ELEMENTARY SCHOOL TUTORING SYSTEM

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1. Introduction

1.1. Purpose of Document

The purpose is to define interfaces between teams of developers and serve as a reference and overall guidance to the architecture of the software project.

1.2. Purpose of System

This system helps the student to improve their analytical skills, reading skills, critical thinking, problem solving on particular subjects. It also helps the student how to manage their time by allotting each subject a particular amount of time so that the student can manage the time to complete those questions. This helps mainly in boosting their confidence.

1.3. Design Goals

1.3.1. Performance

This software should perform the same way irrespective to its Operating System environments.

1.3.2. Portability

As this software is to work on multiple platforms portability is an essential attribute and we ensure this by using JAVA as our programming language.

1.3.3. Security

This software keeps the information of a user in a secure way.

1.3.4. Accuracy

The capability of the software product to provide the right or agreed results or effects with the needed degree of precision.

1.3.5. Adaptability

This software is adapted for different specified environments without applying actions.

1.3.6. Maintainability

Updates or changes in this software can be carried out without affecting the application as a whole.

1.3.7. Scalability

The software has capability to handle a growing amount of work.

1.3.8. Flexibility

In this software architecture each tier can be managed or scaled independently, flexibility is increased.

1.4. References

Page 284-293 in Bernd Bruegge and Allen H. Dutoit, *Object-Oriented Software Engineering: Using UML, Patterns and Java*, 3rd Edition, Prentice Hall, 2010 (ISBN 978-0136061250)

https://en.wikipedia.org/wiki/Software_design_description

https://msdn.microsoft.com/en-us/library/ee658117.aspx#ClientServerStyle

2. Current Software Architecture

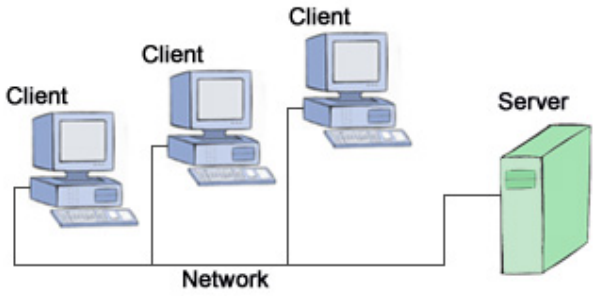

Figure 2.1Client/Server Architectural Style

The current software uses client/server architecture. The client/server architectural style describes distributed systems that involve a separate client and server system, and a connecting network. The simplest form of client/server system involves a server application that is accessed directly by multiple clients, referred to as a 2-Tier architectural style. Client/Server architecture indicates a graphical desktop UI application that communicated with a database server containing much of the business logic in the form of stored procedures, or with a dedicated file server. More generally, however, the client/server architectural style describes the relationship between a client and one or more servers, where the client initiates one or more requests, waits for replies, and processes the replies on receipt. The server typically authorizes the user and then carries out the processing required to generate the result. The server may send responses using a range of protocols and data formats to communicate information to the client.

3. Proposed Software Architecture

3.1. Overview

Three-tier architecture is a client-server architecture in which the functional process logic, data access, computer data storage and user interface are developed and maintained as independent modules on separate platforms. Three-tier architecture allows any one of the three tiers to be upgraded or replaced independently. The user interface is implemented on a desktop PC and uses a standard graphical user interface with different modules running on the application server. The relational database management system on the database server contains the computer data storage logic. The middle tiers are usually multitier.

The three tiers in three-tier architecture are:

1. **Presentation Tier**: Occupies the top level and displays information related to services available on a website. This tier communicates with other tiers by sending results to the browser and other tiers in the network.
2. **Application Tier**: Also called the middle tier, logic tier, business logic or logic tier, this tier is pulled from the presentation tier. It controls application functionality by performing detailed processing.
3. **Data Tier**: Houses database servers where information is stored and retrieved. Data in this tier is kept independent of application servers or business logic.

