Learning Management System

Session: 2021 – 2025

Submitted by:

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Acknowledgments

”I express my sincere gratitude to Allah Almighty for providing me with the strength and motivation to complete this project on time. I am also thankful to my supervisor, **Mr. Nauman Babar**, for his constant guidance, support, and care throughout the project. His valuable insights and techniques for time management helped me to complete the project efficiently. I would also like to acknowledge **Mr. Samyan Qayyum Wahla** for his dedicated teaching of Database Theory, which enabled me to understand the concepts and complete the project with ease. In addition, I am grateful to my friends for their unwavering support and assistance during the challenging times of the project. Their encouragement and advice were invaluable. Overall, I am thankful to everyone who contributed to the successful completion of this project.”

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Abstract

The Learning Management System is an application developed for educational institutions to manage assessments, attendance, course learning outcomes, rubrics, student information, and results. It includes tables such as Assessment, AssessmentComponent, ClassAttendance, Clo, Lookup, Rubric, RubricLevel, Student, StudentAttendance, and StudentResult. The application is developed in C# .Net Framework. The system enables easy management, search, and sorting of student and course learning outcome data. The application allows the admin to manage rubrics and assessments, add assessment components, mark attendance, and download reports. The project aims to streamline assessment processes, track student attendance, and evaluate student performance based on rubrics and learning outcomes. The application is designed for use in the Department of Computer Science at the University of Engineering and Technology Lahore.Additionally, all data in the Learning Management System is managed using SQL database and CRUD operations, providing data management and easy data manipulation. This further ensures the security and integrity of the data and allows for efficient management of student and assessment records.

1 Introduction

1.1 Description

The project named as **Learning Management System** appears to be related to educational institutions and focuses on managing assessments, attendance, course learning outcomes, rubrics, student information, and results.

The project includes several tables, such as Assessment, AssessmentComponent, ClassAttendance, Clo, Lookup, Rubric, RubricLevel, Student, StudentAttendance, and StudentResult. The Assessment table includes details about various assessments such as the assessment ID, title, creation date, total marks, and weightage. The AssessmentComponent table includes information about different components of an assessment such as the ID, name, rubric ID, total marks, creation date, and updated date.

The ClassAttendance table is used to track attendance records for each class session, while the Clo table includes details about course learning outcomes such as the name, creation date, and updated date. The Lookup table appears to be a generic table that stores lookup values for various categories. The Rubric table is used to define assessment rubrics with details such as the rubric ID, details, and Clo ID. The RubricLevel table includes information about different measurement levels within a rubric.

The Student table stores information about individual students such as their ID, first name, last name, contact details, email, registration number, and status. The StudentAttendance table tracks attendance records for individual students, while the StudentResult table is used to store the evaluation results of a student for a particular assessment component, including the rubric measurement ID and evaluation date.

The need for this application made in C# .Net FrameWork is Necessary because managing the data manually is not secure it can be lost.Also before using database we were familiar with file system in which there was a risk of data loss and no security but by using database this issue is resolved it can be used by multiple users at once.Students can be managed, searched and sorted easily. Course Learning Outcomes can also be managed searched or filtered on the deletion of course learning management (Clo) , Assessment component,Rubrics, Rubric Levels, Student Result is also deleted. Admin can Manage Rubrics and add rubric level against each rubric but there is a restriction on the addition of Duplicates. Also assessments can be managed and against each assessment there are assessment components which are added by the admin that can be used for the marking of evaluation against each student.Admin Can also mark Attendance of each students and can also download different kinds of reports which will be helpful for him.Also he can change the students from active to inactive and vice versa. This app is basically for Department of Computer Science UET lahore Overall, the project seems to be aimed at managing assessment processes, tracking student attendance, and evaluating student performance based on rubrics and learning outcomes.

1.2 Motivation

The main motivation for this project was to provide a user-friendly system for efficiently extracting specific information from a database. Simple and complex queries were developed to facilitate the process of querying data from various relations within the database. The system was developed using C# .NET Framework using Winforms and integrated with SQL Server as the database management system. Additionally, iTextSharp was used to generate PDF reports containing relevant information for the department, further enhancing the effectiveness of the management system. The database design was optimized to ensure maximum efficiency in data retrieval and management.

1.3 Target Audience

The target audience for the project are the universities where Students data are managed manually. This desktop application will help them to enter the student's details for the whole department and Manage it.Also it Allows to manage course learning outcomes(CLO's) against each students with different Rubrics and Rubric levels So that the Admin can Mark Evaluations against each students. Also it allows to Manage the attendance system easily because it is much difficult to mark everything manually rather than using a Desktop Application.

2 Technology Stack

Language	C# and T-SQL
IDEs	Visual Studio 2019 Community Edition
UI	Winform - MaterialSkin
PDF	ITextSharp

3 Uniform Resource Locator's

Gitlab Repository	Click Here
Latex Editable Link	Click Here

4 Operational Details

Till now the Learning Management System consists of a single admin that can be departmental staff that will be acting as the only user.Following are the details that the admin can perform.

1. The admin has the right to enter records of the student he/she can also update or delete any student record.He can also search and sort students.
2. The Admin can manage Attendance of each students and can view it.
3. Course Learning Outcomes (CLO's) can be inserted,deleted and updated.

4. Rubrics and its Rubric levels can also be inserted, deleted or updated.
5. Admin can also manage Assessments and its different components.
6. Admin can mark evaluation against each student.He can also update it.
7. He can Change student's status from inactive to active if required.
8. PDF reports can be generated by the admin

5 Database Design

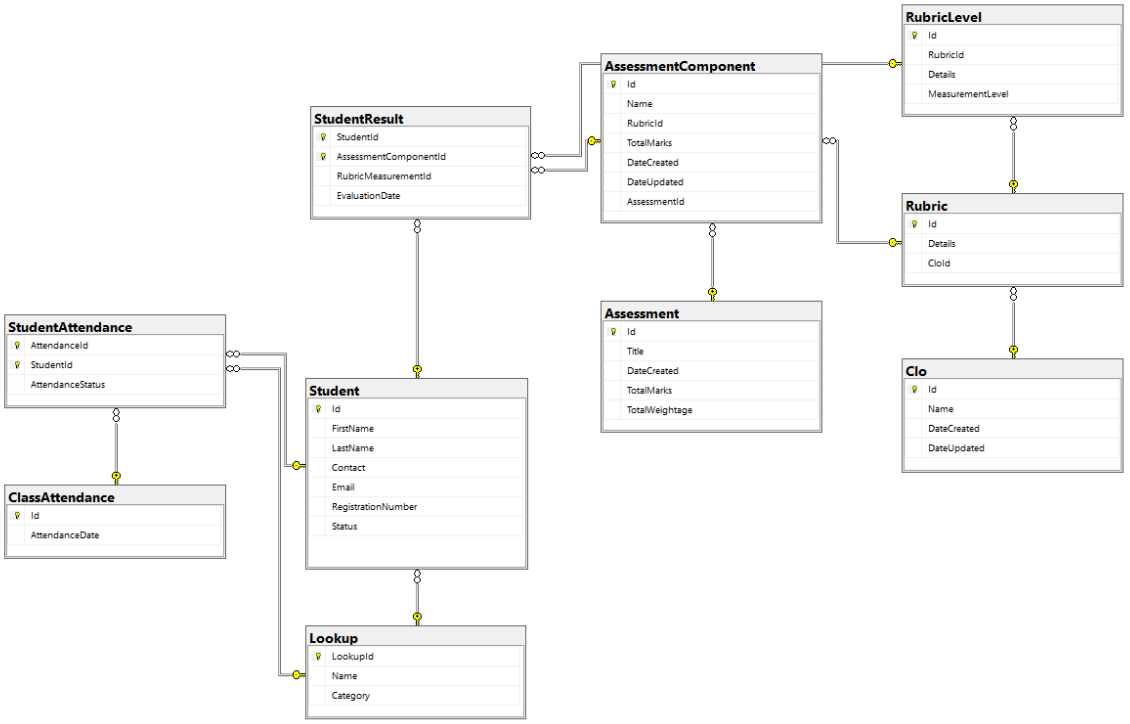


FIGURE 1: Database Diagram

5.1 Lookup

Stores information about different categories of information that are used in the database. This table has a LookupId column, which serves as the primary key, and a Name column that contains the name of the category like Attendancestatus or student staus.

5.2 Student

Stores information about students, including the student ID, first name, last name, contact information, email, registration number, and status.

5.3 StudentAttendance

Stores information about student attendance, including the attendance ID, student ID, and attendance status.

5.4 ClassAttendance

Stores information about the attendance of students in a class, including attendance ID and attendance date.

5.5 Clo

Stores information about course learning objectives (CLO), including the CLO ID, CLO name, date created, and date updated.

5.6 Rubric

Stores information about rubrics used for evaluating assessments. This table includes the rubric ID, rubric details, and a foreign key (CloId) to the Clo table.

