UnicomTIC Management System – Project Report

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1. Introduction

- The **UnicomTIC Management System (UMS)** is a desktop-based academic and administrative software designed for educational institutions.
- Developed using **C# WinForms** with **SQLite** database.
- Follows the **Model-View-Controller (MVC)** architecture for clean separation of concerns.

2. Objective

- Automate academic and user management processes.
- Allow only pre-verified NIC holders (UnicomTIC users) to register.
- Implement **automatic ID generation** for Students and Employees.
- Use structured coding with **Models, DTOs, Enums, Mappers, Repositories, Services, Controllers**.
- Ensure secure password handling and full data validation.
- Limit critical actions like Add/Update/Delete to **Admin only**.
- Record all major activities and identify top-performing students.

3. Key Features

3.1 User Registration and Validation

- Only users whose NIC exists in the **NICDetails** table can register.
- Unauthorized NICs are blocked from registering.
- Automatic ID generation:
    - Students → `UTI0001`, `UTI0002`, ...
    - Lecturers → `LecUTI0001`, `LecUTI0002`, ...

    - Staff → `EmpUTI0001`, `EmpUTI0002`, ...
- Passwords are hashed using a separate utility class for secure login.

3.2 Role-Based Access Control

- User roles: **Admin, Student, Lecturer, Staff, Mentor**.
- Only **Admin** can perform Add, Update, and Delete operations.
- Role-based form access and data visibility enforced.

3.3 Academic and Group Management

- Create and manage **Courses** and **Subjects**.
- Support for **Group hierarchy**:
    - **Main Groups** (e.g., Year 1, Year 2)
    - **Sub Groups** (e.g., A, B)
- Assign **Mentors** to groups.
- Add and view timetable entries based on group and subject.

3.4 Timetable and Attendance

- Create timetables with support for **parallel sessions** for different subgroups.
- Assign **Lecture Halls** or **Labs** to specific activities.
- Record **student attendance** by group and session.

3.5 Performance and Logging

- **Top Performers** module identifies and displays highest-scoring students.
- **Activity Log** tracks login, registration, update actions, and other events.

3.6 Validations and Error Handling

- **Try-Catch** blocks used in all layers (UI, Controllers, Services, Repositories).
- Validates all user inputs (e.g., empty fields, email format, NIC uniqueness).
- All registration steps are securely handled with exception feedback.

4. Project Architecture

- Follows **Modular and Layered Architecture**:

4.1 Models

- Represent database tables (User, Course, Subject, etc.)

4.2 DTOs (Data Transfer Objects)

- Used to safely transfer filtered data between UI and logic layers.

4.3 Enums

- Define constants for roles, activity types, etc.

4.4 Mappers

- Convert between Models ↔ DTOs automatically.

4.5 Interfaces and Repositories

- Repositories perform all **CRUD operations**, abstracted via **Interfaces**.

4.6 Services and Interfaces

- Contain **business logic**, validations, and processing rules.

4.7 Controllers

- Bridge between Services and Forms (UI), handle form events and exceptions.

4.8 Utilities

- Includes a separate folder with a class called **PasswordHasher**:
    - Used to hash and validate passwords during login and registration.
    - Secure password handling avoids plain-text storage.

5. Technologies Used

Layer	**Technology**
Frontend	C# WinForms
Backend	.NET (MVC Pattern)
Database	SQLite
Architecture Style	Layered MVC
Security	Password Hasher Class
Validation	Try-Catch + Field Checks

6. Admin Privileges

- Only **Admin** users can:
    - Add, update, or delete Courses, Subjects, Groups, Users
    - Assign Mentors

    - Generate and manage IDs
    - View full logs and performance reports
- Other roles have **read-only or restricted permissions**.