3.2. Subsystem Decomposition

3.2.1. System Architecture Pattern

We use 3-tier software architectural pattern as a basis for system architecture and design. This is shown in the below figure 3.2.1.

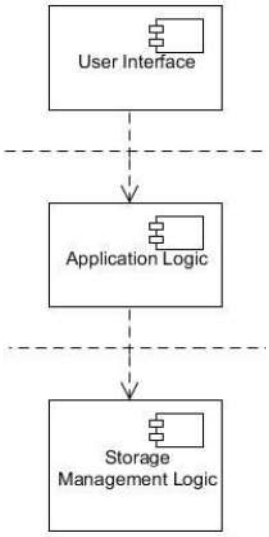

Figure 3.2.1 3-Tier Architectural Style

The main reasons to choose this architecture are Maintainability, Scalability, Flexibility, Security are the main design goals to choose this architecture pattern. When any updates required in the software it can be easily done. It can handle large amount of work due to its high scalability. Since each tier is managed independently, flexibility of software increases. All data is stored on the server which offers a high security.

3.2.2. Subsystem Organization

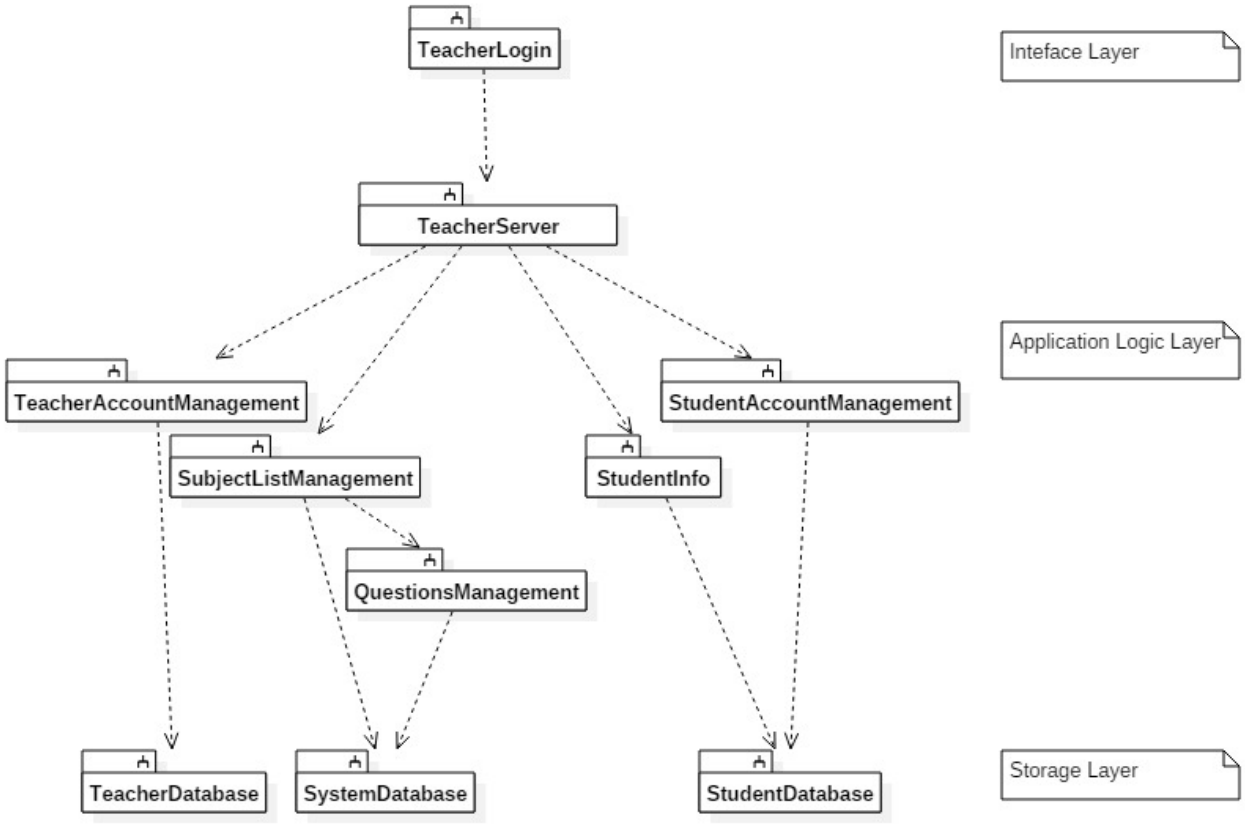

Figure 3.2.2.a Teacher Subsystem Decomposition

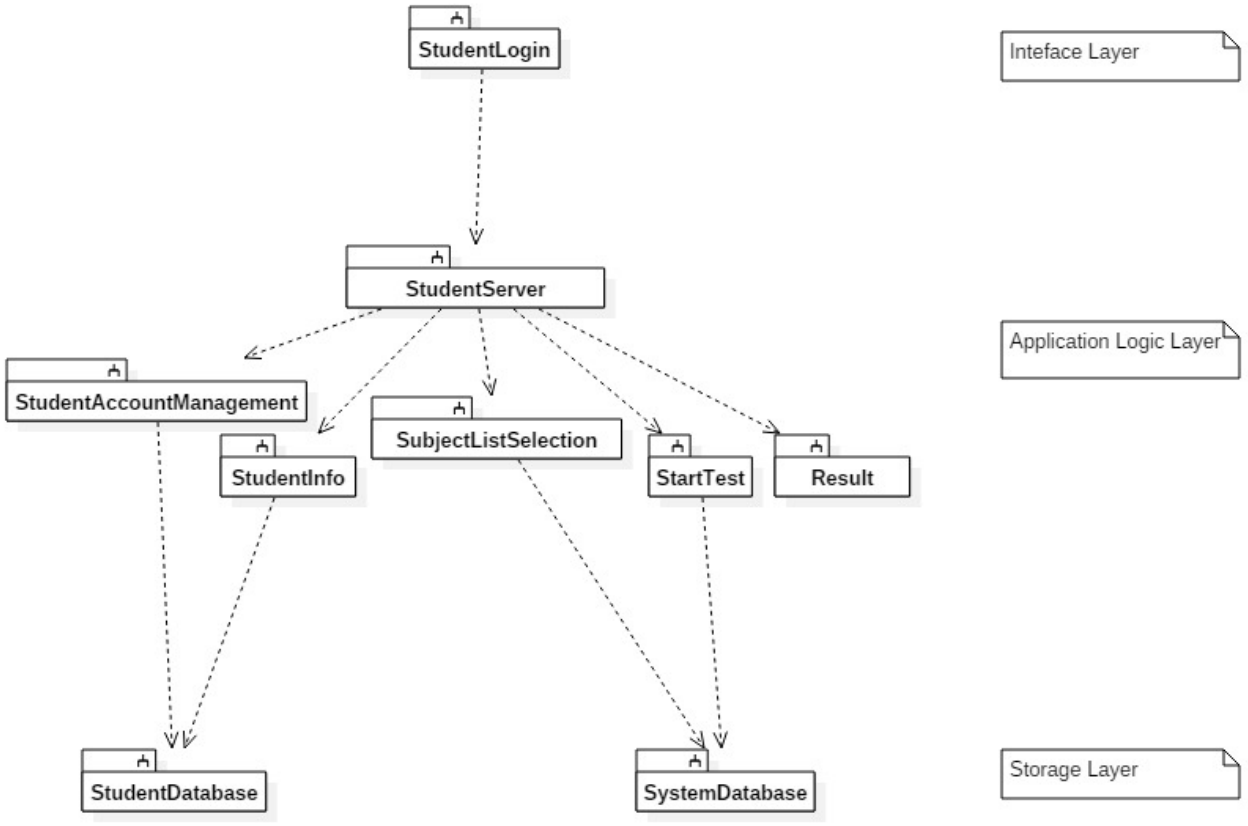

Figure 3.2.2.b Student Subsystem Decomposition

3.2.3. Subsystem Responsibilities

Teacher Login: It authenticates the user whose credentials are stored in the teacher database.

