
1	Grade	Varchar2	PK	2	
2	Gr_Description	Varchar2		20	
3	Minimum_Point	Number		(5,2)	
4	Maximum_Point	Number		(5,2)	

Table Name : STAFF_SUBJECT

Table 5.11 : STAFF SUBJECT

No	Attribute	Data Type	Key	Size	Description /Category
1	StaffSubject_Id	Varchar2	PK	8	
2	Staff_Id	Number	FK	4	
3	SubjectCode	Varchar2	FK	4	

Table Name: SUBSTUDENT

Table 5.12 SUBSTUDENT

No	Attribute	Data Type	Key	Size	Description /Category
1	SubStudent_Id	Varchar2	PK	8	
2	Student_Id	Number	FK	4	
3	SubjectCode	Varchar2	FK	4	

Table Name : ATTENDANCE

Table 5.13 : ATTENDANCE

No	Attribute	Data Type	Key	Size	Description /Category
1	Student_Id	Varchar2	**FK**	10	
2	Class_Id	Number	**FK**	3	
3	Date_Attended	Date			Gives the date of attendance
4	Attended	Varchar2			Yes or No will represents the presence and absence of a student

Table Name: COURSE

Table 5.14 : COURSE

No	Attribute	Data Type	Key	Size	Description /Category
1	Course_Id	Number	**PK**	2	
2	Course_Desc	Char		60	

Table Name : DISCIPLINE

Table 5.15 : DISCIPLINE

No	Attribute	Data Type	Key	Size	Description /Category
1	Case_Id	Varchar2	**PK**	3	
2	Student_Id	Varchar2	**FK**	10	
3	Dicipline_Code	Varchar2	**FK**	3	

Table Name: STAFF_EDU

Table 5.16: STAFF EDU

No	Attribute	Data Type	Key	Size	Description /Category
1	Staff_Id	Number	**FK**	4	
2	Course_Id	Number	**FK**	2	

Table Name: SUBJECT

Table 5.17: SUBJECT

No	Attribute	Data Type	Key	Size	Description /Category
1	Subject_Code	Varchar2	**PK**	4	
2	Subject_Name	Char		28	

Table Name : TIMETABLE

Table 5.18: TIMETABLE

No	Attribute	Data Type	Key	Size	Description
1	Class_Id	Number	**FK**	3	
2	StaffSubject_Id	Varchar2	**FK**	8	
3	Time_start	Varchar2		8	
4	Time_end	Varchar2		8	
5	Day	Varchar2		10	

Table Name : RANKING

Table 5.19: RANKING

No	Attribute	Data Type	Key	Size	Description
1	Student_Id	Varchar2	FK	10	
2	Total_Marks	Number		(8,2)	
3	RANKING	Number		2	

5.4 User Interface Design

User Interface Design is one of the main parts of system design. A good interface design will help user to understand the system fast. The objective of user interface design is to provide the best way for user to interact with the computer system. Computer users are not interested in the technology behind the system. Therefore, a good and user friendly user interface design will certainly play a big role in making the system a success.

The interface is usually defined in broad terms during system specification and is designed in detail during the system design. System specification defines how interfaces fit into the new process and the kinds of input and output they should provide. The detailed design describes the actual screen layouts that make up these inputs and outputs.

Figure 5.13 shows the main page of ScMS. User needs to log in before he enters the system.. After having logged in the user is at liberty to choose one of the sub menus given namely STAFF, STUDENT or SYSTEM menu. If the user clicks at STAFF (see Figure 5.14), then it will show another page with many other options such as Staff Biodata, Staff Training, Assign Subject, View Student Co-curriculum, Classroom Attendance. Assign Co-curriculum and Assign Classroom. The STUDENT menu(Figure 5.15) shows details on Student Biodata, Register Co-curriculum, Subject Registration, Discipline Cases, Parent Biodata. The SYSTEM menu(Figure 5.16) shows information on Grade Type, Discipline Category, Co-curriculum, Classroom, Course List, Staff Category, and Subject List. The ScMS is also a versatile system as it can generate reports. Please refer to Appendix C for sample reports.