7. Extra Modules

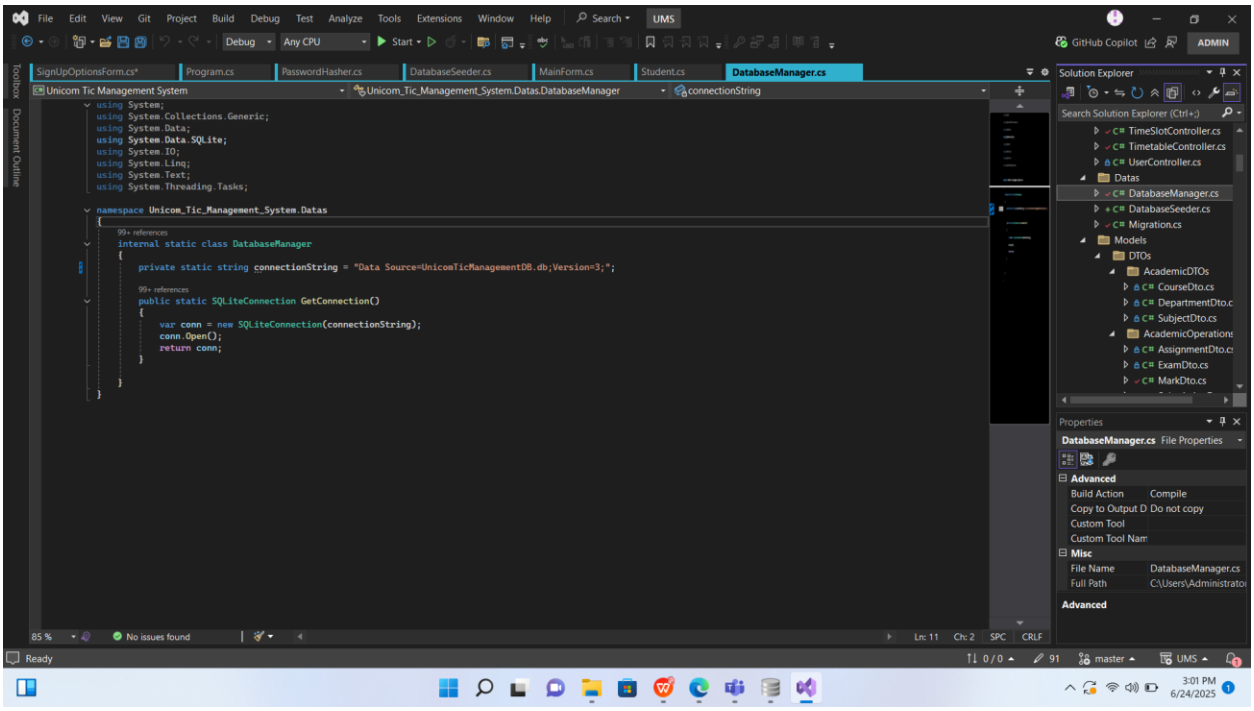
- **Mentor Assignment** – Assign mentors to groups.
- **Top Performers** – Monitor and display top-ranking students by marks.
- **Group Management** – Separate Main and Sub Groups.
- **Timetable Management** – Handle concurrent group sessions.
- **Attendance Module** – Record attendance based on group/subject/session.
- **Activity Logging** – Log all major events for audit and transparency.

8. Validation and Exception Handling

- Input validation on every form field.
- NIC validation ensures only approved users register.
- Passwords are securely hashed and validated.
- **Try-Catch blocks** in every layer to catch and handle errors gracefully.