5.7 RubricLevel

Stores information about different levels of measurement used in rubrics, including the rubric level ID, foreign key (RubricId) to the Rubric table, rubric details, and the measurement level.

5.8 Assessment

Stores information about assessments created, including the assessment ID, title, date created, total marks, and total weightage.

5.9 AssessmentComponent

Stores information about the components of each assessment. This table has a foreign key (RubricId) to the Rubric table, indicating which rubric is used to evaluate each component. It also includes the component name, total marks, date created, date updated, and foreign key (AssessmentId) to the Assessment table.

5.10 StudentResult

Stores information about student results on specific assessment components, including the student ID, assessment component ID, rubric measurement ID, and evaluation date.

6 GUI

6.1 Home Page

This is the homepage which shows the count of all the main things in the project

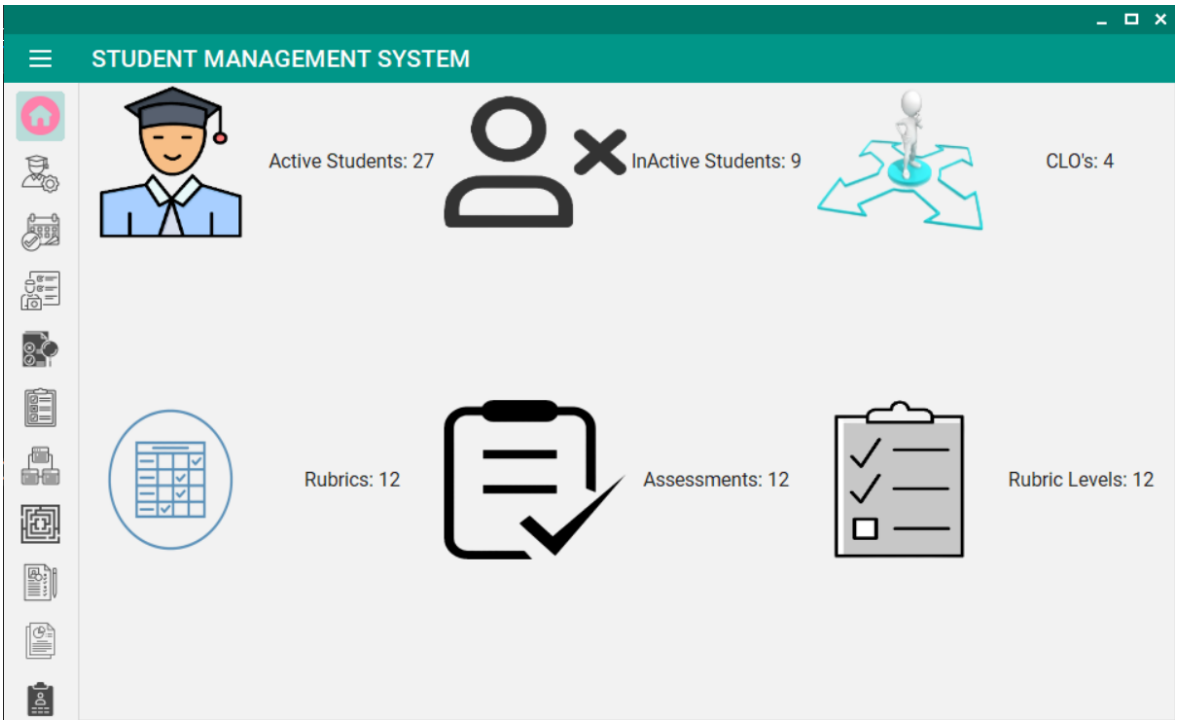


FIGURE 2: Home page viewing count of the data

6.2 Manage Students

This tab page allows you to Manage students data that include insert,update,update,delete and retrieve. It also allows you to sort and search them too.

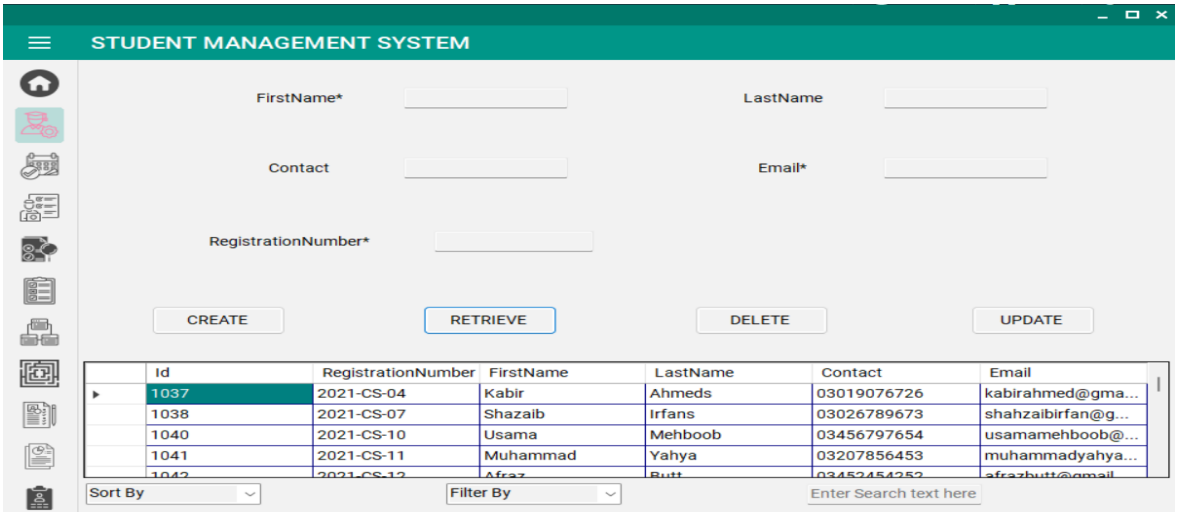


FIGURE 3: Manage Students

6.3 Manage Attendance

This tab page allows Admin to Manage Attendance. Attendance can Also be viewed and updated.

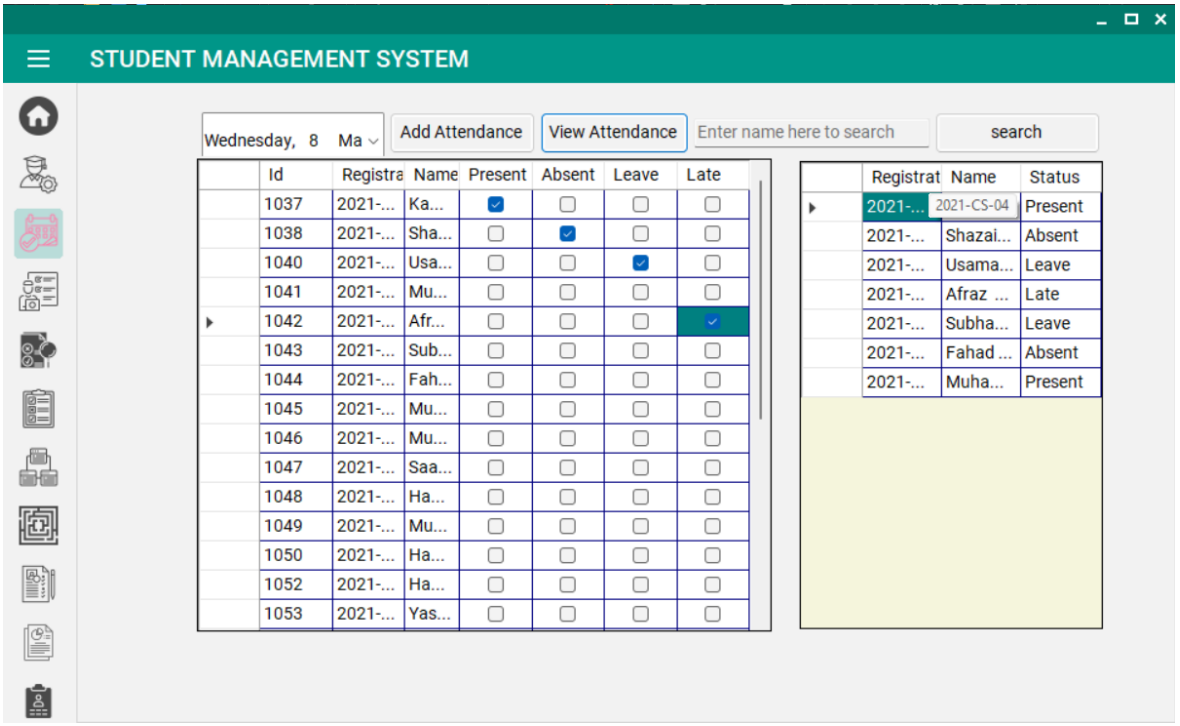


FIGURE 4: Manage Attendance Page

6.4 Manage Course Learning Outcomes(CLO's)

This tab page allows you to manage CLO's, but on the deletion it will delete rubric, rubriclevel, assessment Component,Student result against it