Teacher Server: To access the further process the teacher need to connect to the server.

Teacher Account Management: It helps to change the teacher information and to change the password.

Subject List Management: It helps to update subjects list like addition or deletion of subjects.

Questions Management: It helps to update questions list like addition or deletion of questions.

Student Info: It helps to view the any student info.

Student Account Management: It helps to create student account and deletes and update the student account.

Student Login: It authenticates the user whose credentials are stored in the student database.

Student Server: To access the further process the student need to connect to the server.

Student Account Management: It helps to change the password and update information.

Subject List Selection: It helps to select the subjects by the student to take test.

Start Test: It is the test subsystem which is the process of test.

Result: It processes the test and views the result.

Teacher Database: It stores the data related to teacher.

Student Database: It stores the data related to student.

System Database: It stores the test related data like subjects, questions and results of the respected students.

3.2.4. Subsystem Rationale

Teacher subsystem is created in order to create the student accounts and manage the subject list and manage questions in the particular subject and view the particular student info by accessing to the student database.

Student subsystem is created in order to update any information related to the student, selects the required subject to take the test and helps to know the result for the test.

All the three databases teacher, student and system are created in order to store the respected information and to access them easily.

3.3. Hardware / Software Mapping

3.3.1. COTS

Hardware Components

Main processor - Pentium 4

Hard disk capacity - 80 gb

RAM - 1GB

Processor speed - 466mhz

Display - monitor

Software Components

Operating systems - windows 7/8

Backend end tool - Java virtual machine

It is used for developing code for the project.

Front end tool - Net Beans ide

It is used for implementing and executing the code

Database -MYSQL Database

It is used for storing, updating, deleting, inserting the data.

Technologies - Java (J2EE) with struts framework

It is an open source framework that extends the Java Servlet API and employs a Model, View, Controller (MVC) architecture. It enables you to create maintainable, extensible, and flexible web applications based on standard technologies such as JSP pages, JavaBeans, resource bundles, and XML.

Web Server - Apache/Tomcat

Apache Tomcat is used to deploy Java Servlets and JSPs. So in Java project we can build our WAR (short for Web Archive) file, and just drop it in the deploy directory in Tomcat. So basically Apache is an HTTP Server, serving HTTP. Tomcat is a servlet and JSP Server serving Java technologies.