9. Conclusion

- The **UnicomTIC Management System** is a secure, well-structured, and scalable academic platform.
- It follows **clean coding standards**, supports layered separation, and offers real-world functionality like registration validation, automatic ID generation, timetable scheduling, and mentor management.
- With strong exception handling and password security, the system is suitable for practical use in schools or institutes.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connectionString
using System;
using System.Collections.Generic;
using System.Data;
using System.Data.SQLite;
using System.IO;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
namespace Unicom_Tic_Management_System.Datas
{
99+ references
internal static class DatabaseManager
{
private static string connectionString = "Data Source=UnicomTicManagementDB.db;Version=3;";
99+ references
public static SQLiteConnection GetConnection()
{
var conn = new SQLiteConnection(connectionString);
conn.Open();
return conn;
}
}
}
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TimeSlotController.cs
TimetableController.cs
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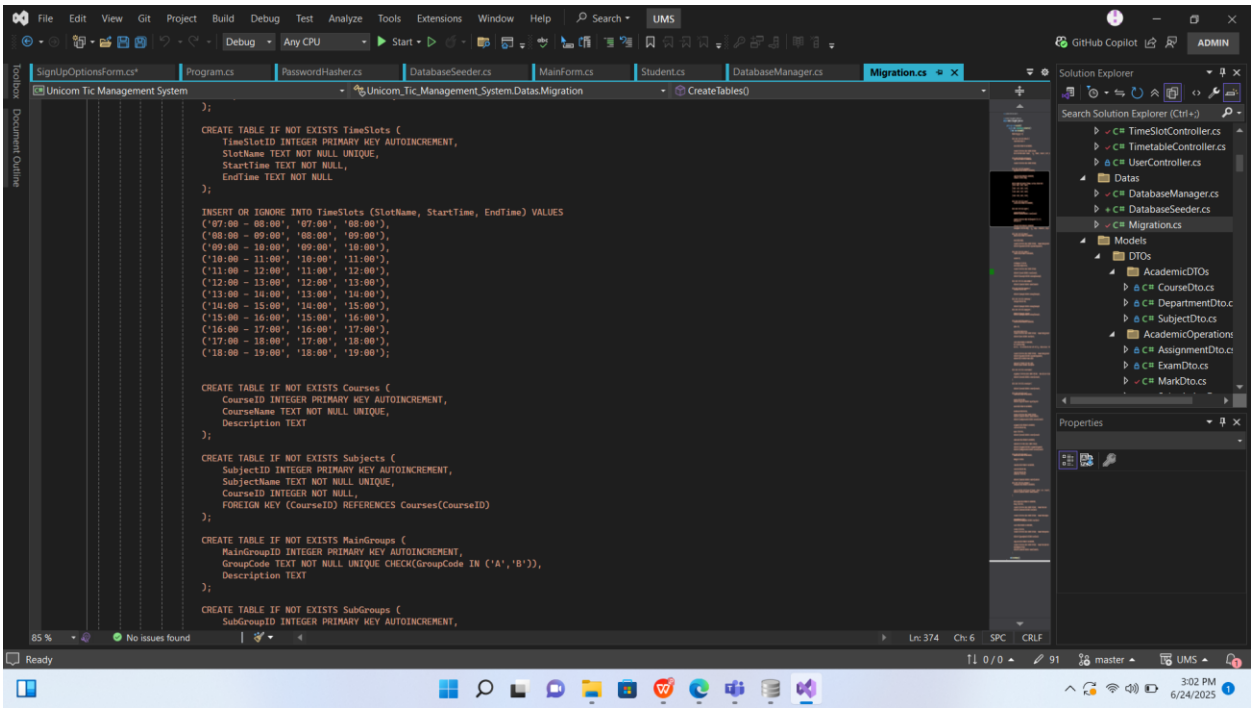
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Unicom Tic Management System
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CreateTables()
);
CREATE TABLE IF NOT EXISTS TimeSlots (
TimeSlotID INTEGER PRIMARY KEY AUTOINCREMENT,
SlotName TEXT NOT NULL UNIQUE,
StartTime TEXT NOT NULL,
EndTime TEXT NOT NULL
);