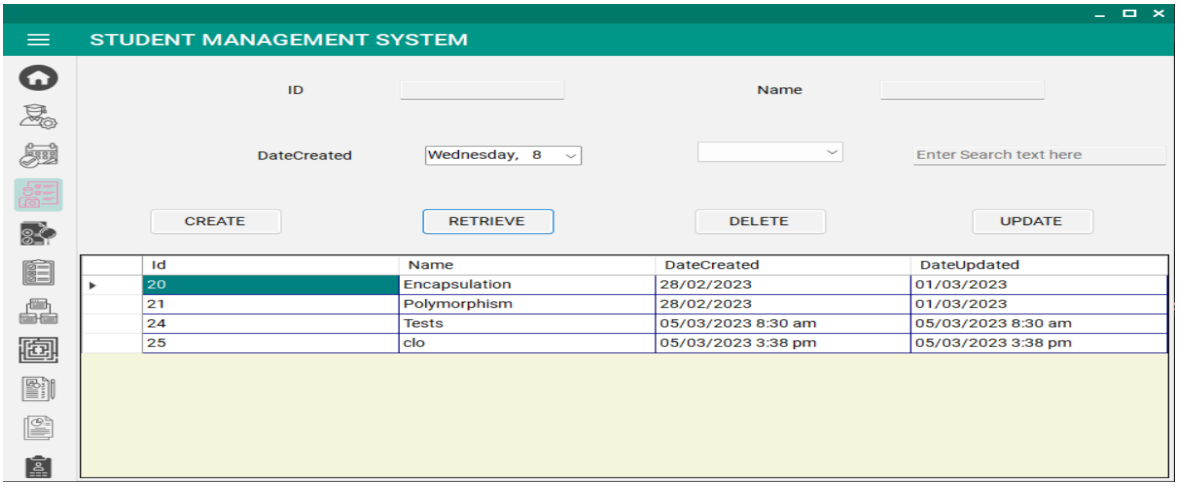


FIGURE 5: Manage clo's in project

6.5 Manage Rubrics

This tab page allows you to manage rubrics but on deletion it will delete StudentResult, Assessment-Component, RubricLevel.

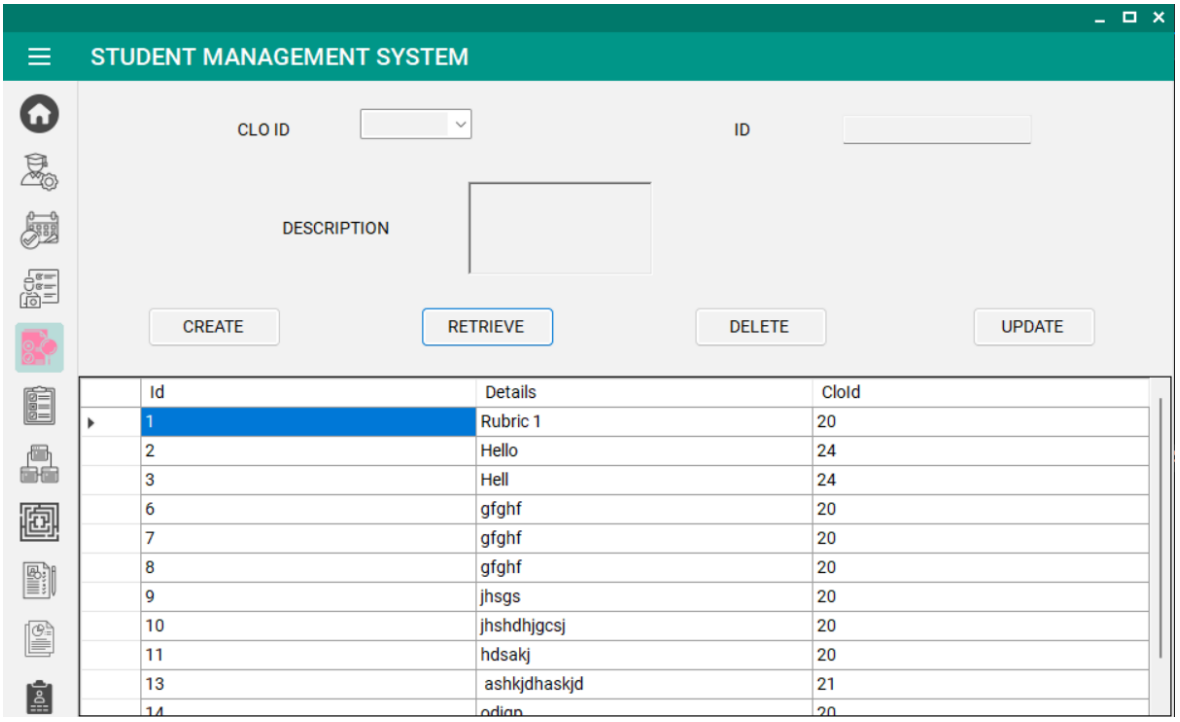


FIGURE 6: Manage Rubrics Page

6.6 Manage Rubric Levels

This tab page allows user to select rubric id and measurement level from combobox and manage it easily on its deletion StudentResult is also deleted.

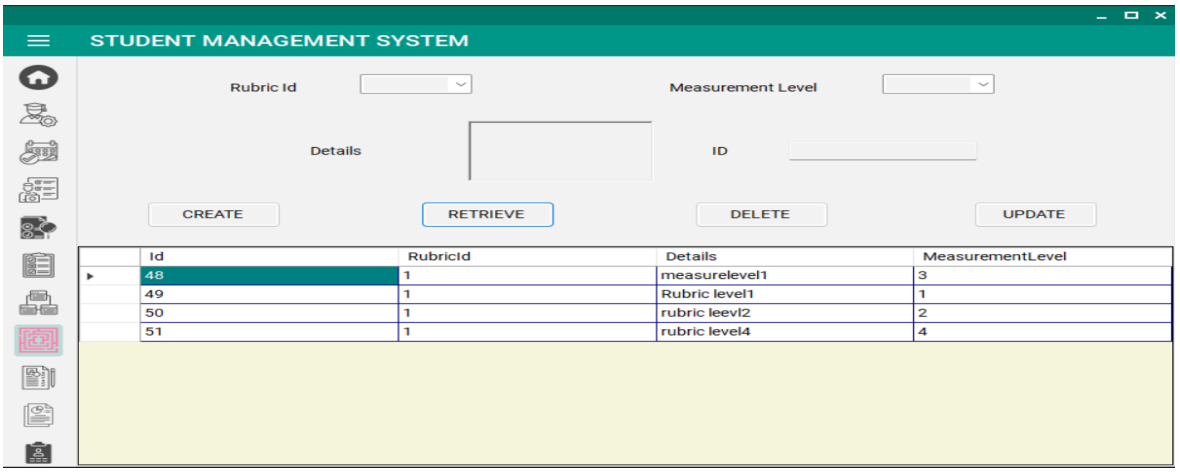


FIGURE 7: Manage levels of rubrics

6.7 Manage Assessment

This tab page allows you to add assessments and manage them also.

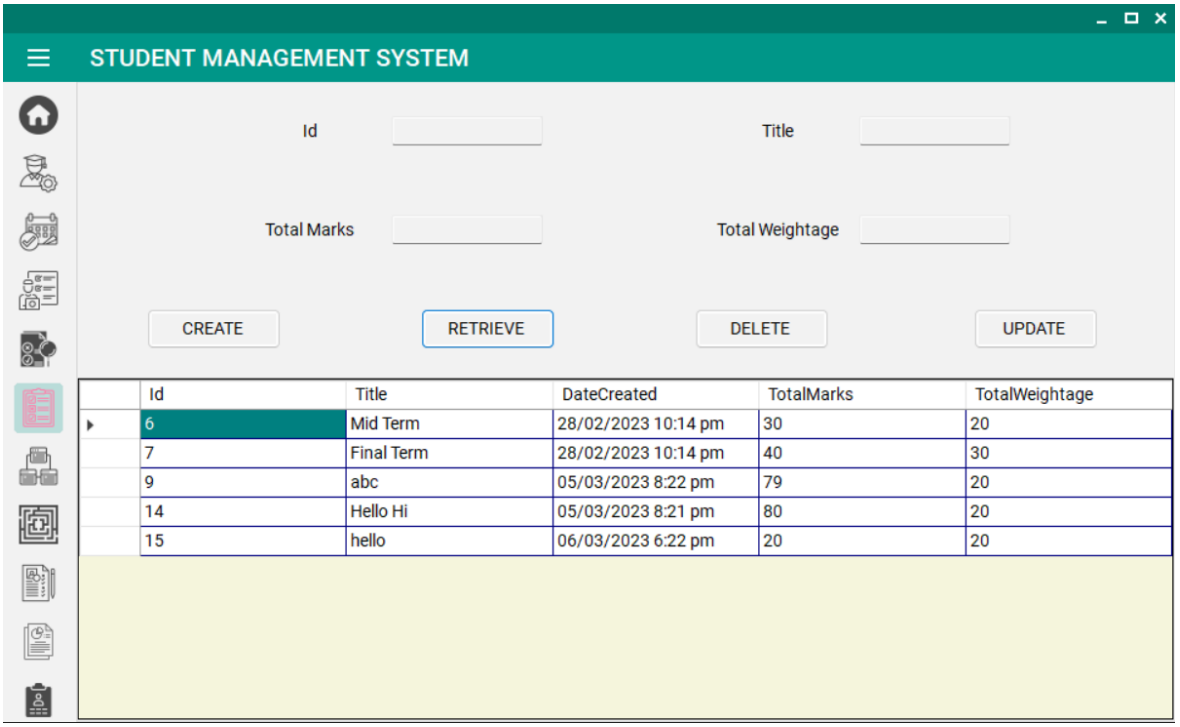


FIGURE 8: Manage Assessments

6.8 Manage Assessment Components

This tab page allows you to manage components of each students.

