reLIFE Scheduler - Application Documentation

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May 31, 2025

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Part I: User Documentation

1. Prerequisites & Development Setup

This section outlines the necessary software, tools, and libraries required to compile, run, and further develop the reLIFE Scheduler application from its source code.

1.1. Software Requirements:

- **Microsoft Visual Studio:** Version [e.g., 2022] or later, with the ".NET desktop development" workload installed.
- **.NET SDK:** Version [8.0] (matching the project's target framework). This is typically included with Visual Studio.
- **Microsoft SQL Server:** A running instance of SQL Server (SQL Server Express [2019/2022], Developer Edition, or Standard/Enterprise). The database schema provided in this documentation needs to be created on this instance.
- **SQL Server Management Studio (SSMS) (Recommended):** For database management, schema creation, and direct data inspection.

1.2. Key NuGet Packages:

The project relies on several NuGet packages for its functionality. These packages should be restored automatically by Visual Studio when the solution is opened, or they can be manually installed via the NuGet Package Manager.

- **Microsoft.Data.SqlClient:**
  - **Project(s) Used In:** reLIFE.BusinessLogic
  - **Purpose:** The primary ADO.NET data provider for connecting to and interacting with Microsoft SQL Server. It is used by all Repository classes for executing SQL queries.
  - **Version (Approximate):** [5.1.x or latest stable]
- **MaterialSkin.2 (or similar name for the specific MaterialSkin library used):**
  - **Project(s) Used In:** reLIFE.WinFormsUI
  - **Purpose:** Provides Material Design theming and custom controls (e.g., MaterialForm, MaterialButton, MaterialTextBox2, MaterialCheckedListBox) for the Windows Forms user interface.

    - **Version (Approximate):** [2.3.x or latest stable]
- **Microsoft.Extensions.Configuration:**
    - **Project(s) Used In:** reLIFE.BusinessLogic (specifically by DbHelper for reading appsettings.json manually) or reLIFE.WinFormsUI (if using a more integrated configuration host).
    - **Purpose:** Provides core abstractions for application configuration.
    - **Version (Approximate):** [8.0.x or version compatible with your .NET target]
- **Microsoft.Extensions.Configuration.Json:**
    - **Project(s) Used In:** reLIFE.BusinessLogic (by DbHelper) or reLIFE.WinFormsUI.
    - **Purpose:** Enables reading configuration settings from JSON files (i.e., appsettings.json).
    - **Version (Approximate):** [8.0.x or version compatible with your .NET target]
- **Microsoft.Extensions.Configuration.Binder (Optional but often included):**
    - **Project(s) Used In:** reLIFE.BusinessLogic or reLIFE.WinFormsUI.
    - **Purpose:** Allows binding configuration sections to strongly-typed C# objects.
    - **Version (Approximate):** [8.0.x or version compatible with your .NET target]

1.3. Project Setup from Source:

1. **Clone/Download Source Code:** Obtain the project source files.
2. **Open Solution:** Open reLIFE.sln in Microsoft Visual Studio.
3. **Restore NuGet Packages:** Visual Studio should automatically prompt to restore packages. If not, right-click the solution in Solution Explorer and select "Restore NuGet Packages."
4. **Database Setup:**
    - Ensure a SQL Server instance is accessible.

    - Create a new database (e.g., reLifeDB).
    - Execute the SQL schema script (provided in Appendix or Section 3.2) against the created database to generate the necessary tables.
5. **Configure Connection String:**
    - Open the appsettings.json file in the reLIFE.WinFormsUI project.
    - Update the DefaultConnection string under ConnectionStrings to point to your SQL Server instance and the reLifeDB database, using appropriate credentials (Windows Authentication or SQL Login).
6. **Build Solution:** Select "Build" > "Rebuild Solution" from the Visual Studio menu. Address any compilation errors.
7. **Run Application:** Set the reLIFE.WinFormsUI project as the startup project (if not already) and run the application (F5 or Start button).