INSERT OR IGNORE INTO TimeSlots (SlotName, StartTime, EndTime) VALUES
('07:00 - 08:00', '07:00', '08:00'),
('08:00 - 09:00', '08:00', '09:00'),
('09:00 - 10:00', '09:00', '10:00'),
('10:00 - 11:00', '10:00', '11:00'),
('11:00 - 12:00', '11:00', '12:00'),
('12:00 - 13:00', '12:00', '13:00'),
('13:00 - 14:00', '13:00', '14:00'),
('14:00 - 15:00', '14:00', '15:00'),
('15:00 - 16:00', '15:00', '16:00'),
('16:00 - 17:00', '16:00', '17:00'),
('17:00 - 18:00', '17:00', '18:00'),
('18:00 - 19:00', '18:00', '19:00');
CREATE TABLE IF NOT EXISTS Courses (
CourseID INTEGER PRIMARY KEY AUTOINCREMENT,
CourseName TEXT NOT NULL UNIQUE,
Description TEXT
);
CREATE TABLE IF NOT EXISTS Subjects (
SubjectID INTEGER PRIMARY KEY AUTOINCREMENT,
SubjectName TEXT NOT NULL UNIQUE,
CourseID INTEGER NOT NULL,
FOREIGN KEY (CourseID) REFERENCES Courses(CourseID)
);
CREATE TABLE IF NOT EXISTS MainGroups (
MainGroupID INTEGER PRIMARY KEY AUTOINCREMENT,
GroupCode TEXT NOT NULL UNIQUE CHECK(GroupCode IN ('A','B')),
Description TEXT
);
CREATE TABLE IF NOT EXISTS SubGroups (
SubGroupID INTEGER PRIMARY KEY AUTOINCREMENT,
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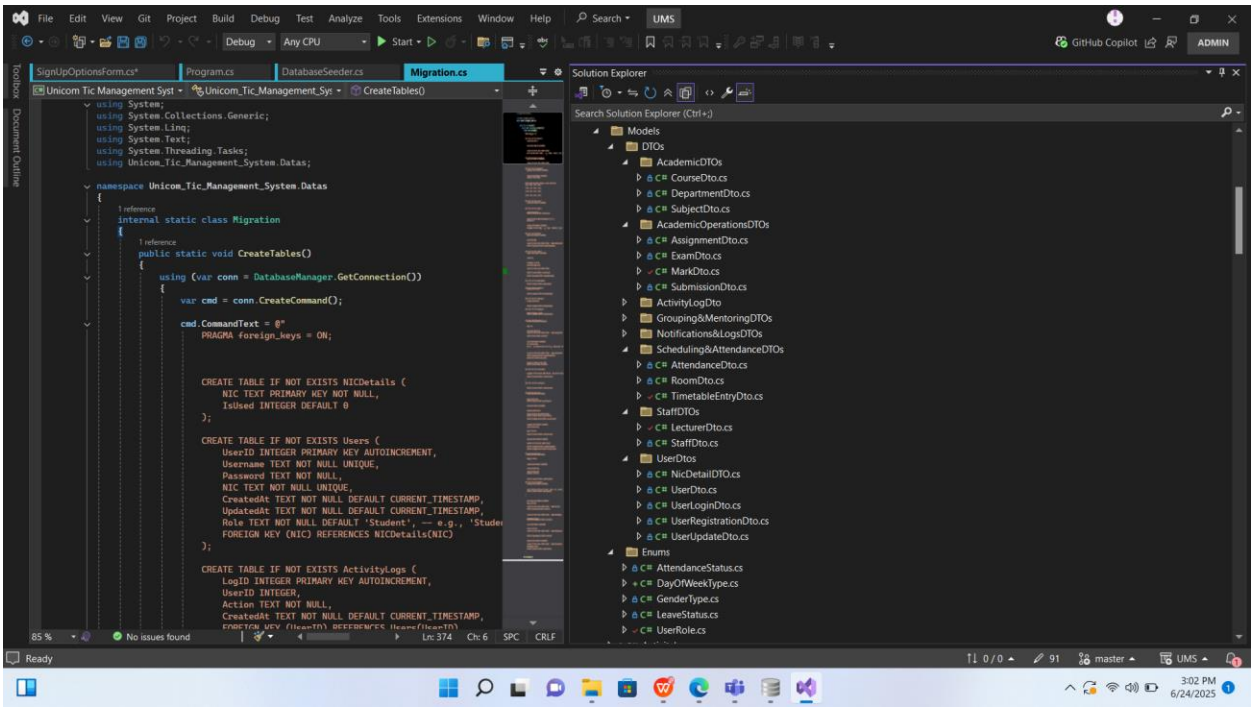
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CreateTables()
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using Unicom_Tic_Management_System.Datas;
namespace Unicom_Tic_Management_System.Datas
{
1 reference
internal static class Migration
{
1 reference
public static void CreateTables()
{
using (var conn = DatabaseManager.GetConnection())
{