Figure 5.13 Main Menu

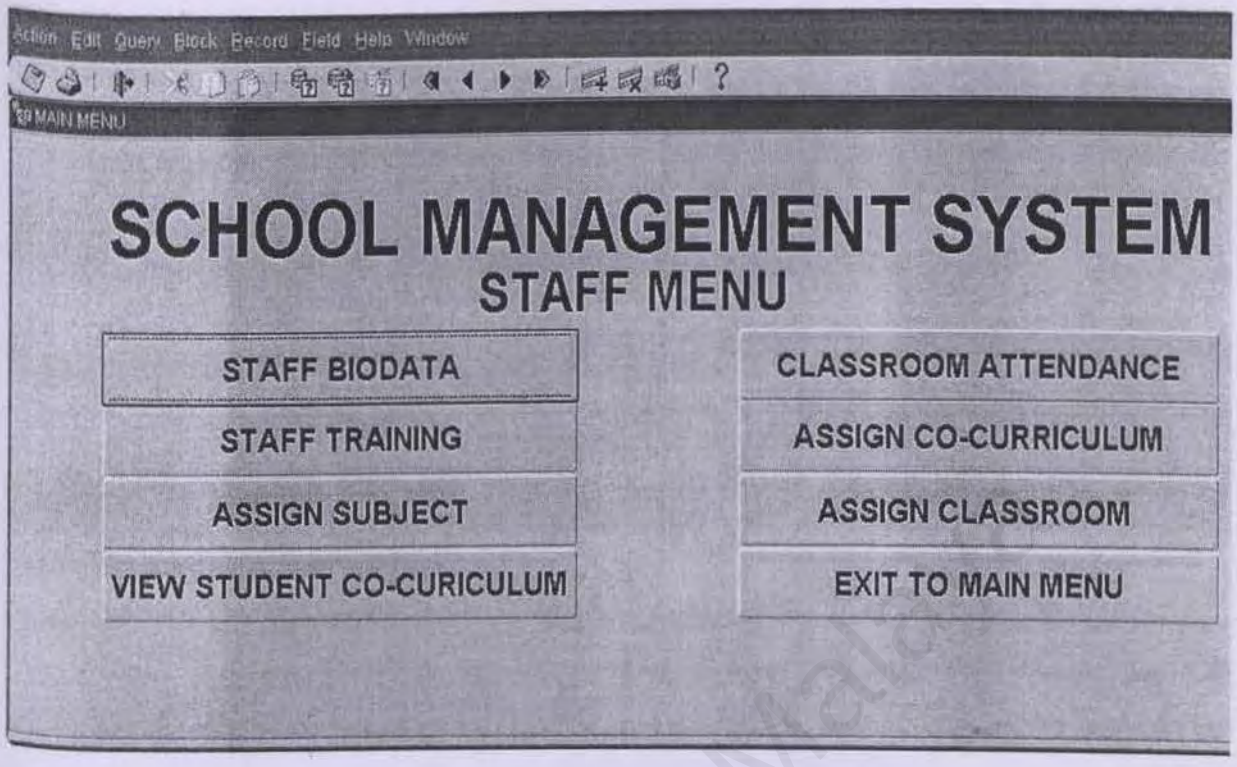


Figure 5.14 Staff Menu

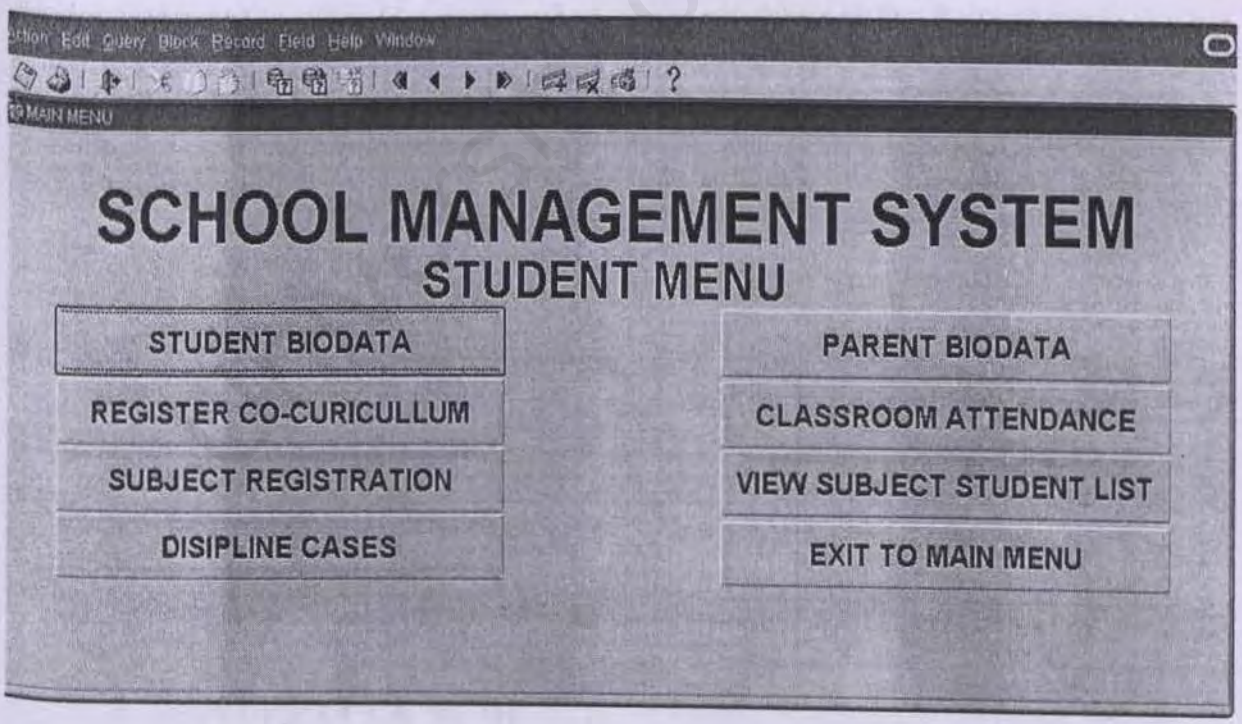


Figure 5.15 Student Menu

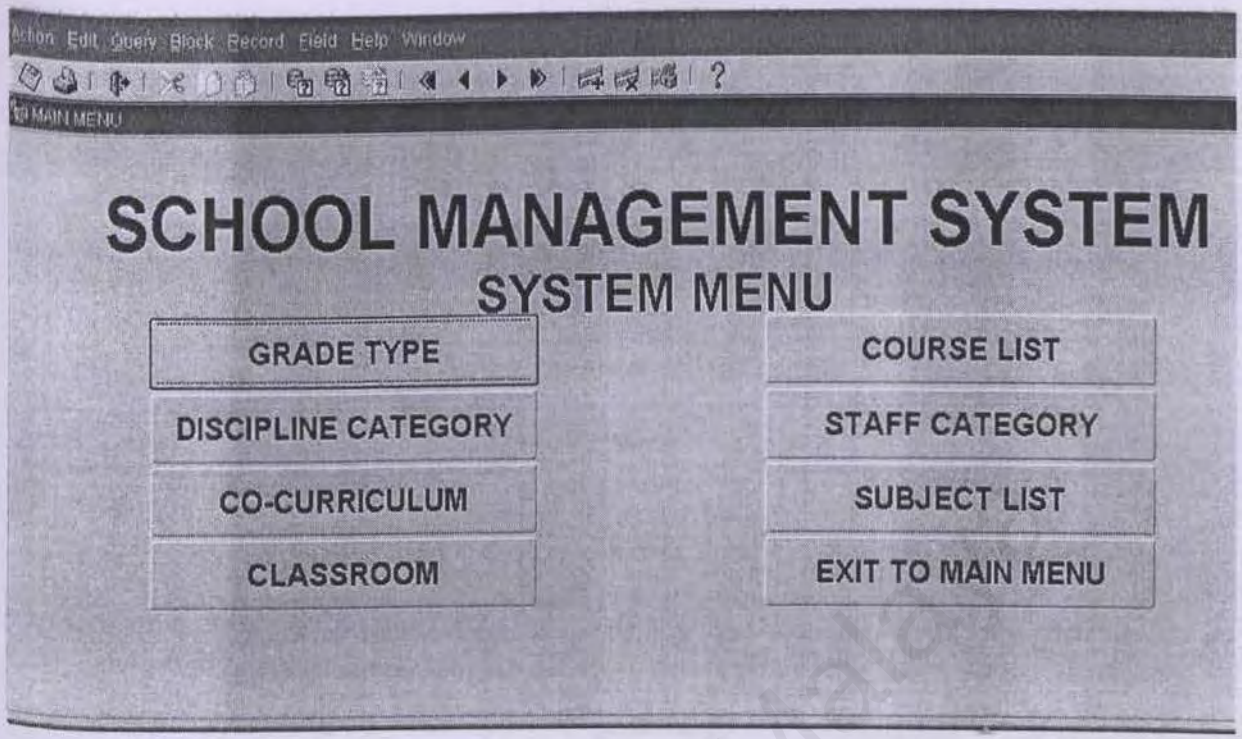


Figure 5.16 System Menu

User interfaces for other important sub-modules are shown in the figures below.