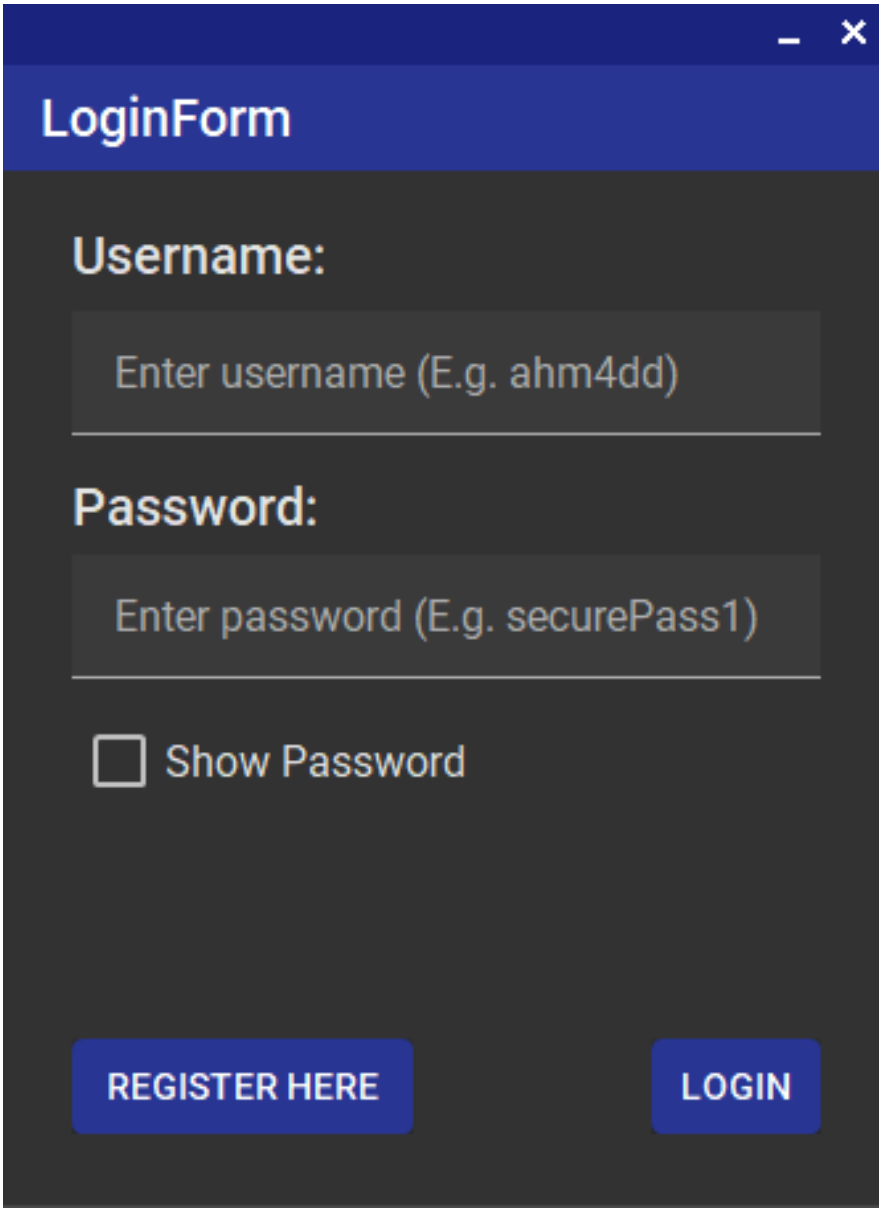
2.4. End-User Prerequisites (Running the compiled application):

For an end-user running a pre-compiled version of reLIFE Scheduler:

