UNICOMTIC

Unicom TIC Management System

Individual Project Report

Project Title: Unicom Tic Management System

Module: Desktop Application Designed

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Assignment number: 2	**Module Name: Destop Application Designed**
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The **Unicom TIC Management System (UMS)** is a desktop application designed for beginners to manage basic operations of a school. It handles various functionalities such as courses, subjects, students, exams, marks, and timetables, with a login system for Admin, Staff, Students, and Lecturers. The system also includes allocation for computer labs and lecture halls to assign places for classes. This application is built using **C# WinForms** with a **Model-View-Controller (MVC)** structure and utilizes a **SQLite database** for data storage. The project aims to help users learn basic C# programming, create forms, use a database, and implement a login system..

Table of Contents

1. Objectives

- Build a simple desktop application using C# WinForms and a basic MVC design.
- Create modules for:
- Course & Subject Management
- Student Management
- Exam & Marks Management
- Timetable Management with Computer Labs and Lecture Halls Allocation
- Implement a basic login system for Admin, Staff, Students, and Lecturers with role-based access.
- Organize data (Model), forms (View), and logic (Controller) using MVC.
- Save data in a SQLite database with simple add, view, edit, and delete actions.
- Develop an easy WinForms interface with buttons and lists.
- Validate inputs and display error messages.
- Utilize C# async/await to maintain application responsiveness.

1.1. Available features

- Login System
- Course & Subject Management.
- Student management
- Exam & Marks Management.
- Timetable Management
- Computer Labs and Leture Halls Allocation
- User friendly Interface
- Data Management
- Input Validation
- Asynchronous Operations

2. The architecture and design of the application

2.1 MVC Architecture

The Unicom TIC Management System is designed using the **Model-View-Controller (MVC)** architecture, which separates the application into three interconnected components:

Model – Represents the data and business logic of the application. It includes classes that define the structure of the data (e.g., Course, Student, Room) and methods for data manipulation (e.g., adding, editing, deleting records).

View: Represents the user interface of the application. It consists of WinForms that display data to the user and provide interactive elements (e.g., buttons, text boxes) for user input.

Controller: Acts as an intermediary between the Model and the View. It handles user input from the View, processes it (e.g., by calling methods on the Model), and updates the View accordingly.

2.2 Data Relationship

The application includes several key data relationships:

- ➢ **Course-Subject**: One-to-many relationship where a course can have multiple subjects.
- ➢ **Student-Course**: Many-to-one relationship where multiple students can be enrolled in one course.
- ➢ **Exam-Subject**: One-to-many relationship where a subject can have multiple exams.
- ➢ **Mark-Student and Mark-Exam**: Links between students and exams, associating each student with their scores for specific exams.
- ➢ **Timetable-Subject**: Each timetable entry corresponds to one subject and is associated with a room (lab or hall).
- ➢ **Room**: Stores information about computer labs and lecture halls.

Folder Structure

The folder structure for the Unicom TIC Management System is organized to facilitate easy navigation and maintainability of the project. Below is the proposed folder structure:

```
UnicomTICManagementSystem (Project Name)
├── Models
│   ├── Course.cs
│   ├── Subject.cs
│   ├── Student.cs
│   ├── Exam.cs
│   ├── Mark.cs
│   ├── Timetable.cs
│   ├── Room.cs
│   └── User.cs
├── Views
│   ├── LoginForm.cs
│   ├── MainForm.cs
│   ├── CourseForm.cs
│   ├── StudentForm.cs
│   ├── ExamForm.cs
│   ├── MarkForm.cs
│   └── TimetableForm.cs
├── Controllers
│   ├── LoginController.cs
│   ├── CourseController.cs
│   ├── StudentController.cs
│   ├── ExamController.cs
│   ├── MarkController.cs
│   └── TimetableController.cs
```

```
├── Repositories
│   └── DatabaseManager.cs
└── Program.cs
```

Folder Descriptions

Models: Contains classes that represent the data structure of the application, such as **`Course`**, **`Subject`**, **`Student`**, **`Exam`**, **`Mark`**, **`Timetable`**, **`Room`**, and **`User`** .

Each class defines properties and methods related to its respective entity.

Views: Contains the WinForms forms for the user interface, including:

`LoginForm.cs`: The form for user login.