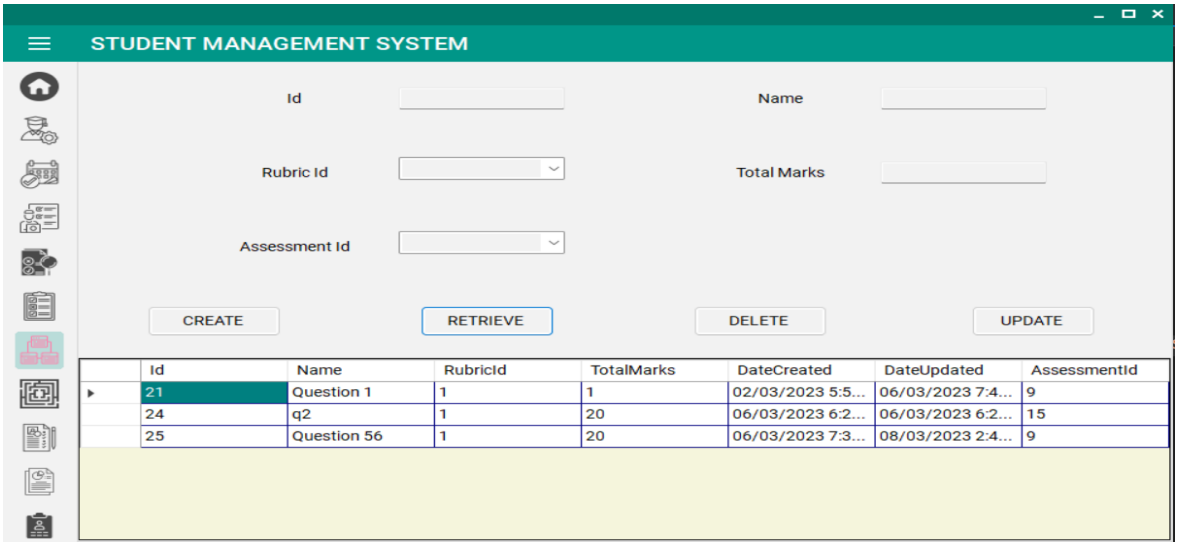


FIGURE 9: Manage assessment components

6.9 Mark Evaluations

This tab page takes assessment component Id and rubricmeasurementId from user and marks evaluation against each student.

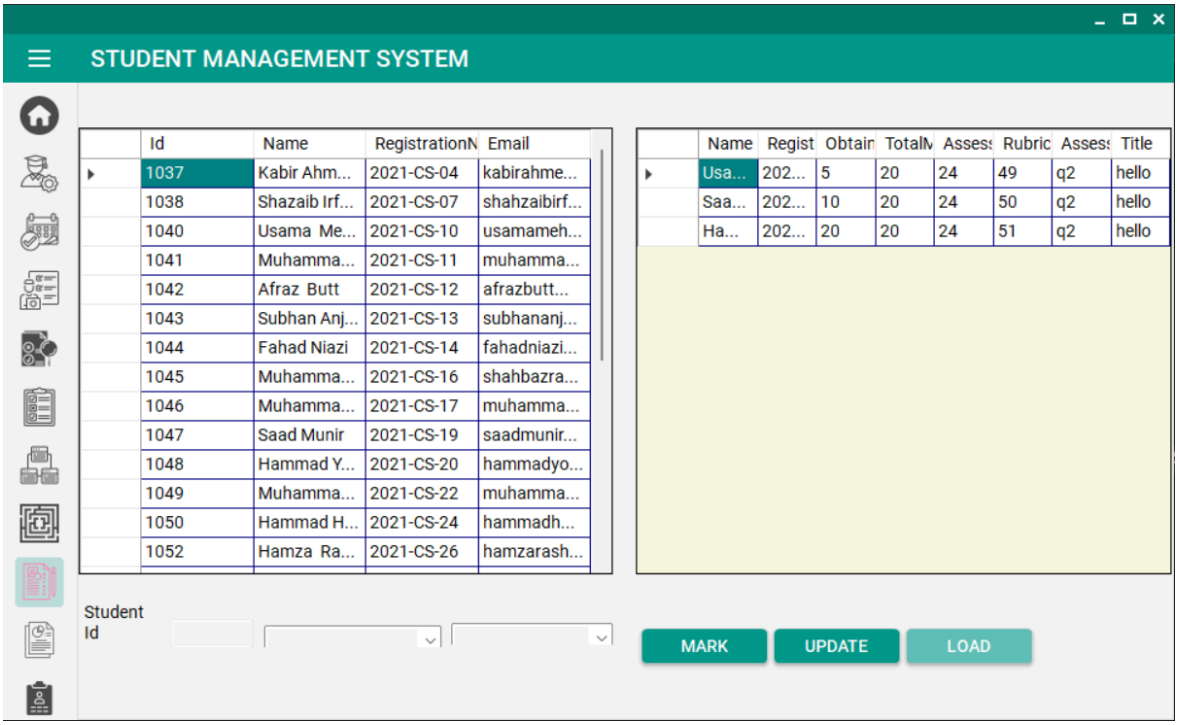


FIGURE 10: Mark Evaluations against students

6.10 Download Reports

Reports tab page allows admin to download different kinds of reports which will be helpful for them in future.

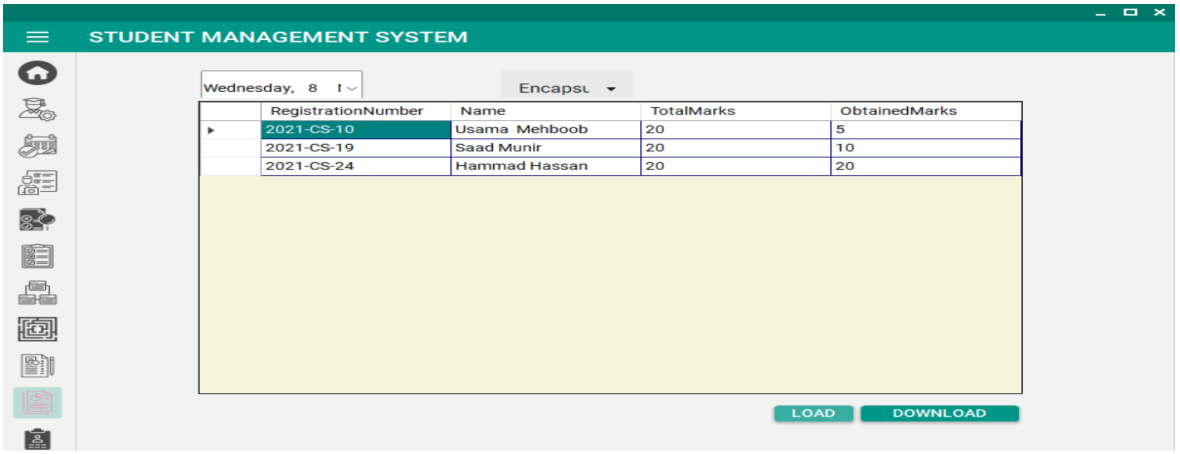


FIGURE 11: Download Reports

6.11 InActive Students

Here the Admin can see the Inactive students and can also change their status to active.