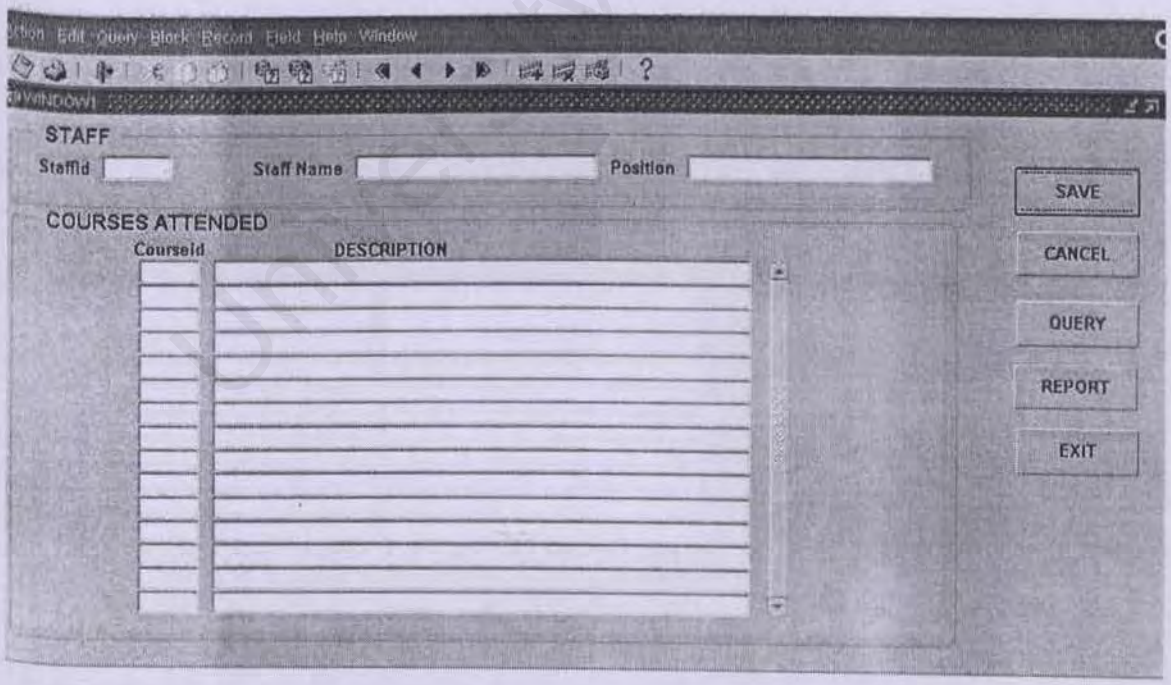


Figure 5.17 Staff Training

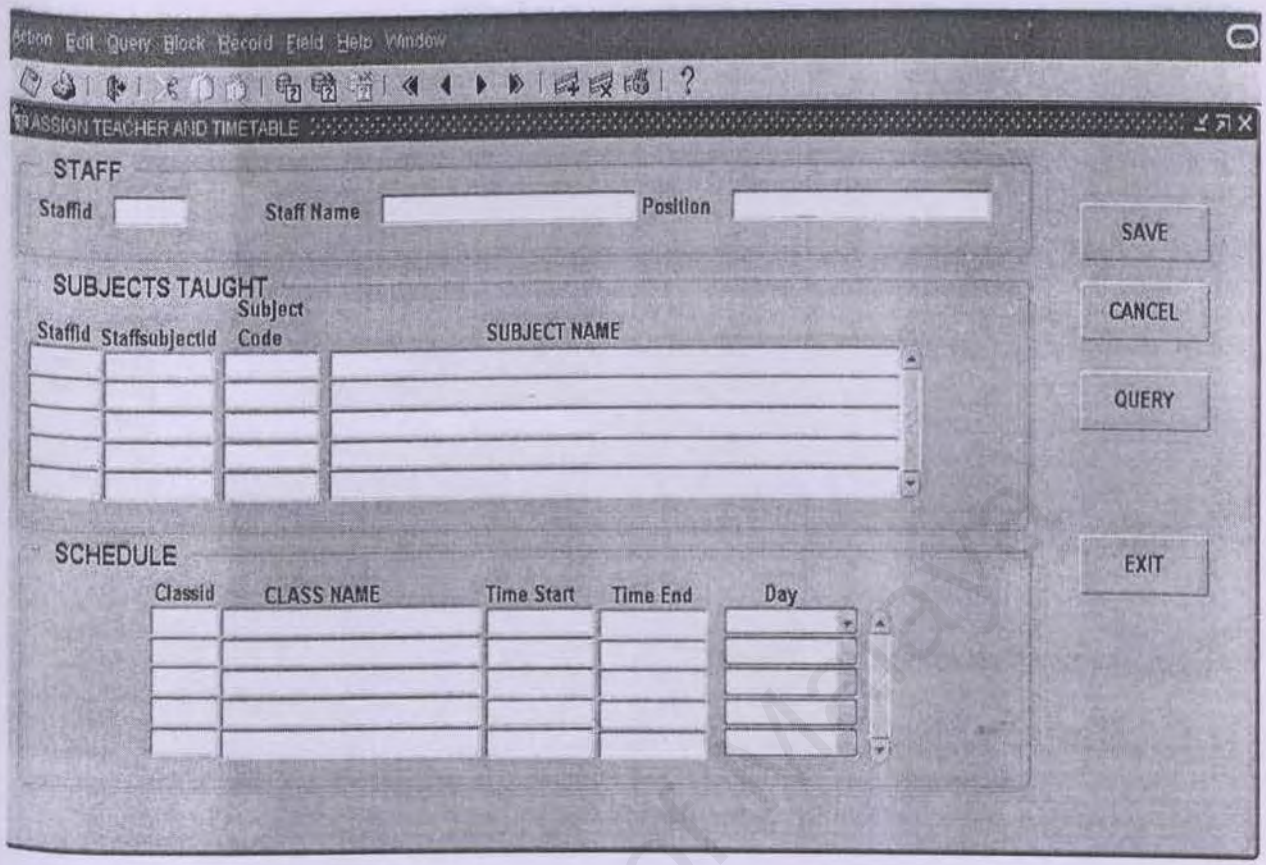


Figure 5.18 Assign Teacher and Subject

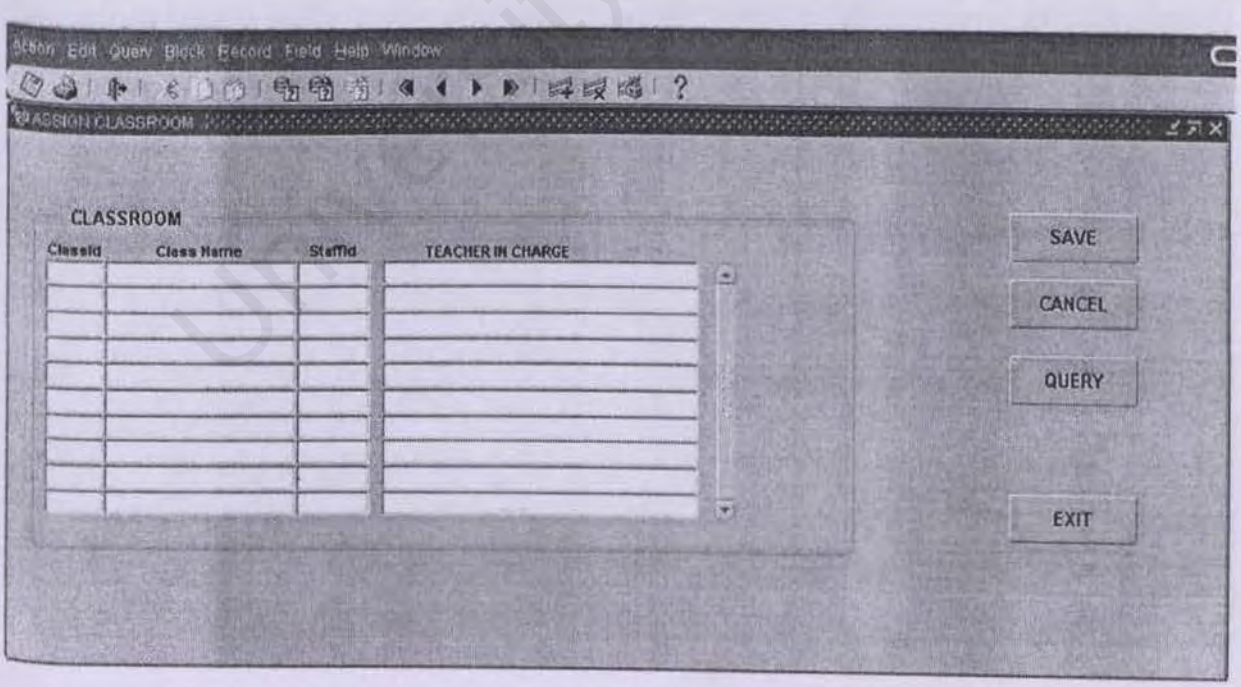


Figure 5.19 Assign Classroom

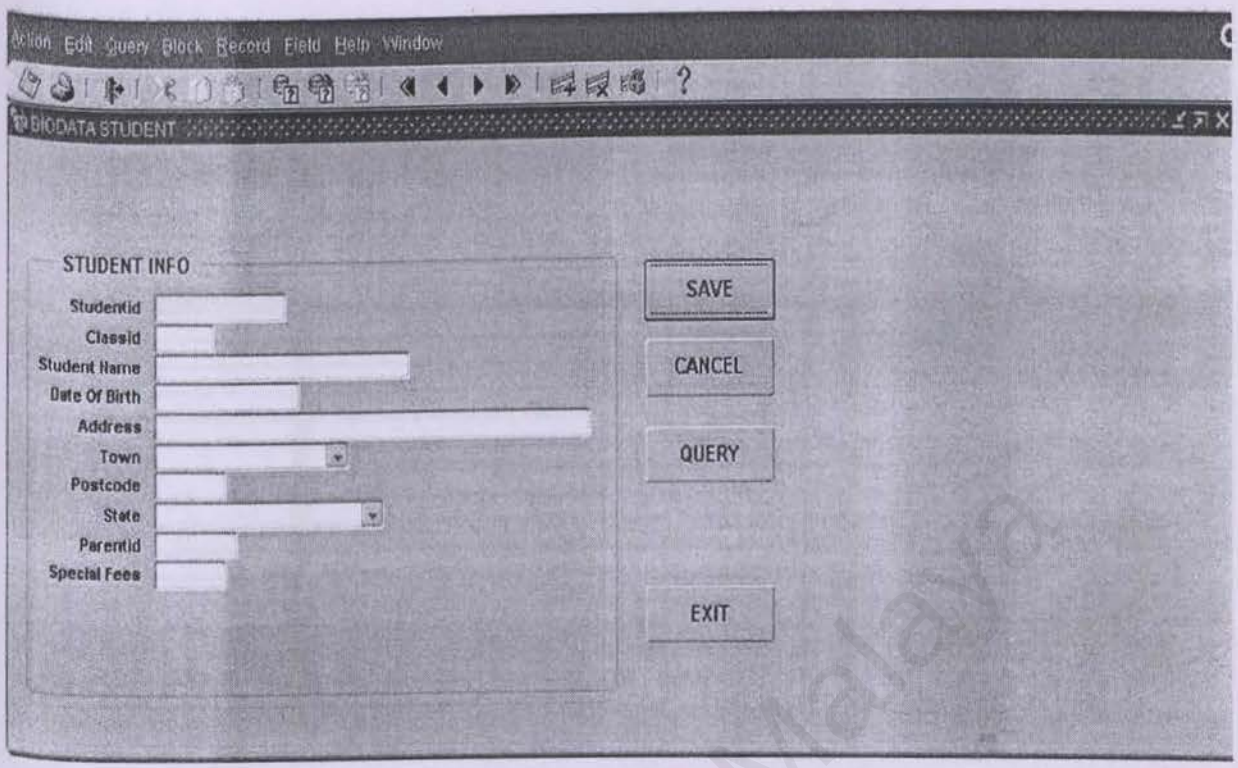


Figure 5.20 Student Information

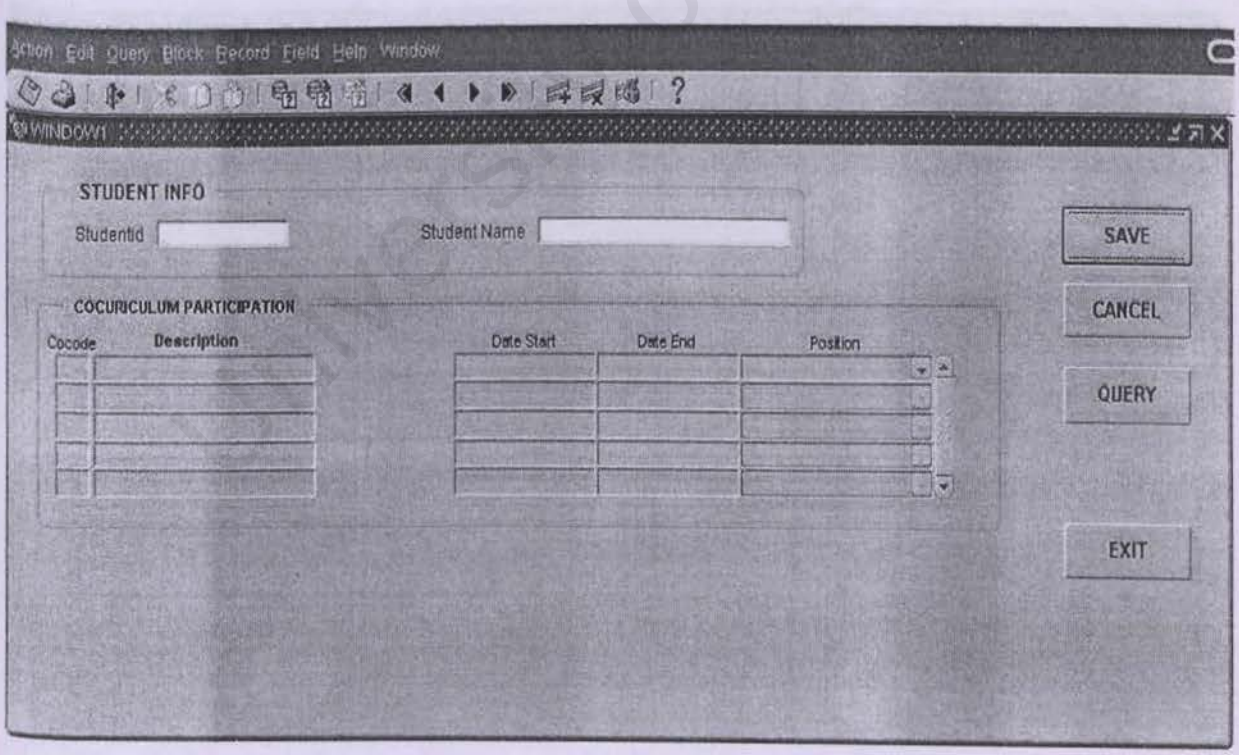


Figure 5.21 Co-curriculum Participation

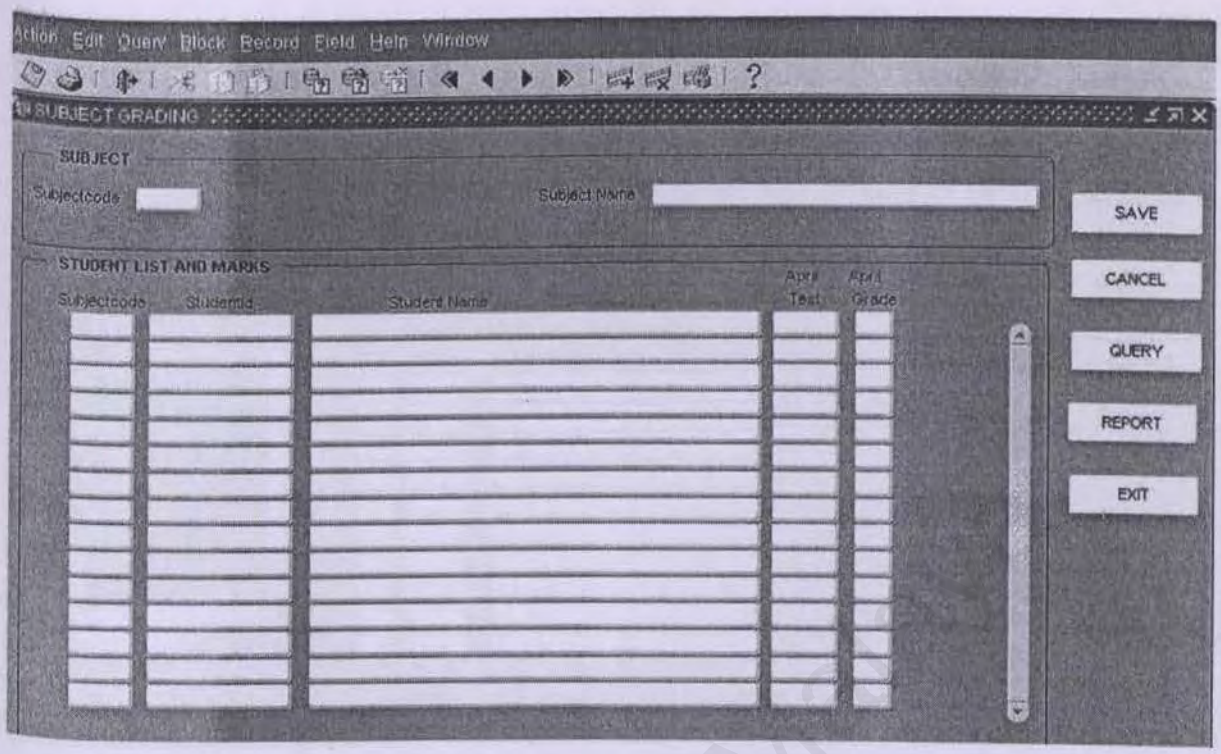


Figure 5.22 Subject and Grade

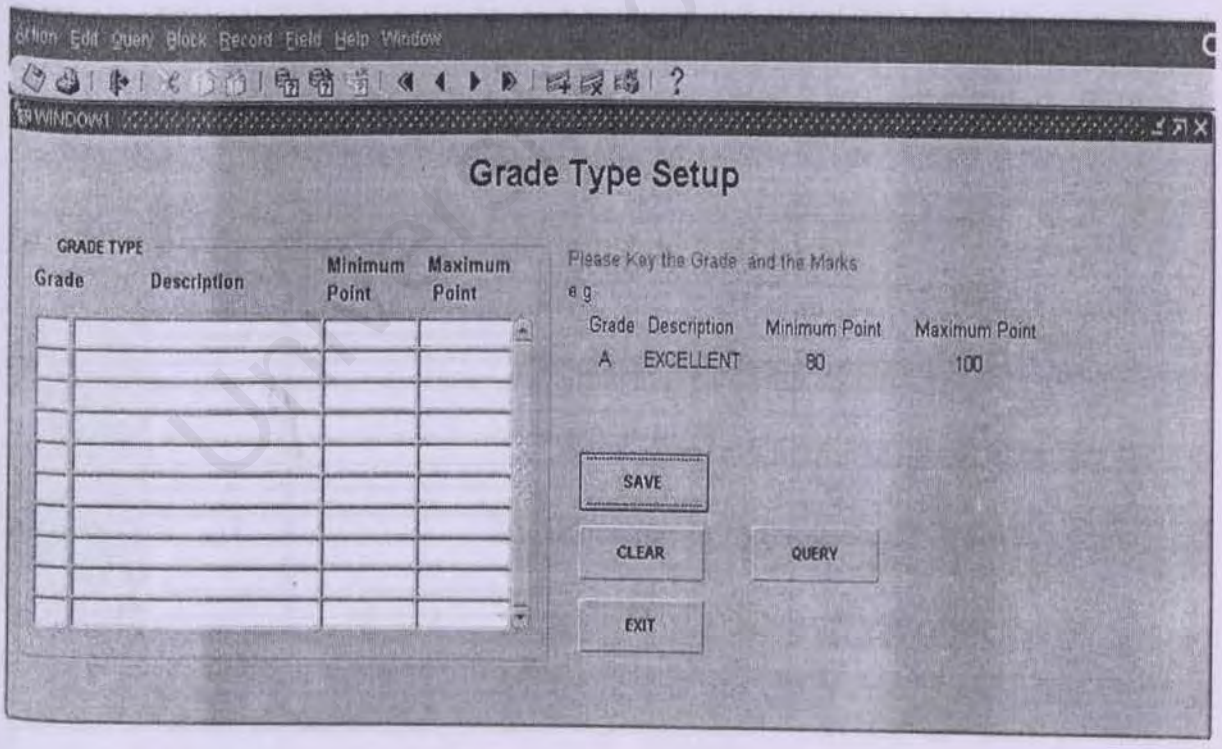


Figure 5.23 Grade Type

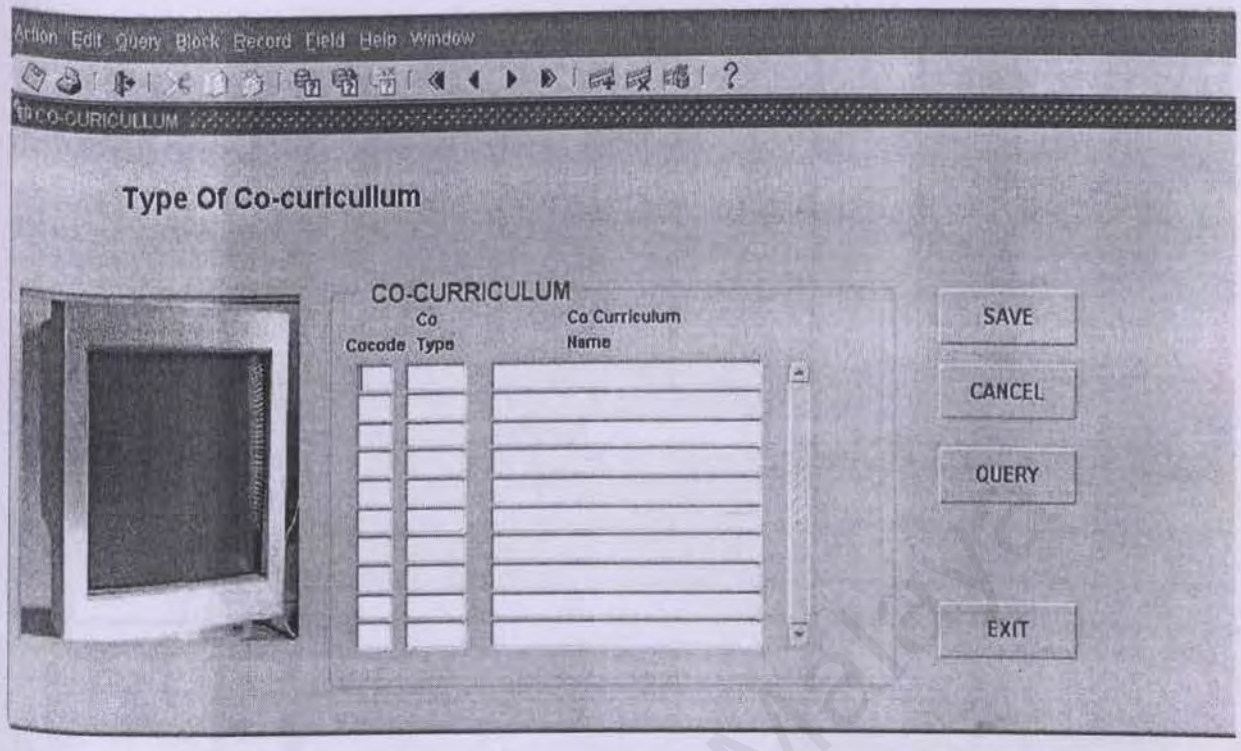


Figure 5.24 Co-curriculum List

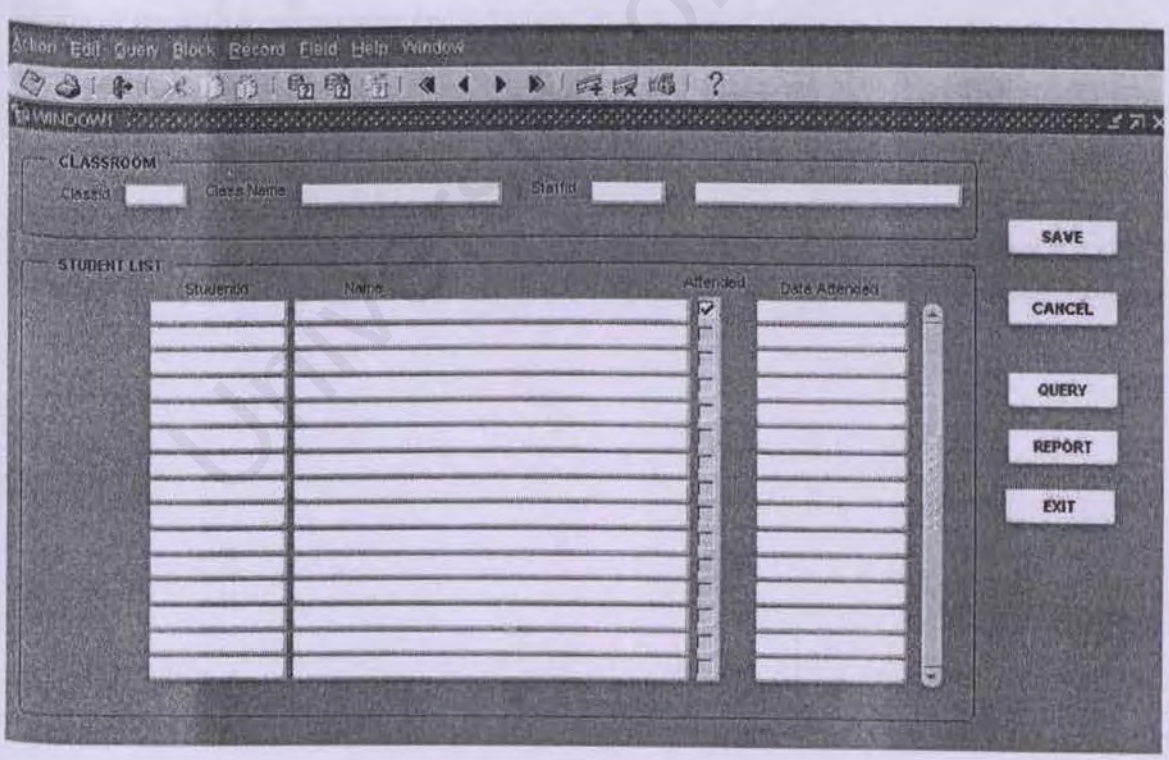


Figure 5.25 Attendance

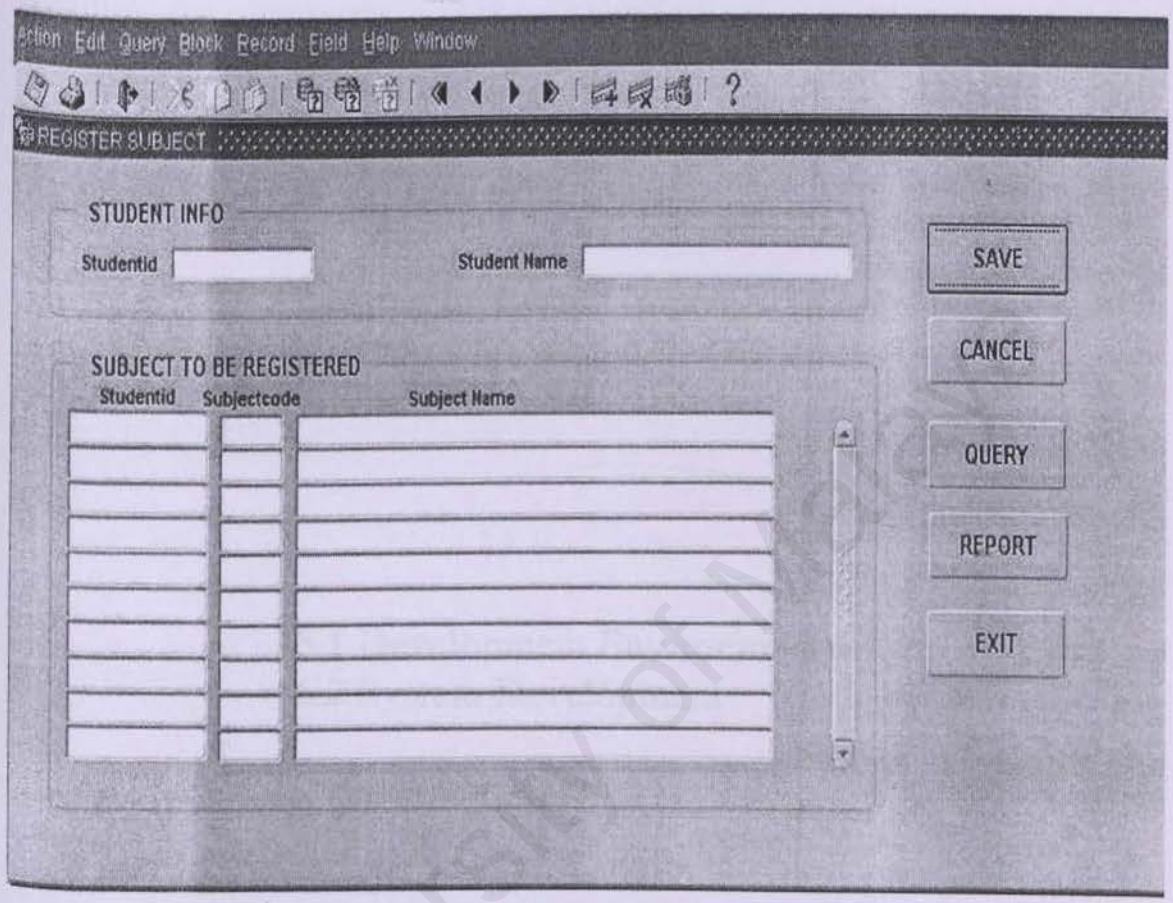


Figure 5.26 Student Subject Registration

Chapter 6: System Impementation

6.1 Development Environment
6.2 System Development

Chapter 6 : System Implementation

6.1 Development Environment

The implementation phase takes place after the system design phase. System implementation is a process that converts the system requirements and design into program codes. This phase at times involve some modifications to previous design. The development environment has certain impact on the development of a system. System development consists of hardware and soft configurations. Using the suitable hardware and software is an important factor in determining the success of the project.