`MainForm.cs`: The main dashboard after login.

`CourseForm.cs`: The form for managing courses.

`StudentForm.cs`: The form for managing students.

`ExamForm.cs`: The form for managing exams.

`MarkForm.cs`: The form for managing marks.

`TimetableForm.cs`: The form for managing timetables.

Controllers: Contains classes that handle the logic for user interactions, including:

`LoginController.cs`: Manages the login process.

`CourseController.cs`: Handles course-related actions.

`StudentController.cs`: Manages student-related actions.

`ExamController.cs`: Handles exam-related actions.

`MarkController.cs`: Manages marks-related actions.

`TimetableController.cs`: Handles timetable-related actions.

Repositories: Contains the **`DatabaseManager.cs`** class, which manages database operations such as adding, viewing, editing, and deleting records in the SQLite database..

Program.cs: The main entry point of the application, where the application starts execution.

2.3 Native Methodologies

The Unicom TIC Management System utilizes various native methodologies and technologies to ensure efficient development and functionality. Below are the key components and methodologies employed in the application:

1. Programming Language: C#

C# is the primary programming language used for developing the Unicom TIC Management System. It is a versatile, object-oriented language that provides strong typing, garbage collection, and support for modern programming paradigms. C# is well-suited for building Windows applications, making it an ideal choice for this project.

2. Integrated Development Environment (IDE): Visual Studio

Visual Studio is the IDE used for developing the application. It offers a comprehensive set of tools for coding, debugging, and testing C# applications. Key features include:

Form Designer: A visual interface for designing WinForms, allowing developers to drag and drop UI elements.

IntelliSense: Provides code suggestions and auto-completion, enhancing productivity and reducing errors.

Debugging Tools: Advanced debugging capabilities to step through code, set breakpoints, and inspect variables.

3. Database Management: SQLite

SQLite is the database management system used to store application data. It is a lightweight, serverless database that is easy to set up and use. Key features include:

Local Storage: SQLite allows for local data storage, making it suitable for desktop applications.

SQL Support: Supports standard SQL queries for data manipulation, making it easy to perform CRUD (Create, Read, Update, Delete) operations.

Integration with C#: The **System.Data.SQLite** library is used to interact with the SQLite database, providing a straightforward API for executing SQL commands.

4. Design Pattern: Model-View-Controller (MVC)

The application follows the **MVC design pattern**, which separates the application into three components:

Model: Represents the data and business logic. It includes classes that define the structure of the data and methods for data manipulation.

View: Represents the user interface, consisting of WinForms that display data and provide interactive elements for user input.

Controller: Acts as an intermediary between the Model and the View, handling user input and updating the View based on changes in the Model.

5. Object-Oriented Programming (OOP)

The application leverages **Object-Oriented Programming (OOP)** principles, including:

Encapsulation: Data is encapsulated within classes, with private fields and public properties to control access.

Inheritance: Common properties and methods can be shared among classes, promoting code reuse and reducing redundancy.

Polymorphism: Allows for methods to be overridden in derived classes, enabling dynamic method resolution.

3.Third party library

- **Entity Framework**

Purpose: Entity Framework (EF) is an Object-Relational Mapping (ORM) framework that simplifies database interactions by allowing developers to work with data as objects.

Benefits:

Reduces the amount of boilerplate code required for database operations.

Provides a LINQ (Language Integrated Query) interface for querying data, making it easier to write and understand database queries.

Supports migrations, allowing for easy updates to the database schema.

4.Test Cases Diagram

Unicom TIC Management System Test Cases

```
├── Login Module
│   ├── T01: Validate Login Functionality
│   ├── T02: Check Role-Based Access
│   └── T03: Validate Error Messages for Invalid Login
├── Course Management Module
│   ├── T04: Add Course
│   ├── T05: Edit Course
│   ├── T06: Delete Course
│   └── T07: View Course List
├── Student Management Module
│   ├── T08: Add Student
│   ├── T09: Edit Student
│   ├── T10: Delete Student
│   └── T11: View Student Details
├── Exam Management Module
│   ├── T12: Add Exam
│   ├── T13: Edit Exam
│   ├── T14: Delete Exam
│   └── T15: View Exam List
├── Marks Management Module
│   ├── T16: Add Marks
│   ├── T17: Edit Marks
│   ├── T18: Delete Marks
│   └── T19: View Marks
└── Timetable Management Module
```