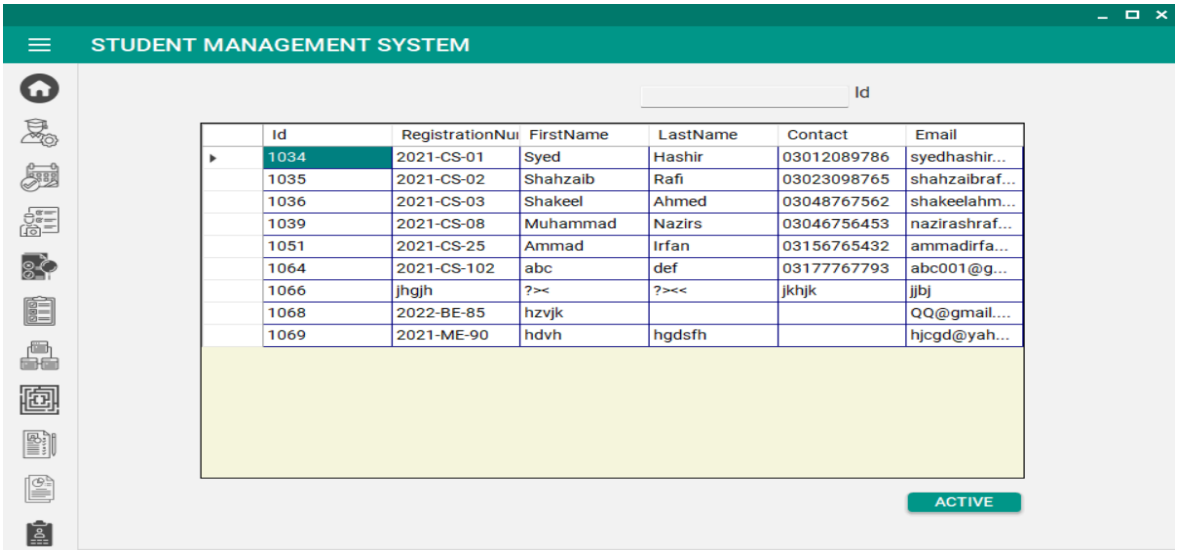


FIGURE 12: Download Reports

7 Activity Flow Diagrams

7.1 Manage Student

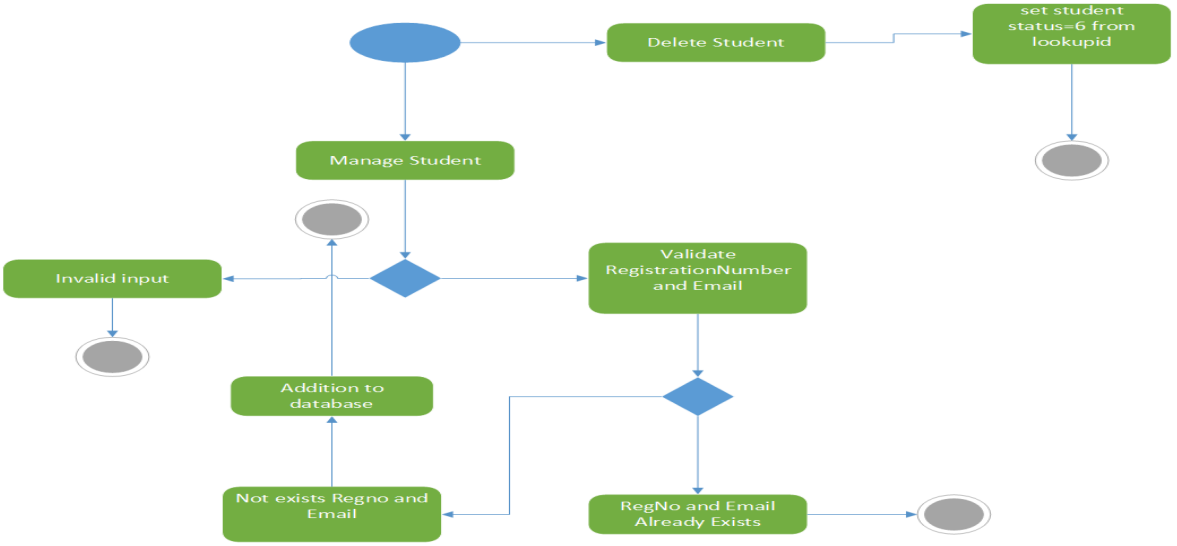


FIGURE 13: Activity Diagram Manage Student

7.2 Manage CLO

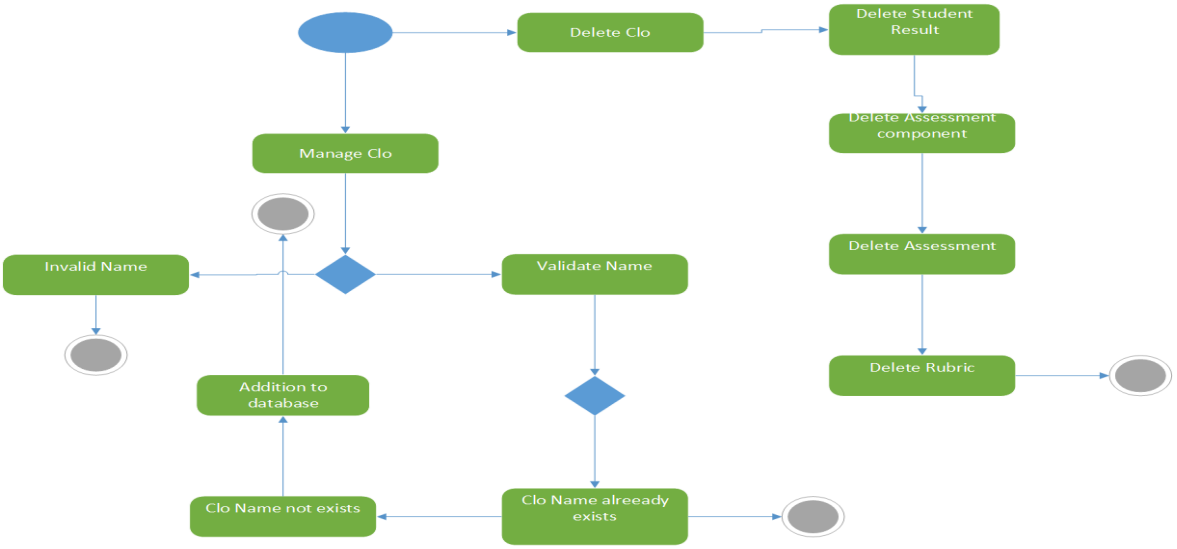


FIGURE 14: Activity Diagram Manage Clo

7.3 Manage Rubric

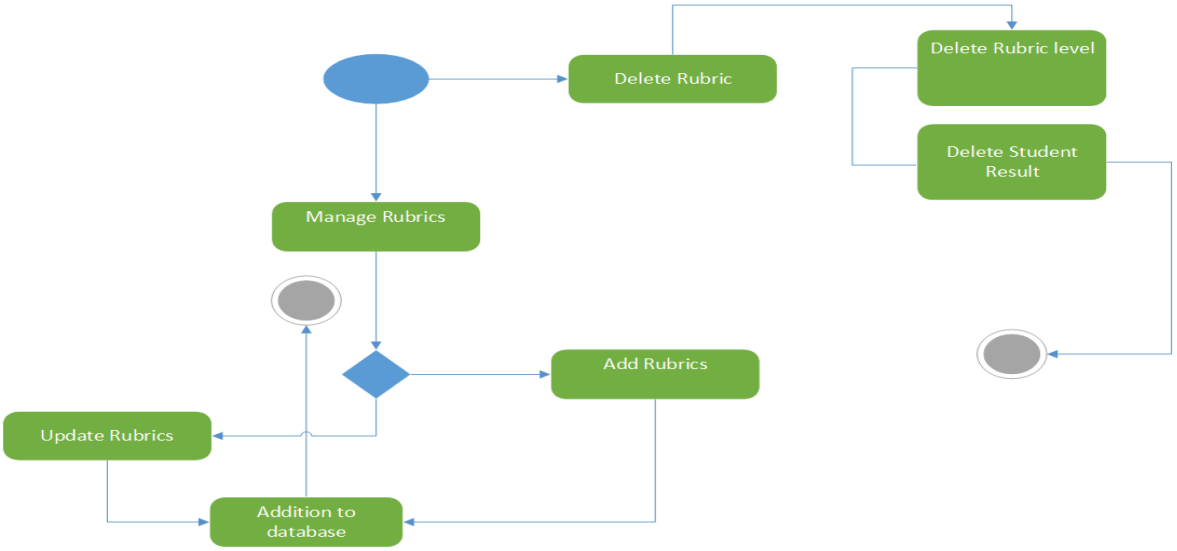


FIGURE 15: Activity Diagram Manage Rubric

7.4 Manage Rubric Level

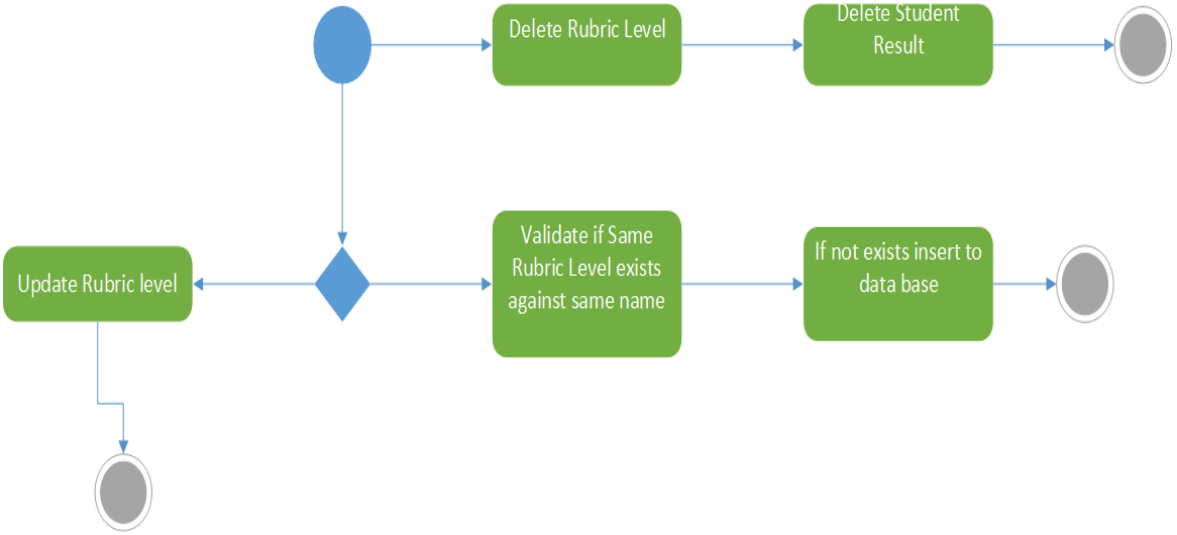


FIGURE 16: Activity Diagram Manage Rubric Level

7.5 Manage Assessment

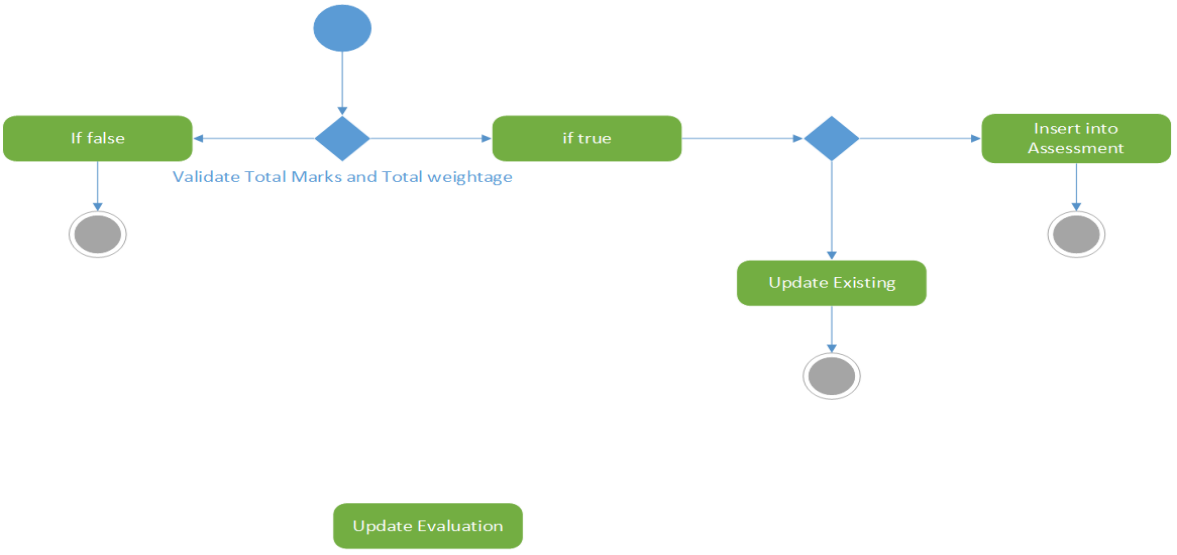


FIGURE 17: Activity Diagram Manage Assessment

7.6 Manage Assessment Component

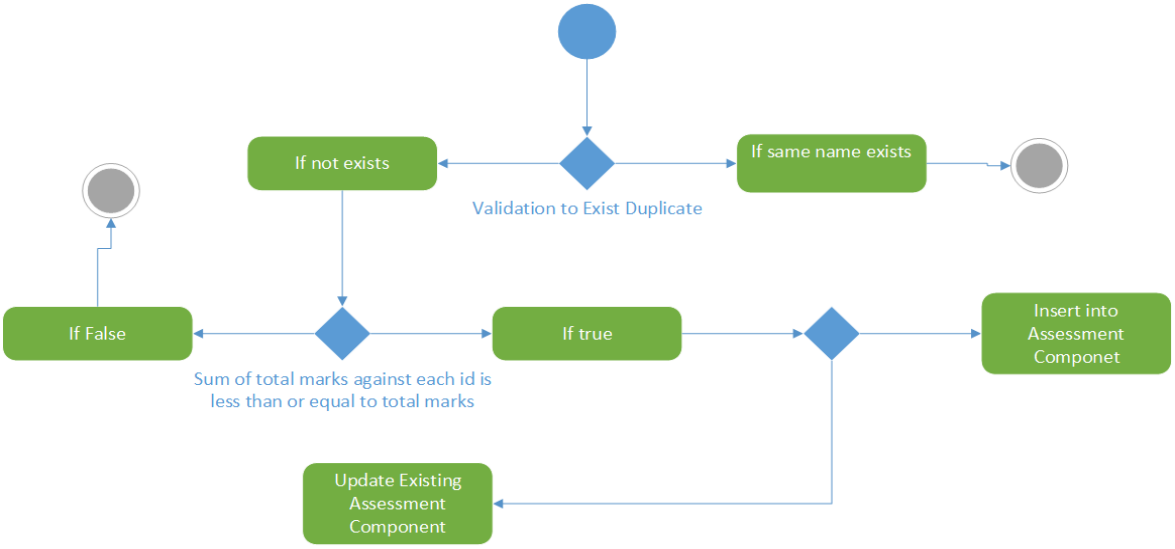


FIGURE 18: Activity Diagram Manage Assessment Component

7.7 Mark Evaluation

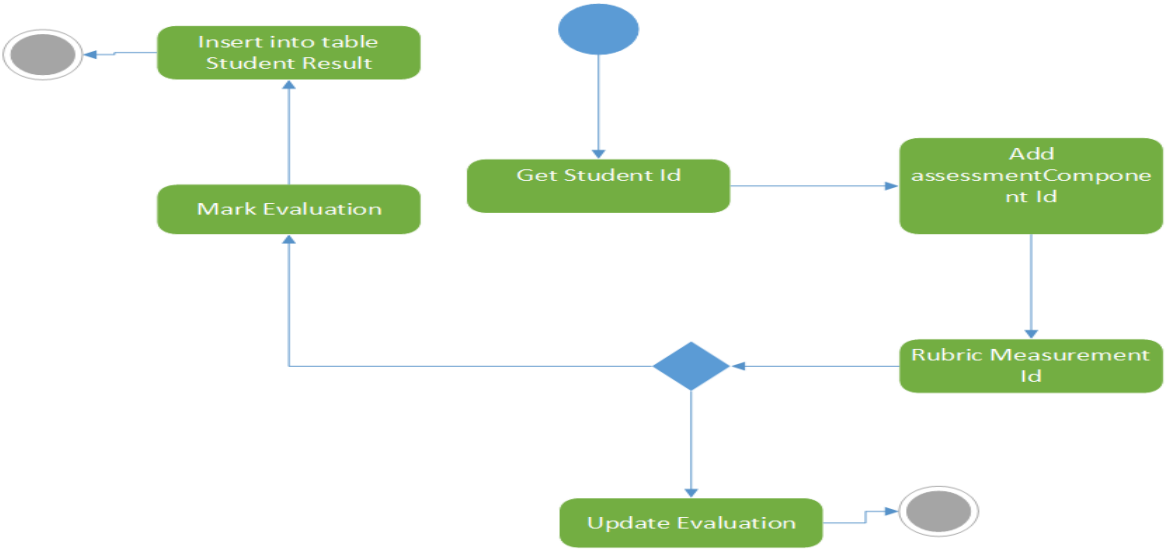


FIGURE 19: Activity Diagram Mark Evaluation

7.8 Manage Attendance

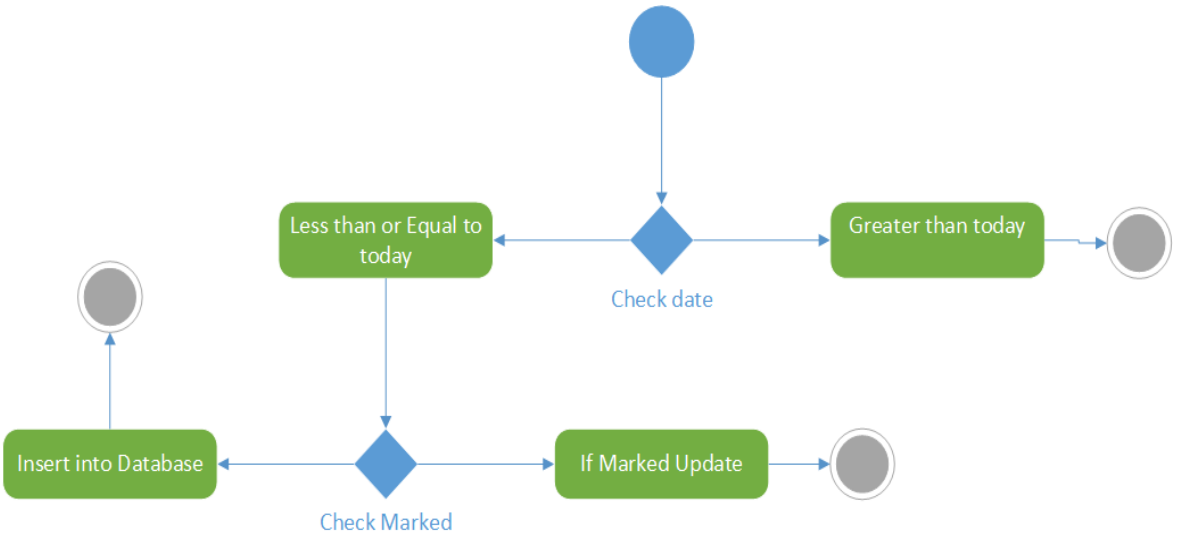


FIGURE 20: Activity Diagram Manage Attendance

8 Generated Reports Queries

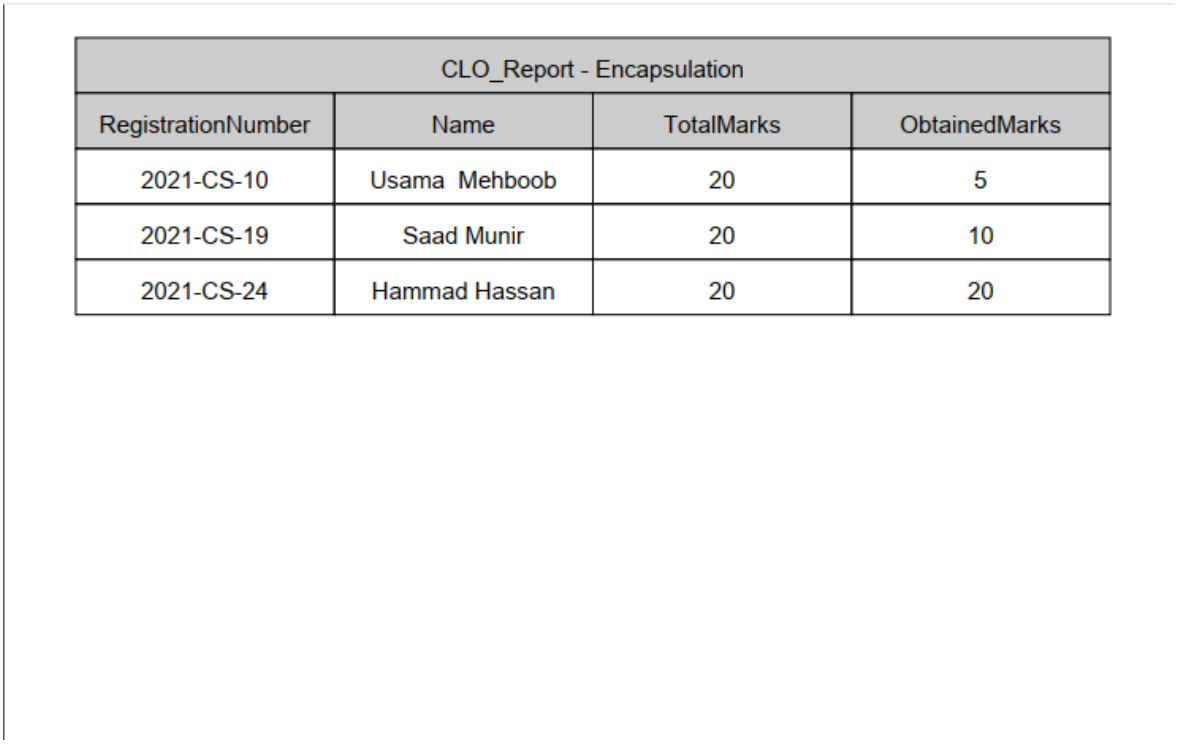
8.1 Report 1

8.1.1 Query

```
SELECT RegistrationNumber, Name,
SUM(TotalMarks) AS TotalMarks,
SUM(ObtainedMarks) AS ObtainedMarks
FROM(
SELECT S.RegistrationNumber,
S.FirstName + ' ' + S.LastName AS Name,
Clo.Name AS[CLO Name], Clo.Id,
A.Title, AC.Name AS[Assessment Component Name],
AC.TotalMarks AS TotalMarks, A.Totalweightage,
(CONVERT(FLOAT, RL.MeasurementLevel)/ MAX(RL.MeasurementLevel)
OVER() * AC.TotalMarks) AS ObtainedMarks,