var cmd = conn.CreateCommand();
cmd.CommandText = @"
PRAGMA foreign_keys = ON;
CREATE TABLE IF NOT EXISTS NICDetails (
NIC TEXT PRIMARY KEY NOT NULL,
IsUsed INTEGER DEFAULT 0
);
CREATE TABLE IF NOT EXISTS Users (
UserID INTEGER PRIMARY KEY AUTOINCREMENT,
Username TEXT NOT NULL UNIQUE,
Password TEXT NOT NULL,
NIC TEXT NOT NULL UNIQUE,
CreatedAt TEXT NOT NULL DEFAULT CURRENT_TIMESTAMP,
UpdatedAt TEXT NOT NULL DEFAULT CURRENT_TIMESTAMP,
Role TEXT NOT NULL DEFAULT 'Student', -- e.g., 'Stude
FOREIGN KEY (NIC) REFERENCES NICDetails(NIC)
);
CREATE TABLE IF NOT EXISTS ActivityLogs (
LogID INTEGER PRIMARY KEY AUTOINCREMENT,
UserID INTEGER,
Action TEXT NOT NULL,
CreatedAt TEXT NOT NULL DEFAULT CURRENT_TIMESTAMP,
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Notifications&LogsDTOs
Scheduling&AttendanceDTOs
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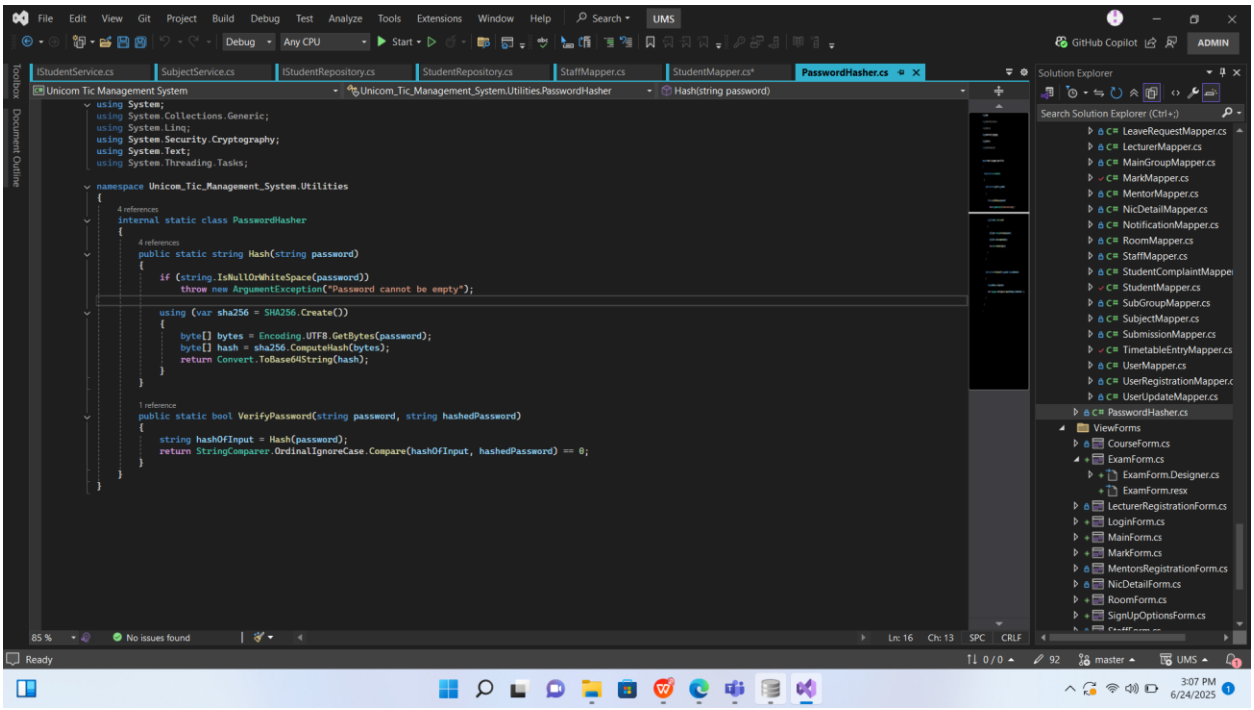
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PasswordHasher.cs
Unicom Tic Management System
Unicom_Tic_Management_System.Utilities.PasswordHasher
Hash(string password)
using System;
using System.Collections.Generic;
using System.Linq;
using System.Security.Cryptography;
using System.Text;
using System.Threading.Tasks;
namespace Unicom_Tic_Management_System.Utilities
{
4 references
internal static class PasswordHasher
{
4 references
public static string Hash(string password)
{
if (string.IsNullOrWhiteSpace(password))
throw new ArgumentException("Password cannot be empty");
using (var sha256 = SHA256.Create())
{