6.1.1 Hardware Configuration

The following hardware specifications have been used to develop the system.

- AMD Athlon processor
- 256 MB SD RAM
- 20 GB Hard Disk
- 14" 256-colour monitor capable of 1024 x 768 resolution
- 1.44 MB Floppy Drive
- 40 x CD-ROM Drive
- Other standard computer peripherals

6.1.2 Software Configuration

The software specifications used in the development of this project are illustrated in Table 6.1

Table 6.1 Software Configuration

Software	Usage	Description
Microsoft Windows 2000 Server	System Development	Server
Windows XP – Client	System Development	Operating System for client side
Microsoft Word	System Development	Documentation
Oracle 9*i*Database	Database	Build the database to store and manipulate data.
Form Builder	Interface Design	Uses the tools and graphics to design the forms.
Oracle9i Application Server	Application Server to deliver Web content	It enables you to deliver more than 10 essay.

6.2 System Development

ScMS is developed firstly by creating 19 tables. These tables are created by using PL/SQL Language. This application is part of Oracle 9*i*Developer Suite (9*i*DS). The relational tables are the foundation of the Oracle database and the tables here are manipulated by the RDBMS using the DDL (data definition language) and DML(data manipulation language). The Data Definition Language allows the database designer

to define all the data that will be stored in the database. The data includes not only data on school information but also rules and constraints such as types of relationship between entities, validation and integrity rules. The DDL is able to able to capture information about the data stored in the database. The DBMS stores all the data in the data dictionary or repository. The DBMS automatically applies rules and constraints when users access the database for information. The Data Manipulation Language allows users to manipulate information contained in the database. It allows to read, update and delete information Users can do this by using Structured Query Language(SQL). SQL provides a set of powerful, easy-to-use commands to retrieve information from the Oracle database.

6.2.1 Architecture Implementation

In describing the architecture implementation there is a need to mention the various components of Oracle 9*i*AS J2EE and Web Cache so that one can understand how the system as a whole works. The components include the following:

- Oracle 9*i* AS Web Cache: For both static and dynamic requests, this component can cache the results, thus reducing the workload of the Web server machine behind it.
- Oracle HTTP Server: This is the Oracle 9*i*AS component that services HTTP requests. It responds to requests forwarded to it by Oracle 9*i*AS Web Cache. The Oracle HTTP server sub-system is comprised of a Web server (based on

Apache), a Perl execution environment, a PL/SQL and a OC4J routing system.

- Oracle 9*i*AS containers for J2EE(OC4J): This is the J2EE compliant container in Oracle 9*i*AS. It provides clustering capabilities for the J2EE component – servlets, Java Server Pages(JSP) and Enterprise Java Beans(EJB). It also contains other mechanics such as Java object cache which provides caching capabilities.
- Infrastructure Repository: This is a database or file based repository.
- Clustering Infrastructure Components: These include Oracle Process Manager and Notification Services, mod_oc4j and Distributed Configuration Manager.

The components deployed in a clustered scenario is shown in the next page.