((CONVERT(FLOAT, RL.MeasurementLevel) / MAX(RL.MeasurementLevel)
OVER() * AC.TotalMarks) / A.TotalMarks * A.TotalWeightage) AS
ObtainedWeightage
FROM Student S
INNER JOIN StudentResult SR
ON S.Id = SR.StudentId
INNER JOIN RubricLevel RL
ON SR.RubricMeasurementId=RL.Id
INNER JOIN Rubric R
ON RL.RubricId = R.Id
INNER JOIN Clo
ON R.CloId = Clo.Id
INNER JOIN AssessmentComponent AC
ON R.Id = AC.RubricId
INNER JOIN Assessment A
ON AC.AssessmentId = A.Id
WHERE SR.StudentId = [StudentId] AND
```

```
AC.Id = [AssessmentComponentId])
AS NewTable WHERE [CLO Name] =’" + textx + "’
GROUP BY RegistrationNumber, Name, Title
```

LISTING 1: SQL query to retrieve total and obtained marks of a specific assessment component for a given student and CLO, grouped by student.



CLO_Report - Encapsulation			
RegistrationNumber	Name	TotalMarks	ObtainedMarks
2021-CS-10	Usama Mehboob	20	5
2021-CS-19	Saad Munir	20	10
2021-CS-24	Hammad Hassan	20	20

FIGURE 21: Clo Wise Reports

8.2 Report 2

8.2.1 Query

```
SELECT SubQuery.RegistrationNumber, SubQuery.Name, SubQuery.TotalMarks,
SUM(SubQuery.ObtainedMarks) AS ObtainedMarks, SubQuery.TotalWeightage,
SUM(SubQuery.ObtainedWeightage) AS ObtainedWeightage
FROM(SELECT DISTINCT S.RegistrationNumber, S.FirstName + ’’ + S.LastName AS Name,
A.Title, A.TotalMarks, A.Totalweightage, (CONVERT(FLOAT, RL.MeasurementLevel)
/ MAX(RL.MeasurementLevel) OVER() * AC.TotalMarks) AS ObtainedMarks,
((CONVERT(FLOAT, RL.MeasurementLevel) / MAX(RL.MeasurementLevel) OVER()
* AC.TotalMarks) / A.TotalMarks * A.TotalWeightage) AS ObtainedWeightage