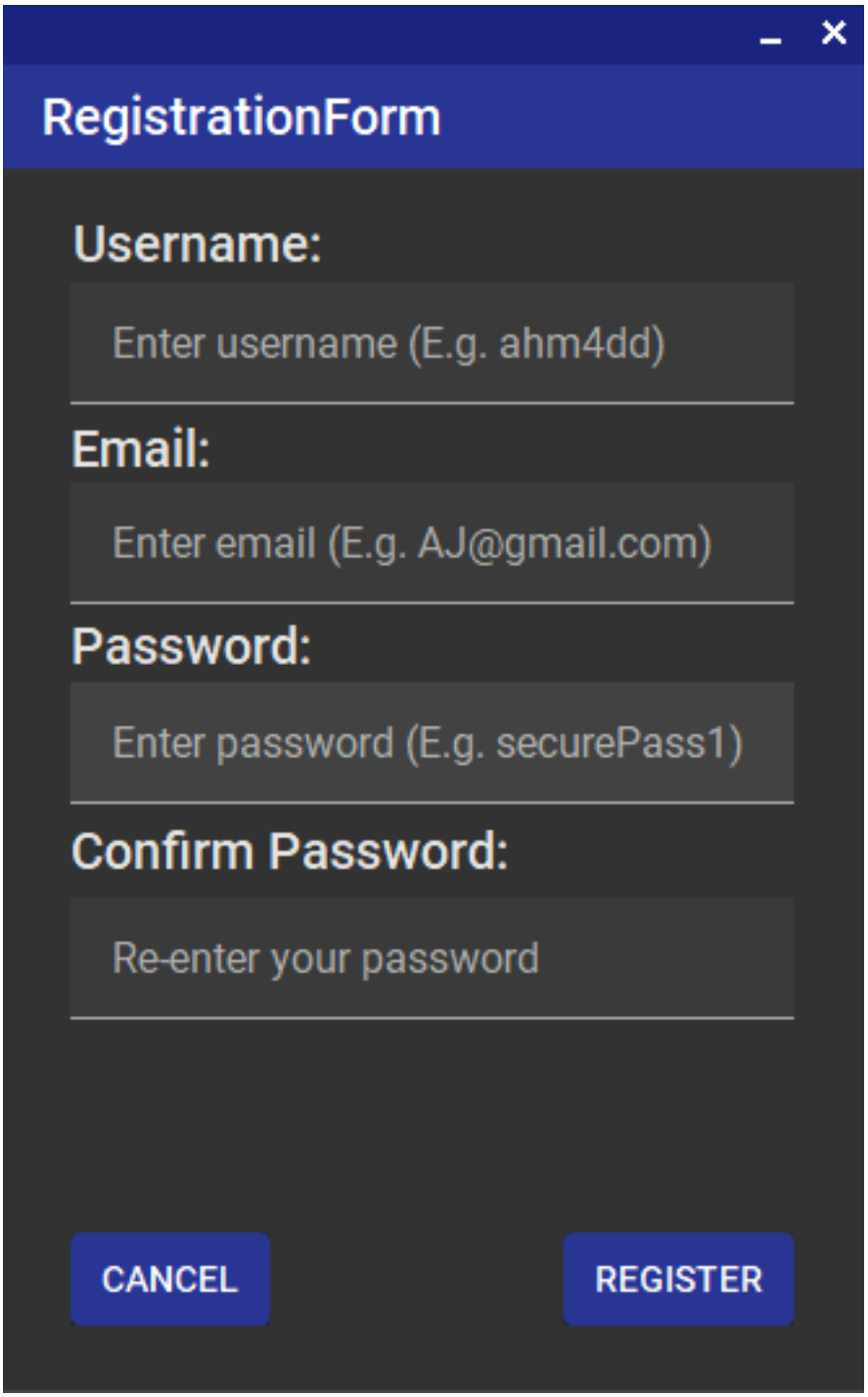
- **.NET Desktop Runtime:** The appropriate version of the .NET Desktop Runtime corresponding to the project's target framework (e.g., .NET 8.0 Desktop Runtime) must be installed on the user's machine.
- **(Implicit) Database Connectivity:** While not a user installation step, the application requires connectivity to the SQL Server database as configured during development/deployment. For a standalone single-user setup, this often means SQL Server Express running on the same machine.