byte[] bytes = Encoding.UTF8.GetBytes(password);
byte[] hash = sha256.ComputeHash(bytes);
return Convert.ToBase64String(hash);
}
}
1 reference
public static bool VerifyPassword(string password, string hashedPassword)
{
string hashOfInput = Hash(password);
return StringComparer.OrdinalIgnoreCase.Compare(hashOfInput, hashedPassword) == 0;
}
}
}
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LeaveRequestMapper.cs
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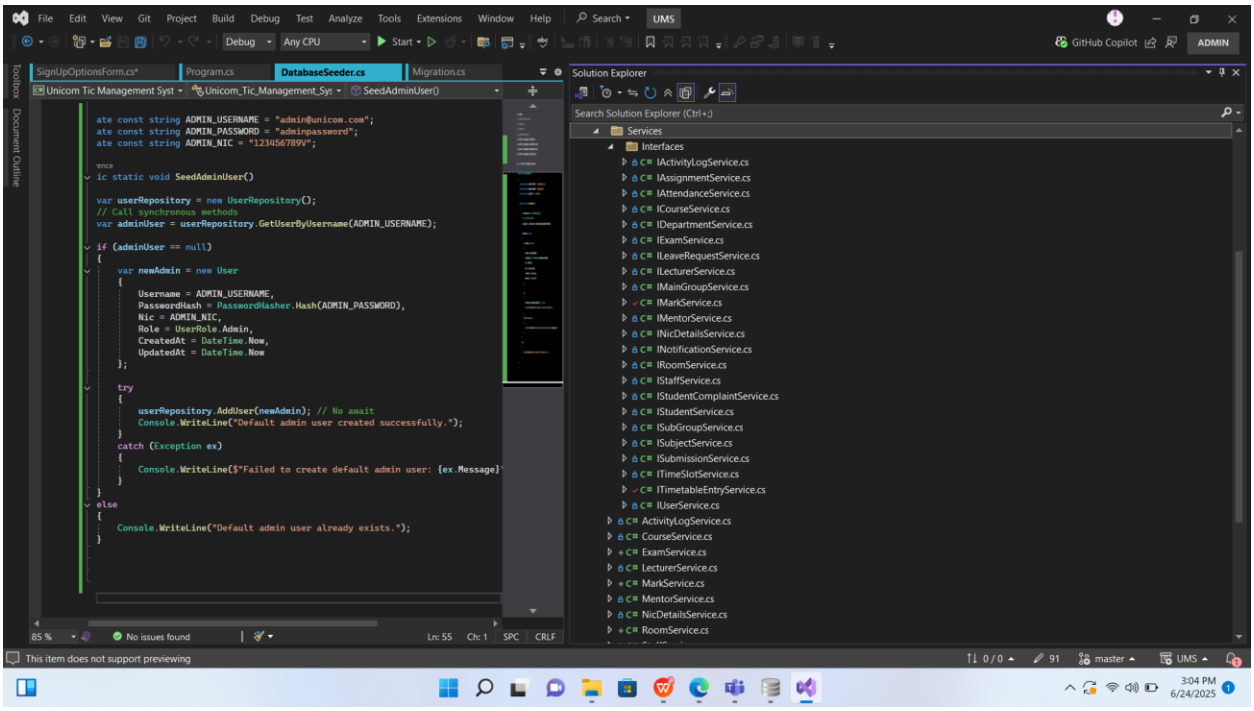
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SeedAdminUser()
ate const string ADMIN_USERNAME = "admin@unicom.com";
ate const string ADMIN_PASSWORD = "adminpassword";
ate const string ADMIN_NIC = "123456789V";
ic static void SeedAdminUser()
var userRepository = new UserRepository();
// Call synchronous methods
var adminUser = userRepository.GetUserByUsername(ADMIN_USERNAME);
if (adminUser == null)
{
var newAdmin = new User
{
Username = ADMIN_USERNAME,
PasswordHash = PasswordHasher.Hash(ADMIN_PASSWORD),
Nic = ADMIN_NIC,
Role = UserRole.Admin,
CreatedAt = DateTime.Now,
UpdatedAt = DateTime.Now
};
try
{
userRepository.AddUser(newAdmin); // No await
Console.WriteLine("Default admin user created successfully.");
}
catch (Exception ex)
{
Console.WriteLine($"Failed to create default admin user: {ex.Message}
}
}
else
{
Console.WriteLine("Default admin user already exists.");
}
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IAssignmentService.cs
IAttendanceService.cs
ICourseService.cs
IDepartmentService.cs
IExamService.cs