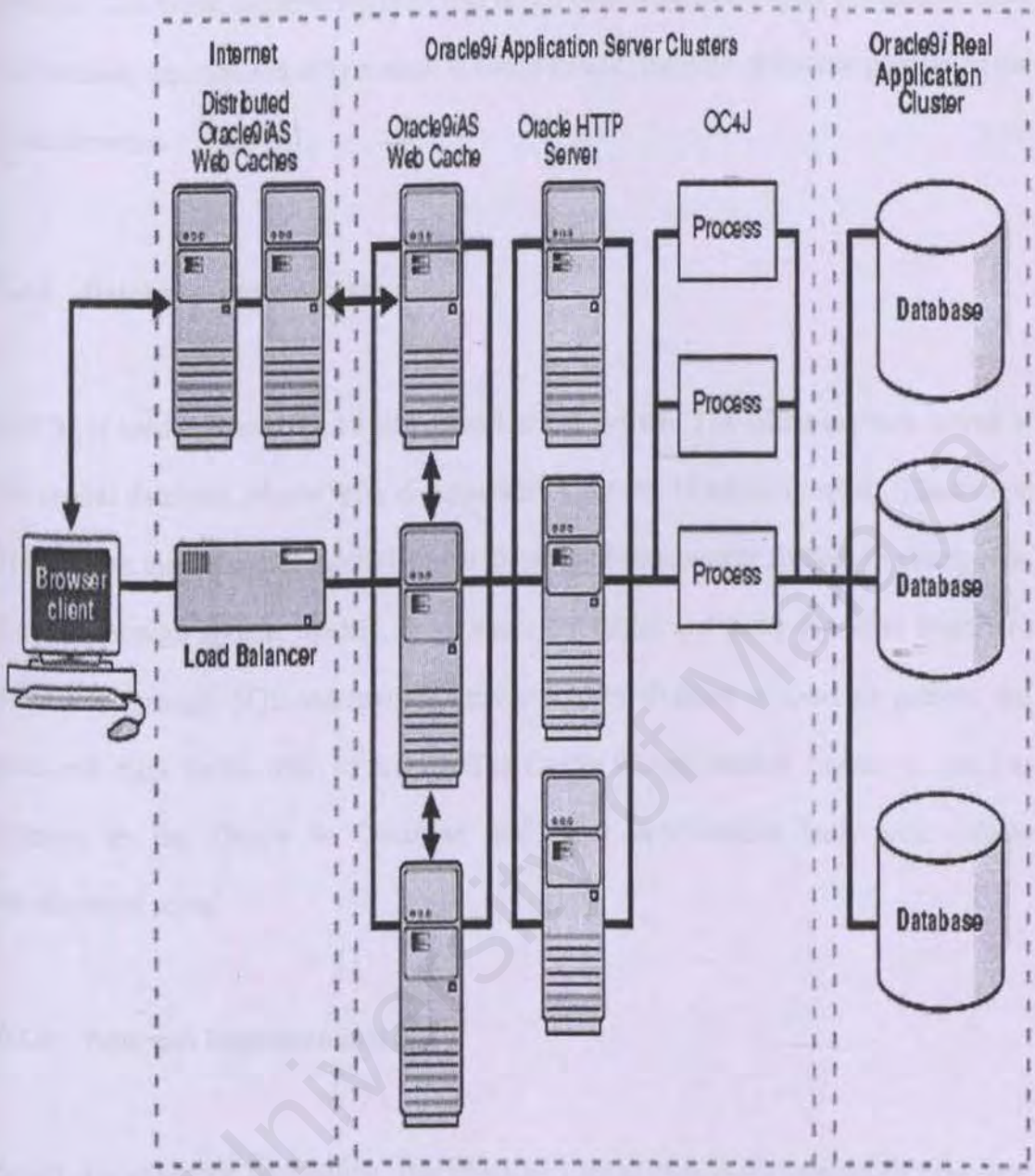


Figure 6.1 Clustered Components

Basically the architecture implementation shows the Form services through the client browser request for information from the Web server by way of the J2EE servlet

(OC4J). The client requests are then sent to the Oracle database to be processed. Once this is done, the required information is relayed back through the same process to the client browser.

6.2.2 Database Implementation

Pl/SQL is used to create the 19 tables used in this system. The tables are then stored in the central database. Please refer to Appendix A for the 19 tables created . The Oracle 9*i* Database makes use of the Relational Database Management System to manipulate the data through update, modify, drop, alter, join tables and carry out other important processes through SQL statements. Oracle Report Builder is used to present the analyzed data in the form of reports. The Oracle 9*i* Application Server is used to connect to the Oracle 9*i* Database and other applications built with Oracle development tools.

6.2.3 Program Implementation

ScMS is a windows application that involves a lot of data input process by users that involves the database.. To carry this out form design must be carried out. Oracle Form Builder is used to design the various forms used in the school management system. Some of the designed forms are either in tabular form or in form design. After having input data into the designed forms coding would have to be done using PL/SQL Editor. A number of triggers were also created to facilitate procedures like

save, clear, exit, query etc. Part of the coding used in this system is printed in the appendix for easy reference. PL/SQL Plus is further used by the system developer to design complex program codes to carry out attendance analysis and marks analysis. A list of values (LOV) was used a number of times to help in input of data.

Chapter 7: System Testing

7.1 Testing Approach
7.2 Types of Testing

Chapter 7: System Testing

7.1 Purpose of Testing

The primary purpose of testing is to ensure the resulting component of program as well as the program as a whole fulfills the requirements specification and to eliminate errors in the program, Thus, a systematic test procedure is required to ensure the system is tested thoroughly and completely. Generally there are 4 basic concepts related to software testing.

- Error detection
- Error removal
- Error tracking
- Regression testing.

The ScMS follows the classical strategy for testing software, beginning with unit or component testing and working towards integration and system testing as a whole. The figure in the next page shows the testing process starts from component testing, integration testing and finally user testing. However, the back arrow shows that the reverse testing will take place as defects or errors are discovered. Programming and coding adjustments are required to rectify the error.

7.2 Types of Testing

ScMS is considered as a fairly large system because it consists of many sub-systems. Therefore the entire system should not be tested as a single unit The Staff Menu or

module consists of 7 other sub modules. Similarly, the Student Menu and System Menu consists of many other sub modules. Each main module will handle a few sub modules. The testing process will proceed in stages when testing is carried out incrementally in line with the system implementation.

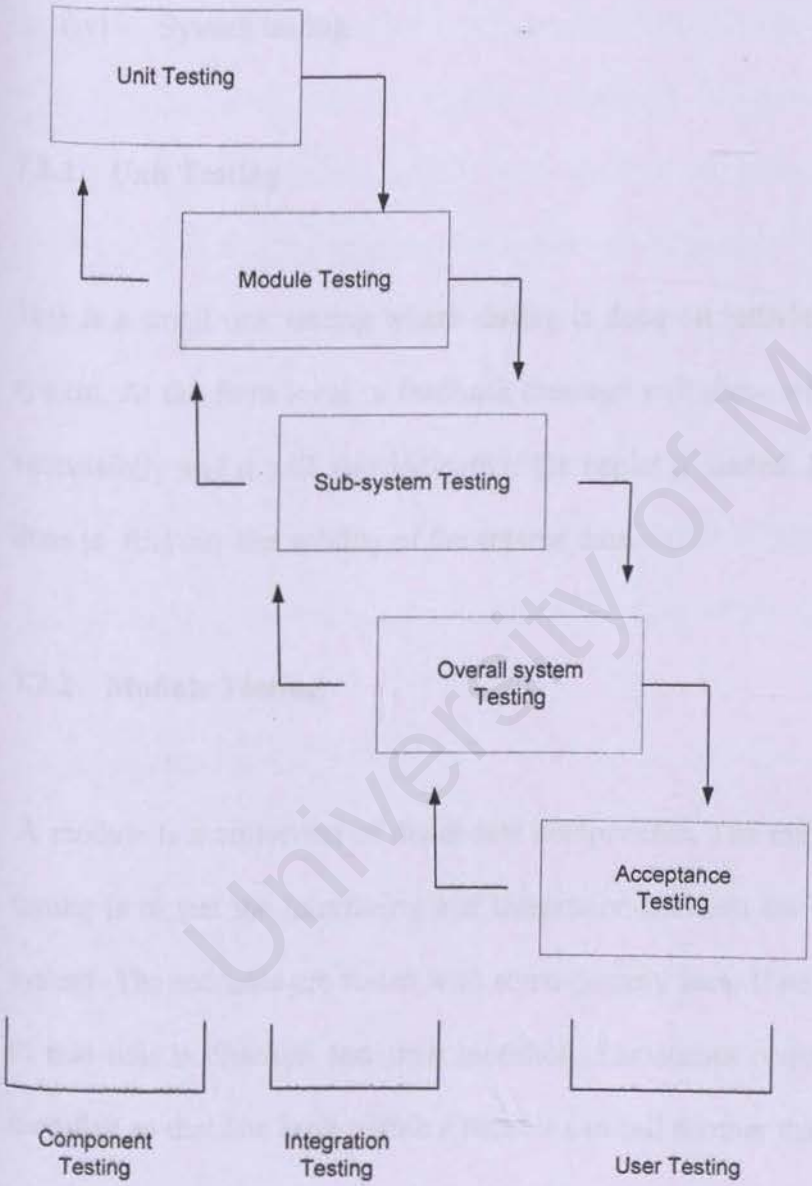


Figure 7.1 The Process of System Testing

The most commonly used types of testing are :

(i) Unit Testing

(ii) Module testing

(iii) Integration testing

(iv) System testing

7.2.1 Unit Testing

This is a small unit testing where testing is done on individual components of the system. At the form level a feedback message will show whether the form is built successfully and it will also indicate if the applet if loaded. Input validation is also done to find out the validity of the entered data.