├── **T20: Add Timetable Entry**

├── **T21: Edit Timetable Entry**

├── **T22: Delete Timetable Entry**

└── **T23: View Timetable**

Login Module

- **T01: Validate Login Functionality**

- **Purpose**: Ensure that users can log in with valid credentials.
- **Steps**:

1. Open the login form.
2. Enter a valid username and password.
3. Click the "Login" button.

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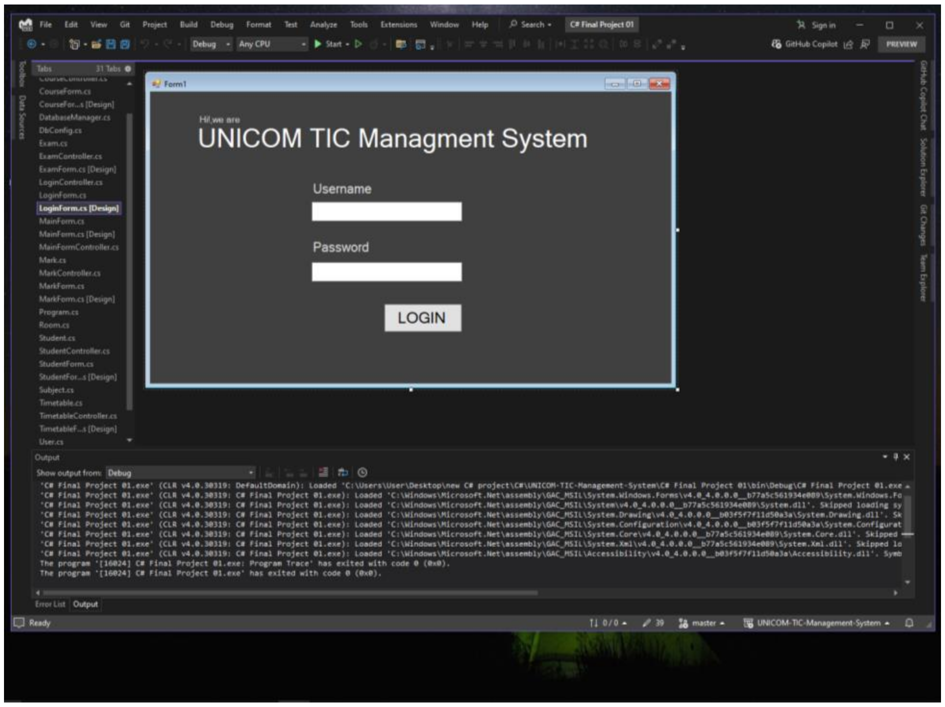

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Course Management Module

- **T04: Add Course**
- **Purpose**: Verify that an Admin can add a new course.
- **Steps**:

1. Log in as Admin.
2. Navigate to the Course Management section.
3. Enter course details and click "Add".

- **Expected Outcome**: The new course is added and displayed in the course list.
- **T05: Edit Course**
- **Purpose**: Ensure that an Admin can edit an existing course.
- **Steps**:

1. Log in as Admin.
2. Select a course to edit.
3. Modify course details and click "Save".

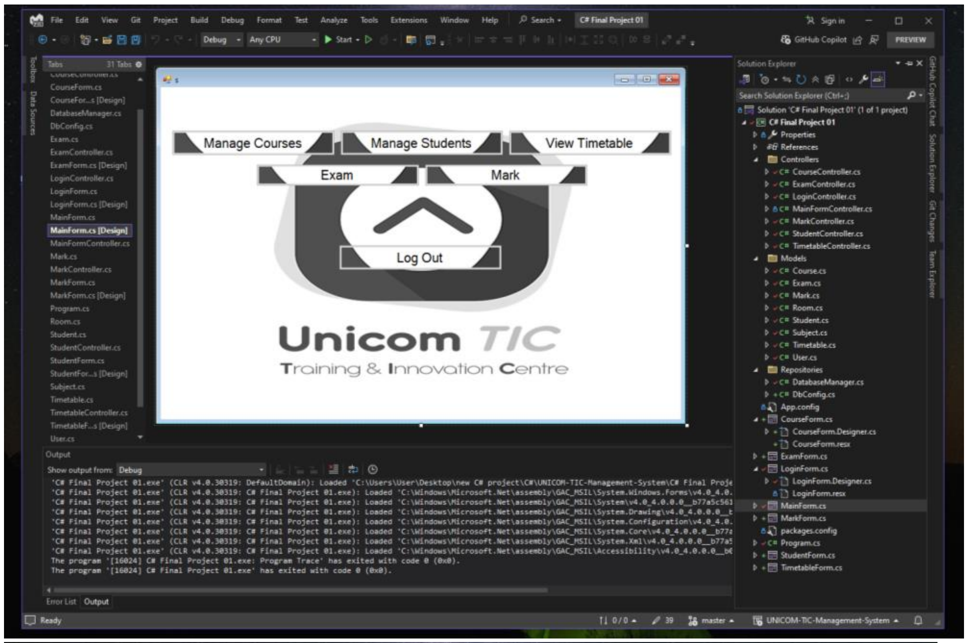
- **Expected Outcome**: The course details are updated in the course list.
- **T06: Delete Course**
- **Purpose**: Verify that an Admin can delete a course.
- **Steps**:

1. Log in as Admin.
2. Select a course to delete.
3. Click the "Delete" button.

- **Expected Outcome**: The course is removed from the course list.
- **T07: View Course List**
- **Purpose**: Ensure that all courses are displayed correctly.
- **Steps**:

1. Log in as Admin.
2. Navigate to the Course Management section.

- **Expected Outcome**: A list of all courses is displayed.



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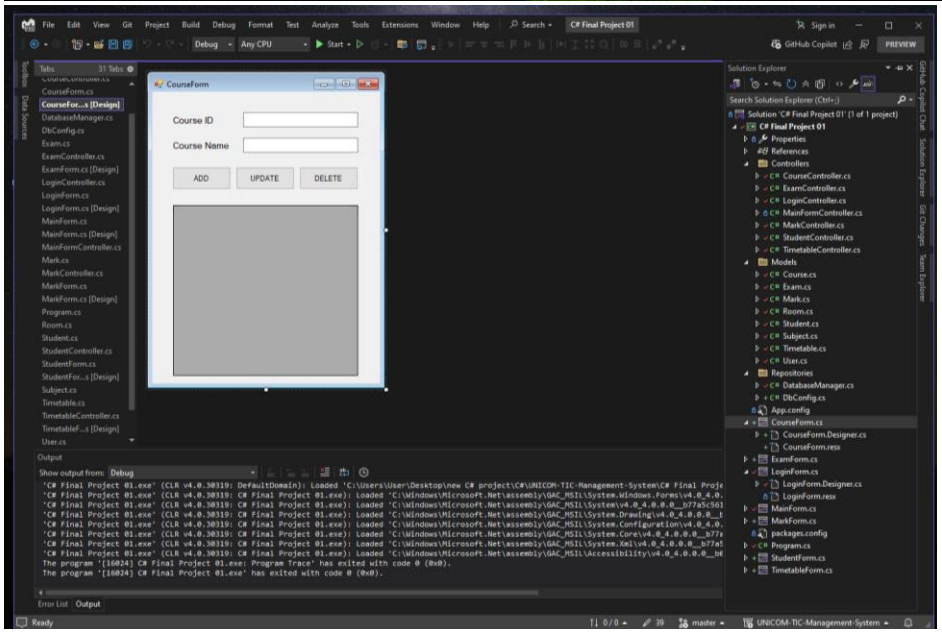

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```

Exam Management Module

- **T12: Add Exam**
- **Purpose**: Verify that an Admin can add a new exam.
- **Steps**:

1. Log in as Admin.
2. Navigate to the Exam Management section.
3. Enter exam details and click "Add".

- **Expected Outcome**: The new exam is added and displayed in the exam list.
- **T13: Edit Exam**
- **Purpose**: Ensure that an Admin can edit an existing exam.
- **Steps**:

1. Log in as Admin.
2. Select an exam to edit.
3. Modify exam details and click "Save".

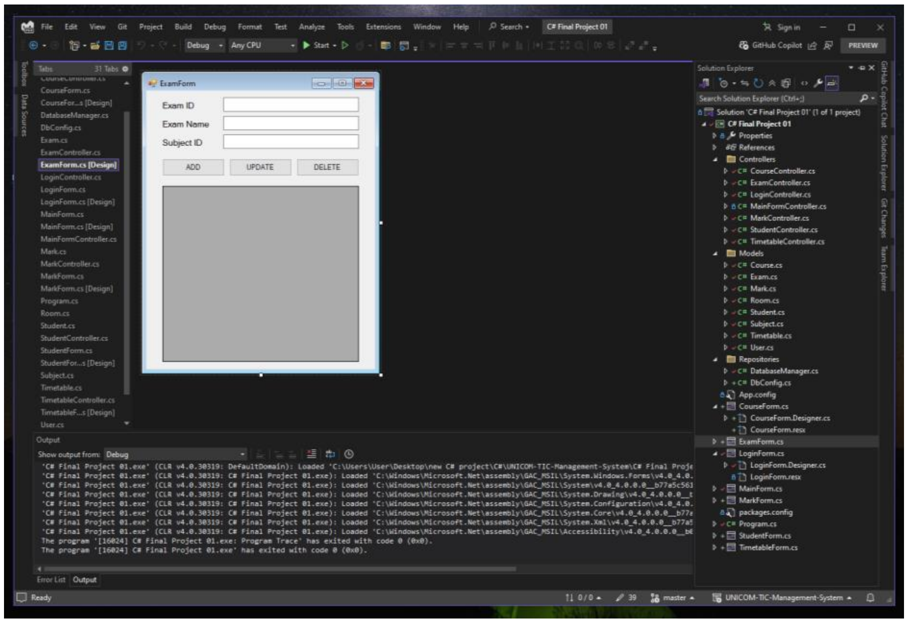
- **Expected Outcome**: The exam details are updated in the exam list.
- **T14: Delete Exam**
- **Purpose**: Verify that an Admin can delete an exam.
- **Steps**:

1. Log in as Admin.
2. Select an exam to delete.
3. Click the "Delete" button.

- **Expected Outcome**: The exam is removed from the exam list.
- **T15: View Exam List**
- **Purpose**: Ensure that all exams are displayed correctly.
- **Steps**:

1. Log in as Admin.
2. Navigate to the Exam Management section.

- **Expected Outcome**: A list of all exams is displayed.



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Marks Management Module

- **T16: Add Marks**
- **Purpose**: Verify that an Admin or Lecturer can add marks for a student.
- **Steps**:

1. Log in as Admin or Lecturer.
2. Navigate to the Marks Management section.
3. Enter marks for a student and click "Add".

- **Expected Outcome**: The marks are added and displayed in the marks list.
- **T17: Edit Marks**
- **Purpose**: Ensure that an Admin or Lecturer can edit existing marks.
- **Steps**:

1. Log in as Admin or Lecturer.
2. Select marks to edit.
3. Modify the marks and click "Save".

- **Expected Outcome**: The marks are updated in the marks list.
- **T18: Delete Marks**

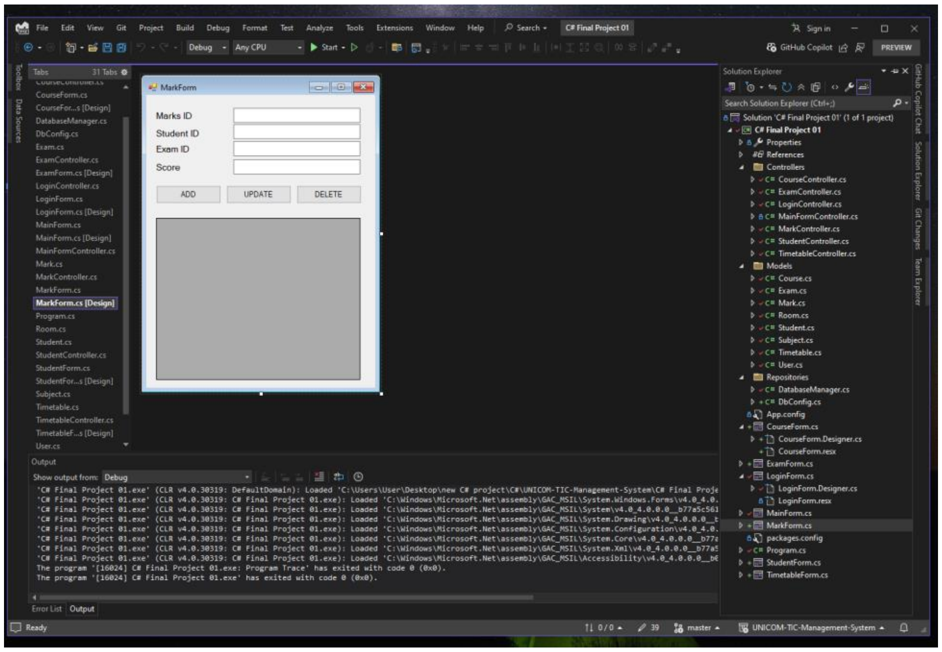
- **Purpose**: Verify that an Admin or Lecturer can delete marks.
- **Steps**:

1. Log in as Admin or Lecturer.
2. Select marks to delete.
3. Click the "Delete" button.

- **Expected Outcome**: The marks are removed from the marks list.
- **T19: View Marks**
- **Purpose**: Ensure that students can view their own marks.
- **Steps**:

1. Log in as a Student.
2. Navigate to the Marks Management section.

- **Expected Outcome**: The student's marks are displayed.



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Timetable Management Module

- **T20: Add Timetable Entry**
- **Purpose**: Verify that an Admin can add a new timetable entry.

- **Steps**:

1. Log in as Admin.
2. Navigate to the Timetable Management section.
3. Enter timetable details and click "Add".

- **Expected Outcome**: The new timetable entry is added and displayed in the timetable list.
- **T21: Edit Timetable Entry**
- **Purpose**: Ensure that an Admin can edit an existing timetable entry.
- **Steps**:

1. Log in as Admin.
2. Select a timetable entry to edit.
3. Modify the details and click "Save".

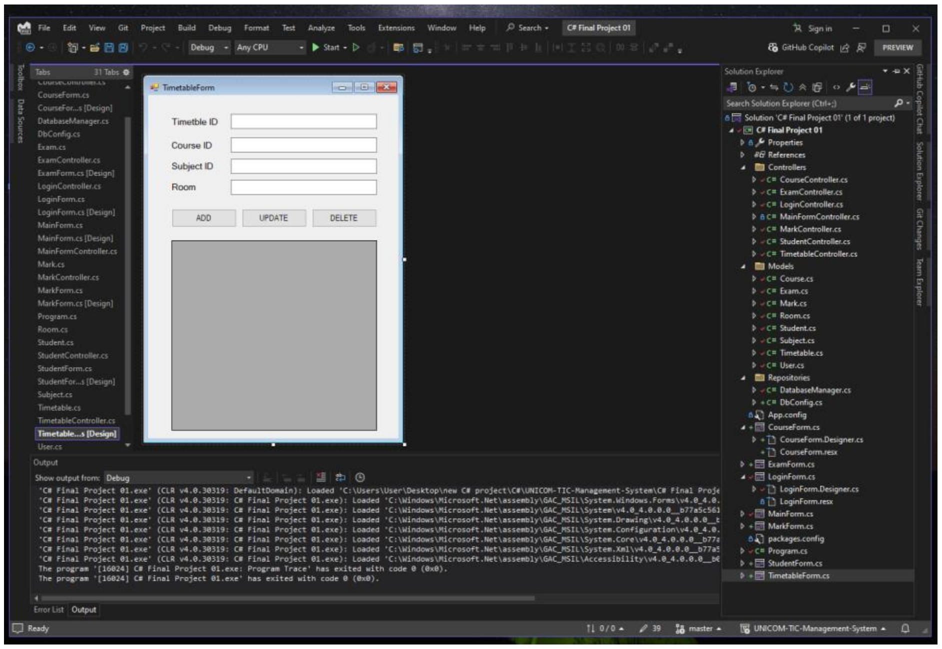
- **Expected Outcome**: The timetable entry is updated in the timetable list.
- **T22: Delete Timetable Entry**
- **Purpose**: Verify that an Admin can delete a timetable entry.
- **Steps**:

1. Log in as Admin.
2. Select a timetable entry to delete.
3. Click the "Delete" button.

- **Expected Outcome**: The timetable entry is removed from the timetable list.
- **T23: View Timetable**
- **Purpose**: Ensure that all users can view the timetable.
- **Steps**:

1. Log in as any user role.
2. Navigate to the Timetable Management section.

- **Expected Outcome**: The timetable is displayed, showing subjects, time slots, and rooms.