ILeaveRequestService.cs
ILecturerService.cs
IMainGroupService.cs
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INicDetailsService.cs
INotificationService.cs
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IStudentComplaintService.cs
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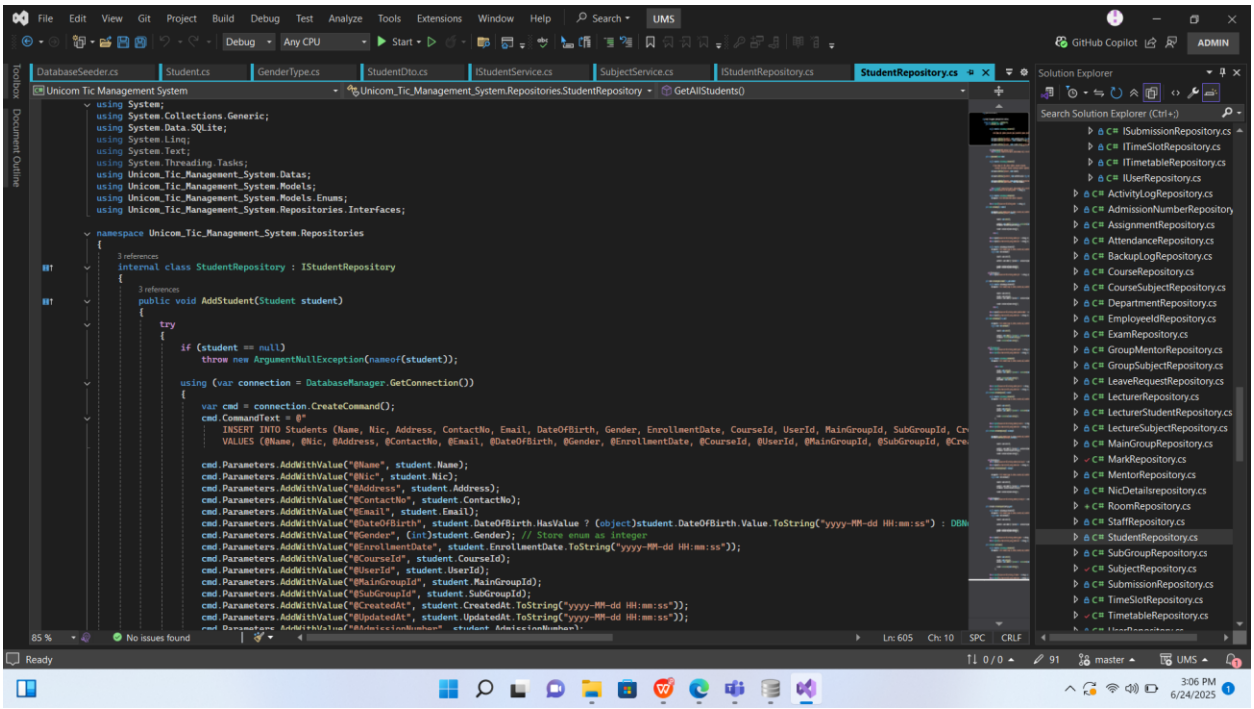
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IStudentService.cs
SubjectService.cs
IStudentRepository.cs
StudentRepository.cs
Unicom Tic Management System
Unicom_Tic_Management_System.Repositories.StudentRepository
GetAllStudents()
using System;
using System.Collections.Generic;
using System.Data.SQLite;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using Unicom_Tic_Management_System.Datas;
using Unicom_Tic_Management_System.Models;
using Unicom_Tic_Management_System.Models.Enums;
using Unicom_Tic_Management_System.Repositories.Interfaces;
namespace Unicom_Tic_Management_System.Repositories
{
3 references
internal class StudentRepository : IStudentRepository
{
3 references
public void AddStudent(Student student)
{
try
{
if (student == null)
throw new ArgumentNullException(nameof(student));
using (var connection = DatabaseManager.GetConnection())
{
var cmd = connection.CreateCommand();
cmd.CommandText = @"
INSERT INTO Students (Name, Nic, Address, ContactNo, Email, DateOfBirth, Gender, EnrollmentDate, CourseId, UserId, MainGroupId, SubGroupId, Cr
VALUES (@Name, @Nic, @Address, @ContactNo, @Email, @DateOfBirth, @Gender, @EnrollmentDate, @CourseId, @UserId, @MainGroupId, @SubGroupId, @Cre