3.3.2. SW deployment

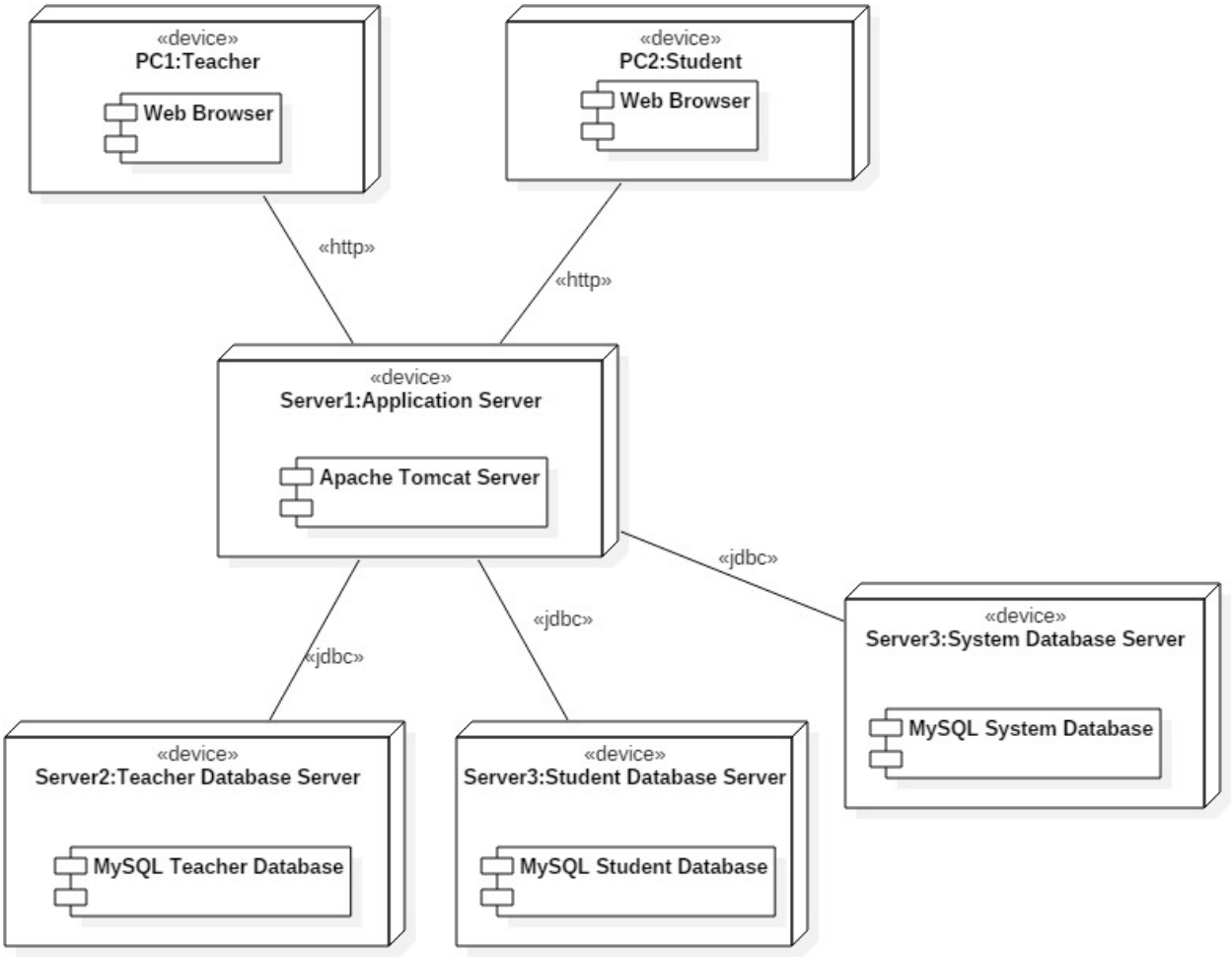

Figure3.3.2. Deployment Diagram

3.4. Persistent Data Management

It will largely depend on relational database to perform access/modify student and teacher data and storing subjects lists and questions for the respective subjects. Data will be stored in mySQL and manipulated through the Database Subsystem, which will ensure data integrity and consistency. Database Subsystem will contain all necessary SQL queries that will be accessible by the rest of the Subsystems.

The data stored in the database will include:

- Student information
- Subjects list
- Questions list
- Teacher information

The database will be backed up on a daily basis to ensure data security.