FROM Student S
JOIN StudentResult SR
ON S.Id = SR.StudentId
JOIN RubricLevel RL
ON SR.RubricMeasurementId = RL.Id
JOIN Rubric R
ON RL.RubricId = R.Id
JOIN AssessmentComponent AC
```

```
ON R.Id = AC.RubricId
JOIN Assessment A
ON AC.AssessmentId = A.Id
WHERE SR.StudentId = [StudentId]
AND AC.Id =[AssessmentComponentId] AND A.Title ='" + textx + "') AS SubQuery
GROUP BY SubQuery.RegistrationNumber, SubQuery.Name,SubQuery.TotalMarks,
SubQuery.TotalWeightage
```

LISTING 2: SQL query to retrieve obtained marks and weightage of a specific assessment for a given student and assessment component, grouped by student.

Assessment Report - hello					
Registration Number	Name	TotalMarks	ObtainedMarks	TotalWeightage	ObtainedWeightage
2021-CS-10	Usama Mehboob	20	5	20	5
2021-CS-19	SaadMunir	20	10	20	10
2021-CS-24	HammadHassan	20	20	20	20
2021-CS-35	Subhan Suleman	20	10	20	10

FIGURE 22: AssessmentComponent Wise Reports

8.3 Report 3

8.3.1 Query

```
Select distinct Student.Id, RegistrationNumber,
FirstName + ' ' + LastName As Name,
(select Name from Lookup
where LookupId=StudentAttendance.AttendanceStatus)
As Status
From Student
JOIN StudentAttendance
on Student.Id=StudentAttendance.StudentId
JOIN ClassAttendance
on ClassAttendance.Id=StudentAttendance.AttendanceId
Where Status = 5  and AttendanceDate=@AttendanceDate
```

LISTING 3: SQL query to retrieve distinct student IDs, registration numbers, names, and attendance status for a given attendance date and where the status is equal to 5.