cmd.Parameters.AddWithValue("@Name", student.Name);
cmd.Parameters.AddWithValue("@Nic", student.Nic);
cmd.Parameters.AddWithValue("@Address", student.Address);
cmd.Parameters.AddWithValue("@ContactNo", student.ContactNo);
cmd.Parameters.AddWithValue("@Email", student.Email);
cmd.Parameters.AddWithValue("@DateOfBirth", student.DateOfBirth.HasValue ? (object)student.DateOfBirth.Value.ToString("yyyy-MM-dd HH:mm:ss") : DBN
cmd.Parameters.AddWithValue("@Gender", (int)student.Gender); // Store enum as integer
cmd.Parameters.AddWithValue("@EnrollmentDate", student.EnrollmentDate.ToString("yyyy-MM-dd HH:mm:ss"));
cmd.Parameters.AddWithValue("@CourseId", student.CourseId);
cmd.Parameters.AddWithValue("@UserId", student.UserId);
cmd.Parameters.AddWithValue("@MainGroupId", student.MainGroupId);
cmd.Parameters.AddWithValue("@SubGroupId", student.SubGroupId);
cmd.Parameters.AddWithValue("@CreatedAt", student.CreatedAt.ToString("yyyy-MM-dd HH:mm:ss"));
cmd.Parameters.AddWithValue("@UpdatedAt", student.UpdatedAt.ToString("yyyy-MM-dd HH:mm:ss"));
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ITimetableRepository.cs
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ActivityLogRepository.cs
AdmissionNumberRepository
AssignmentRepository.cs
AttendanceRepository.cs
BackupLogRepository.cs
CourseRepository.cs
CourseSubjectRepository.cs
DepartmentRepository.cs
EmployeeIdRepository.cs
ExamRepository.cs
GroupMentorRepository.cs
GroupSubjectRepository.cs
LeaveRequestRepository.cs
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