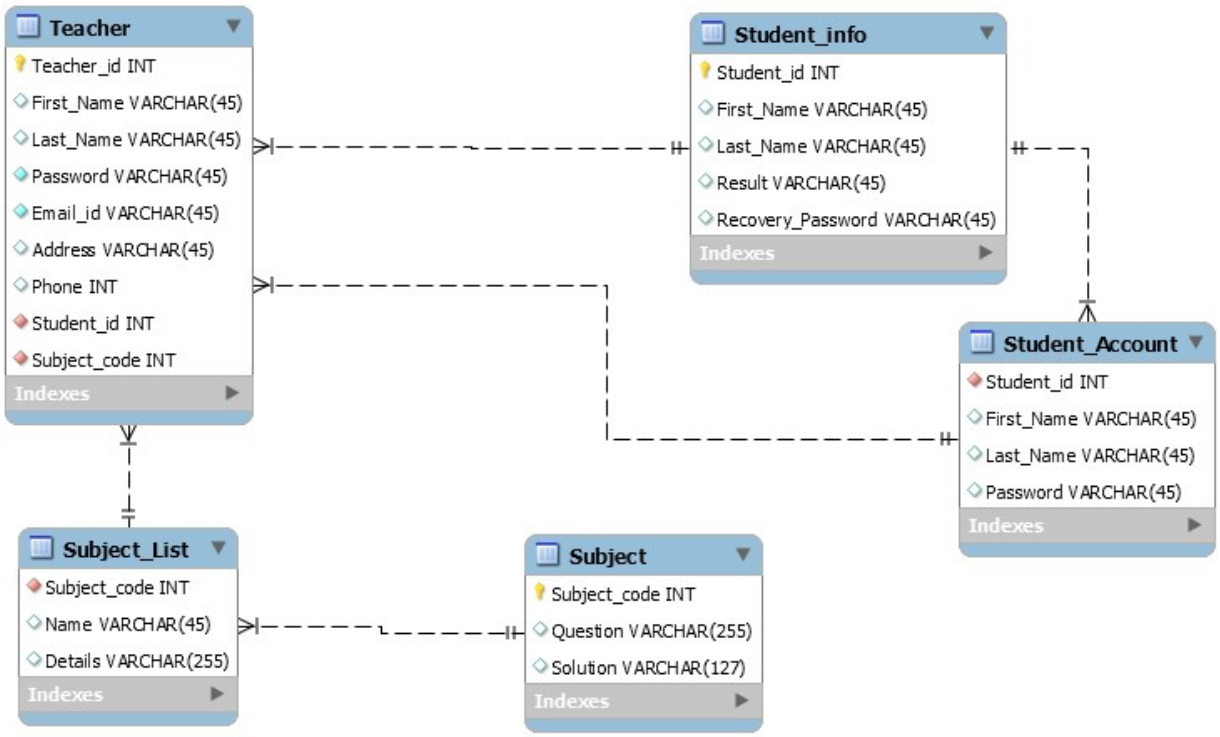

Figure3.4.1. Teacher Database

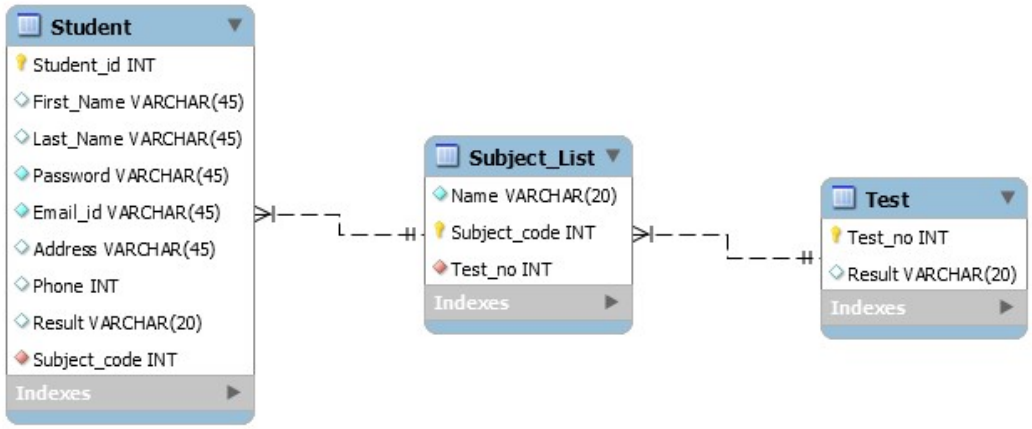

Figure3.4.2. Student Database

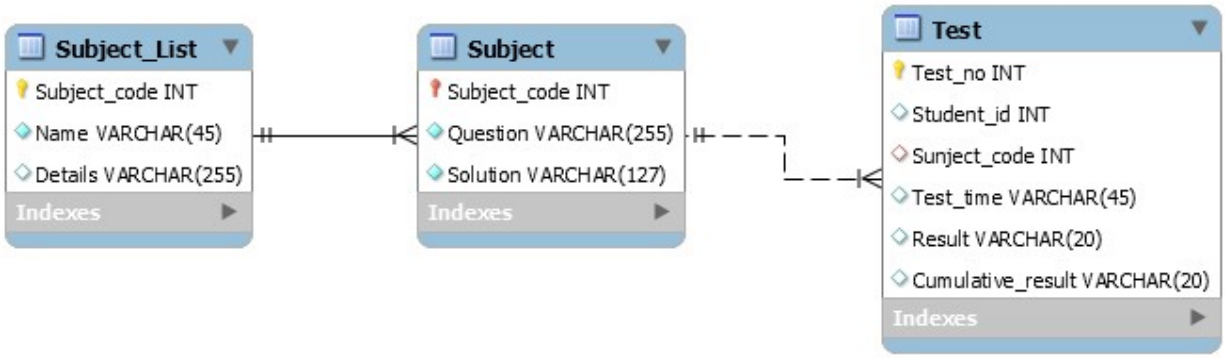

Figure3.4.3. System Database

3.5. Access Control and Security

3.5.1. Access Control

	TEACHER	STUDENT
DATA ENTRY	YES	NO
USER SETTINGS	YES	NO
CREATE STUDENT ACCOUNT	YES	NO
CREATE TEACHER ACCOUNT	YES	NO
TEACHER LOGIN	YES	NO
TEACHER LOGOUT	YES	NO
VIEW STUDENT INFO	YES	NO
DELETE STUDENT ACCOUNT	YES	NO
UPDATE SUBJECT LIST	YES	NO
UPDATE QUESTIONS	YES	NO
STUDENT LOGIN	NO	YES
SELECT SUBJECT	NO	YES
START TEST	NO	YES
TAKING TEST	NO	YES
SUBMIT TEST	NO	YES
VIEW RESULT	NO	YES
CUMMULATIVE RESULT	NO	YES
ACCESS/MODIFY TEACHER DATA	YES	NO
ACCESS/MODIFY STUDENT DATA	YES	YES

Table3.5.1. Access Control Matrix

3.5.2. Security

Authentication Mechanism:

LDAP is used for verifying the user login is correct or not. The Lightweight Directory Access Protocol (**LDAP**) is a directory service protocol that runs on a layer above the TCP/IP stack. It provides a mechanism used to connect to, search, and modify Internet directories. The **LDAP** directory service is based on a client-server model.

Encryption:

SSL (Secure Sockets Layer) is the standard security technology for establishing an encrypted link between a web server and a browser. This link ensures that all data passed between the web server and browsers remain private and integral.

Database Security:

Varying level of access control will be provided to different users of the system to maintain the database security

3.6. Global Software Control

Teacher creates teacher account and student account.

Teacher view the student account and if any changes has to be done teacher will modify it.

Teacher can update the subject lists and questions whenever it is necessary.

Student logins for the test and enters the login id and password. If the entered id and password are correct then the system will display with list of subjects. Student selects and starts the test. After completion of the test he submits the test and views the result and also he can view the cumulative result.

3.7. Boundary Conditions

Startup: Go to system URL and login

Shut Down: Click log out and close browser

Error Conditions:

- Logging in:
  - Login id or password field are blank.
  - Login id is not a 8 digit string.
  - Password is not 8 characters long.
  - Password and login id don't match.
  - Username is wrong or does not exist.
  - The welcome screen does not appear after logging in.

- User settings
  - User is unable to change certain settings or changes don't reflect.
  - Between the time of editing and updating, the system crashes.

- Data Entry
  - The system fails when the teacher is entering information.

- Taking Test
  - While taking the test the system suddenly stops working
  - After submitting the test it could not display the result.

- Student Information
  - After updating the student information it cannot display the updated information

- Subject list and questions
  - After updating the subject list and questions it cannot display the updated or modified information

- Monitor display
  - The system crashes or the backup also crashes.
  - The system hangs up.

- Logging out
  - Teacher or student unable to logout.