Attendance Report - 2023-03-06			
Id	RegistrationNumber	Name	Status
1037	2021-CS-04	Kabir Ahmed	Present
1038	2021-CS-07	Shazaib Irfan	Absent
1039	2021-CS-08	Muhammad Nazir	Leave
1040	2021-CS-10	Usama Mehboob	Leave
1041	2021-CS-11	Muhammad Yahya	Present
1042	2021-CS-12	Afraz Butt	Present
1043	2021-CS-13	Subhan Anjum	Present
1058	2021-CS-37	Bilal Baig	Leave
1059	2021-CS-28	Ali Haider	Leave
1060	2021-CS-39	Ghulam Mustafa	Leave

FIGURE 23: Attendance Reports

8.4 Report 4

8.4.1 Query

```
DECLARE @cols AS NVARCHAR(MAX),
@query AS NVARCHAR(MAX),
@MinDate DATE, @MaxDate DATE,
@SQL NVARCHAR(MAX);
SELECT @MinDate = MIN(AttendanceDate),
@MaxDate = MAX(AttendanceDate)
FROM ClassAttendance;
SET @cols = '';
WHILE @MinDate <= @MaxDate
BEGIN SET @cols = CONCAT(
@cols, ', MAX(CASE WHEN AttendanceDate = ''',
CONVERT(VARCHAR(10), @MinDate, 120), ''' THEN CASE sa.AttendanceStatus
WHEN 1 THEN ''Present''
WHEN 2 THEN ''Absent''
WHEN 3 THEN ''Late''
WHEN 4 THEN ''Leave''
ELSE ''Not Marked Yet''
END ELSE NULL END) AS [', CONVERT(VARCHAR(10), @MinDate, 120), ']');
SET @MinDate = DATEADD(DAY, 1, @MinDate);
END;
SET @SQL = 'SELECT s.FirstName + '' '' + s.LastName AS Name' + @cols + '
FROM Student s
LEFT JOIN StudentAttendance sa
ON s.Id = sa.StudentId
LEFT JOIN ClassAttendance ca
ON ca.Id = sa.AttendanceId
GROUP BY s.Id, s.FirstName, s.LastName
```

```
    ORDER BY s.LastName, s.FirstName';
    EXEC sp_executesql @SQL;
```

LISTING 4: SQL script to generate a dynamic pivot table displaying student attendance data by date.

Full Attendance Report

Name	2023-02-27	2023-02-28	2023-03-01	2023-03-02	2023-03-03	2023-03-04	2023-03-05	2023-03-06	2023-03-07	2023-03-08
hzvjk										
?>< ?>><										
Shakeel Ahmed	Leave	Present	Present							
Kabir Ahmed s	Late	Present	Present	Present			Present	Present	Absent	Present
Usman Aleem				Present						
Subhan Anjum		Present	Absent	Present				Present		Late
Bilal Baig		Present	Present	Present				Late		
Afraz Butt		Absent	Present	Present				Present		Leave
abc def										
bvvhvhj qhqhfvh										
Ali Haider				Present						
Ali Haider		Present	Present	Present				Late		
Syed Hashir	Present	Absent	Present	Present				Present	Absent	
Hammad Hassan		Present	Present	Present						
Hammad Hassan		Absent	Present							
Yasir Hassan		Present	Present	Present						
hdvh hgdsfh										
Ammad Irfan		Present	Present	Present						
Shazaib Irfans		Present	Leave	Present			Absent	Absent		Absent
Saleem Malik		Present	Present	Present						
Usama Mehboob		Present	Present	Present			Leave	Late		Late
Saad Munir		Late	Present	Present						
Ghulam Mustafa		Present	Present	Present				Late		

FIGURE 24: Attendance Reports

8.5 Report 5

8.5.1 Query

```
SELECT Name, RegistrationNumber, ObtainedMarks, TotalMarks,
AssessmentComponentId, RubricMeasurementId, AssessmentComponent, Title
FROM(SELECT FirstName + ' ' + LastName AS Name, RegistrationNumber,
(CONVERT(FLOAT, RubricLevel.MeasurementLevel) / MAX(RubricLevel.MeasurementLevel)
OVER() * AssessmentComponent.TotalMarks) AS ObtainedMarks, AssessmentComponent.TotalMarks,
AssessmentComponentId, RubricMeasurementId,AssessmentComponent.Name AS AssessmentComponent,
Assessment.Title
FROM Student
JOIN StudentResult
ON Student.Id = StudentResult.StudentId
JOIN RubricLevel
ON StudentResult.RubricMeasurementId = RubricLevel.Id
JOIN Rubric
ON RubricLevel.RubricId = Rubric.Id
JOIN AssessmentComponent
ON Rubric.Id = AssessmentComponent.RubricId
JOIN Assessment
ON AssessmentComponent.AssessmentId = Assessment.Id
WHERE StudentResult.StudentId = StudentId
AND
AssessmentComponent.Id = AssessmentComponentId)
AS subquery
```

LISTING 5: OverAll Assessment report

Overall Assessment Report							
Name	RegistrationNumber	Obtained Marks	TotalMarks	AssessmentComponentId	RubricMeasurementId	AssessmentComponent	Title
Usama Mehboob	2021-CS-10	5	20	24	49	q2	hello
Subhan Anjum	2021-CS-13	20	20	26	51	Q23	Mid Term
Saad Munir	2021-CS-19	10	20	24	50	q2	hello
Muhammad Talha	2021-CS-22	10	20	25	50	Question 56	abc
Muhammad Talha	2021-CS-22	5	20	26	49	Q23	Mid Term
Yasir Hassan	2021-CS-27	0.25	1	21	49	Question 1	abc
Hammad Hassan	2021-CS-24	20	20	24	51	q2	hello
Subhan Suleman	2021-CS-35	10	20	24	50	q2	hello
Bilal Baig	2021-CS-37	5	20	26	49	Q23	Mid Term

FIGURE 25: Over All Assessment Reports

9 Testing

Testing was started in the end of the project and that was a good experience to test it because only by this I can resolve the errors.I have done approximately three phases of testing. The queries that were integrated in the application were tested through the SQL Server.

9.1 Testing phase 1

In the first phase of testing I found many errors and exceptions in my project.I have to handle it.Fixing them was a challenge but have to fix it and made validation functions for input that uses regular expressions that we studied in **Theory of Automata and Formal Languages**.

9.2 Testing phase 2

In the second phase of testing I found an exception like Foreign Key, means if i have to delete Clo I have to delete its all of links firstly using query then It will be deleted that was a very challenging but i fixed it.

9.3 Testing Phase 3

In the third phase of testing i have to review all project and recheck report giving queries also

10 Limitations

Following are the limitations of the project:

1. The application is only oriented towards a single user which makes it almost a hectic task for the admin to keep record of all things.
2. No login form is present and thus anyone can access the application, making the data to be insecure.
3. Attendance of not all students mandatory is a limitation because in my project the system allows to mark attendance of as many students as you want not complete required that is a major limitation as we compared to our **LMS**.
4. The UI is not 100% responsive.
5. There might be some validations missed. Also Admin needs to Load the data after insertion.

11 Future Work

The future work that can be done on the project are enlisted below:

1. Making of a Sign in / Sign up form.
2. Students can be given access to the application, from where they can view their evaluation details.
3. Teachers can be given access to do different tasks.

4. Updations in Attendance style of the students.
5. Will make the UI responsive if find time to do so.
6. Change the style of code in backened like, **Business Logic**, **User Interface**, **Data Layer** should be different and should be implemented using **Object Oriented Structure**.

12 Collaboration

We worked on a project and were able to complete it successfully with the help of our supervisor, **Mr. Nauman Babar**, and our classmates. Our supervisor guided us in understanding the case study and explained the database schema and relations between different database tables in detail, which was crucial for the success of our project. The supervisor also provided us with a database diagram to help us understand the schema better. We discussed the project with our classmates, which further enhanced our understanding of the project. The main goal was to understand the associations between different tables in the schema, and our classmates and supervisor helped us achieve that goal. We were able to discuss any problems we encountered during the project with our supervisor, which helped us complete the project successfully.

13 Conclusion

The **Learning Management System** is a Project designed to manage and implement databases using Structure Query Language (SQL) in real-life scenarios. Previously, people were accustomed to using file systems to manage records, but this method carried a high risk of data loss. With the implementation of SQL databases, managing large amounts of data has become much easier. The only requirement is to understand the syntax and different operations of SQL, which can significantly aid in data management.