7.2.2 Module Testing

A module is a collection of dependent components. The main objective of module testing is to test the interfacing and integration between the modules that form the system. The modules are tested with some dummy data. If an error occurs, the error to that unit is checked and then modified. Sometimes coding would have to be modified so that one form within a module can call another that is relevant.

7.2.3 Integration Testing

This phase involves testing collection of modules which have been integrated into sub-systems. Sub-systems may be independently designed and implemented. Sub-systems interface mismatch is often detected and rectified during this stage . Integration testing is based on a written system specification. This can be a detailed system requirements of the system. A separate individual or a team should be responsible for integration testing. Two types of integration testing that are widely used are bottom-up integration and top-down integration. ScMS makes use of top-down testing as the scale of ScMS is not extremely large. Top-level component has to be programmed and tested at the first level. Only then, the sub-components are implemented and tested at the next lower level modules.. Special attention is given to the master-detail relationship at this stage. This relationship must be created and followed so that the components can linked appropriately in all the sub-modules.

7.2.4 System Testing

When the unit testing and the integration testing have been completed, the whole system would be tested to ensure the software product does not fail. System testing can be broken down into two types namely security testing and performance testing.

7.2.4.1 Security Testing

Security attempts to verify the protection mechanism built into the system. It attempts to protect the system from unauthorized users and hackers. During security testing, the tester plays the role of an individual who tries to hack into the system. In ScMS , the user is given a password. In fact the user is created by going through a strict procedure. The database cannot be entered until and unless one has the appropriate userID and password.

7.2.4.2 Performance Testing

Performance testing is designed to test the run-time performance of software within the context of an integrated system. Hardware resources appear to be more important at this stage and it is often necessary to measure the hardware utilization such as processor cycles. The table below compares two computers that have been used in the performance testing of ScMS.

Table 7.1 Performance Testing Table

Computer A	Computer B
Intel Pentium II processor	AMD Athlon 1600 processor(Compaq 921 AP Presario)
128 MB RAM	384 MB RAM
Intel Motherboard	Compaq motherboard

The results shows that the system can perform fairly well but there is a big difference in terms of speed execution. Data entry, data retrieval and loading are much faster using Computer B with a higher capacity RAM. and a much faster processor.

7.2.5 User Acceptance Testing

When a system has been built, there typically is a final phase of 'user acceptance' testing. This is to ensure that the product complies with functional and quality requirements including usability. It is often prudent to have the client test the application before it is released to the target audience. At the acceptance stage however, it is difficult and costly to make major changes. But it is essential to identify any critical problems and assess their likely impact on the product success. Late evaluation may also help identify quick wins , that is a minor change may make a big difference to the quality of use.

7.2.5.1 Test Case

A test case is a set of input data and expected results that test the system with the purpose of causing failure and detecting faults. If there is a shortcoming or fault, then the source codes are reviewed and rectified. In the case of **ScMS** a number of teachers including the principal and three Senior Assistants were given the

opportunity to test the system and their results were recorded and evaluated. The test procedure and the corresponding results are tabulated below.

Table 7.2 Test Case

No	Test Condition	Expected Result	Fail/Pass	Remarks
1.	Connecting to the system	User able to open the system	Pass	
2.	User able to log into the system using allocated password	User logs-in without any difficulty	Pass	If user fails he or she is given 3 tries.
3.	User able to view main student and system menu	User able to surf the different options.	Pass	
4.	Teacher able to upload information	Teacher updates student file	Pass	
5.	Teacher downloads information	Teacher prints student list	Pass	
6	User able to find specific info by executing query.	Able to obtain information	Pass	Query codes will have to be programmed
7	User able to obtain summary attendance by day, month and semester	Summary of attendance could be obtained through mouse click.	Pass	Elaborate coding is necessary

8	Teacher able to analyze test marks	Analysis of marks done with ease	Pass	
9	Principal able to sort teachers according to salary	Done with just a mouse click	Pass	
10	Teacher uses Report Builder to make summary reports	User makes use of simple command buttons to make reports.	Pass	

Chapter 8: System Evaluation and Conclusion

8.1 Problems Encountered and its Solutions
8.2 Evaluation by End Users
8.3 System Strength
8.4 System Constraints and Future Enhancement
8.5 Knowledge and Experience Gained
8.6 Conclusion

Chapter 8 : System Evaluation and Conclusion

8.1 Problems Encountered and its Solution

A number of problems were encountered while making the system and its subsystems. During the creation of the SQL tables, it was found that some tables could not be created. This was so because the master table had to be created before the detail is created. This error was rectified when the relationship was established and measures were taken to avoid such a pitfall in later creation of tables. Secondly the input of data into tables was found to be a laborious task. This task was made simple by creating many LOV's (List of Values). In this way, input of value became a easier task. Thirdly, a technical problem arose. The loading of applets into the forms was rather slow. The 256 RAM capacity was inadequate and another 128 MB was added. This tremendously increased the speed of loading the applets. Problems were also encountered in arriving at a suitable coding program for analyzing marks of the tudents and making analysis of the attendance. Many trial and error sessions were done before a suitable solution was found.

8.2 Evaluation by End users

End users in particular teachers and school administrators found the system extremely useful to them as the system was able to speed up the recording and retrieving of information. It eliminated much of the tedious chores of a teacher and shortened the time span of processing marks and attendance. One notable

weakness is that the system was not able to automatically sort data regarding timetabling. Information regarding school book aid, library records and hostel information was again not included in the system. On the part of the system developer it was beyond the scope to build a system covering all aspects of the school.

8.3 System Strength

The advantages of the system are listed below:

8.3.1 User friendliness

The system interface design is attractive, user friendly and easily understood by end users. It tells the users how to work with the system. Users have the control of the system function flow by just clicking on the appropriate buttons. Users are able to views the system even from remote areas. This means teachers can work on the system from the comforts of their home.

8.3.2 Password protection

The ScMS is a password-protected site. Giving authorized ID and password prohibit unauthorized personnel from accessing information from the system. With password restrictions people find it rather difficult to hack into the system.

8.3.3 System Transparency

This refers to the condition where the users do not need to know where the database reside, how the system structure is, its database management system and anything related to building the system. Users are just required to know how to communicate with the user interface.

8.3.4 Validation of Input Data

The system is precise on computations and control. Client side validation technique is used to implement validated data. Only valid data entry is accepted. If there is an error , an error message will prompt the user about the error

8.4 System Constraints and Future Enhancement

As mentioned earlier, ScMS is only a part of the entire school administration system. Parts which were left out are the Book Aid Scheme, library records, hostel records and timetabling. If these four areas could be incorporated into the system then ScMS would be fully complete. The four areas mentioned above were also left out because of time constraint. The eight months allocated to do this project was inadequate to complete a school management system incorporating all the major features in a typical school.

8.5 Knowledge and Experience Gained

Some of the knowledge and experience that I gained from the development of ScMS are documented below.

8.5.1 Time Management

A project would not be successful without proper and effective time management skills. During the development of ScMS, there were other constraints such as studying for other subjects and doing other assignments. It was a struggle and I had to manage my time in such a way that I could comfortably manage and complete all my tasks within the specified time. This project has aided me to realize the importance of time management.

8.5.2 Documentation

Project documentation also serves as a learning experience and the requirement for documentation has to follow the standard procedure that is specified . The entire project had to be documented in a professional manner and an appropriate numbering system implemented. In this way documentation became systematic and can be used as a reference by end users.

8.5.3 Skills Improvement

Valuable knowledge was gained in Oracle coding principles, database design and analyzing user needs. Automatic generation of attendance and marks analysis became difficult tasks at first but after many trial coding runs the problem was resolved.

8.6 Conclusion

In conclusion, ScMS has achieved its objective in building a window-based application by fulfilling all the functional and non-functional requirements. However, there is still room for improvement in ScMS . Other features such as Book Aid Scheme, Hostel Administration and Timetabling in the school administration ought be included so that the system would be able to serve everyone's needs.

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