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'C# Final Project 01.exe' (CLR v4.0.30319: C# Final Project 01.exe): Loaded 'C:\Windows\Microsoft.Net\assembly\GAC_MSIL\System.Drawing\v4.0_4.0.0.0__b
'C# Final Project 01.exe' (CLR v4.0.30319: C# Final Project 01.exe): Loaded 'C:\Windows\Microsoft.Net\assembly\GAC_MSIL\System.Configuration\v4.0_4.0.
'C# Final Project 01.exe' (CLR v4.0.30319: C# Final Project 01.exe): Loaded 'C:\Windows\Microsoft.Net\assembly\GAC_MSIL\System.Core\v4.0_4.0.0.0__b77a
'C# Final Project 01.exe' (CLR v4.0.30319: C# Final Project 01.exe): Loaded 'C:\Windows\Microsoft.Net\assembly\GAC_MSIL\System.Xml\v4.0_4.0.0.0__b77a5
'C# Final Project 01.exe' (CLR v4.0.30319: C# Final Project 01.exe): Loaded 'C:\Windows\Microsoft.Net\assembly\GAC_MSIL\Accessibility\v4.0_4.0.0.0__b0
The program '[16024] C# Final Project 01.exe: Program Trace' has exited with code 0 (0x0).
The program '[16024] C# Final Project 01.exe' has exited with code 0 (0x0).
```

6. Issues / Error

Here I have list down the problem and errors faced in this application while developing.

- Unhandled exceptions causing application crashes.
- Data integrity issues (e.g., orphaned records)
- And more issues and error I am not a finished.

7. Reference

When developing the Unicom TIC Management System, various resources and references can be utilized to guide the design, implementation, and testing processes. Below is a list of references that may be helpful:

1. Official Documentation

- **C# Documentation**:
- Microsoft. (n.d.). C# Guide. Retrieved from Microsoft Docs
- **Entity Framework Documentation**:
- Microsoft. (n.d.). Entity Framework Core Documentation. Retrieved from Microsoft Docs
- **SQLite Documentation**:
- SQLite. (n.d.). SQLite Documentation. Retrieved from SQLite Official Site
- **WinForms Documentation**:
- Microsoft. (n.d.). Windows Forms Documentation. Retrieved from Microsoft Docs

2. Books

- **C# Programming**:
- Troelsen, A., & Japikse, J. (2017). Pro C# 7: With .NET and .NET Core. Apress.
- **Entity Framework**:
- Ploeh, J. (2019). Dependency Injection in .NET. Manning Publications.
- **Design Patterns**:
- Gamma, E., Helm, R., Johnson, R., & Vlissides, J. (1994). Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley.

3. Online Tutorials and Courses

- **C# Programming Tutorials**:

- Codecademy. (n.d.). Learn C#. Retrieved from Codecademy
- **Entity Framework Core Tutorials**:
- Pluralsight. (n.d.). Entity Framework Core: Getting Started. Retrieved from Pluralsight
- **WinForms Development**:
- Udemy. (n.d.). C# Windows Forms Applications: A Beginner's Guide. Retrieved from Udemy

4. Community and Forums

- **Stack Overflow**:
- A community-driven Q&A platform where developers can ask questions and share knowledge about C#, Entity Framework, and other related technologies. Retrieved from Stack Overflow
- **GitHub**:
- A platform for version control and collaboration, where developers can share and contribute to open-source projects. Retrieved from GitHub

5. Tools and Libraries

- **Visual Studio**:
- Microsoft. (n.d.). Visual Studio IDE. Retrieved from Visual Studio
- **Dapper**:
- Stack Exchange. (n.d.). Dapper Documentation. Retrieved from Dapper GitHub
- **NLog**:
- NLog. (n.d.). NLog Documentation. Retrieved from NLog Official Site