2. Get Started

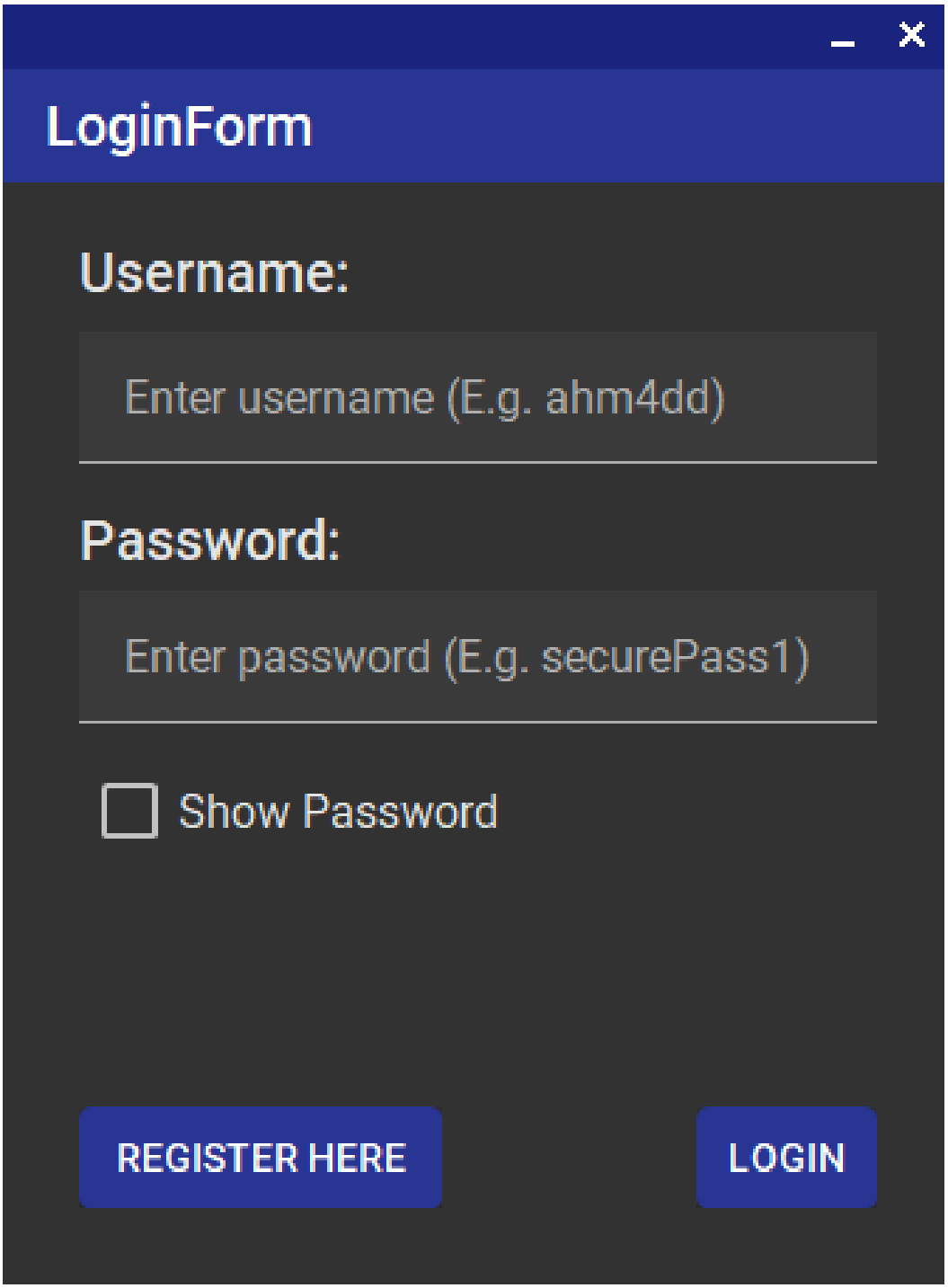
2.1. Launching the Application



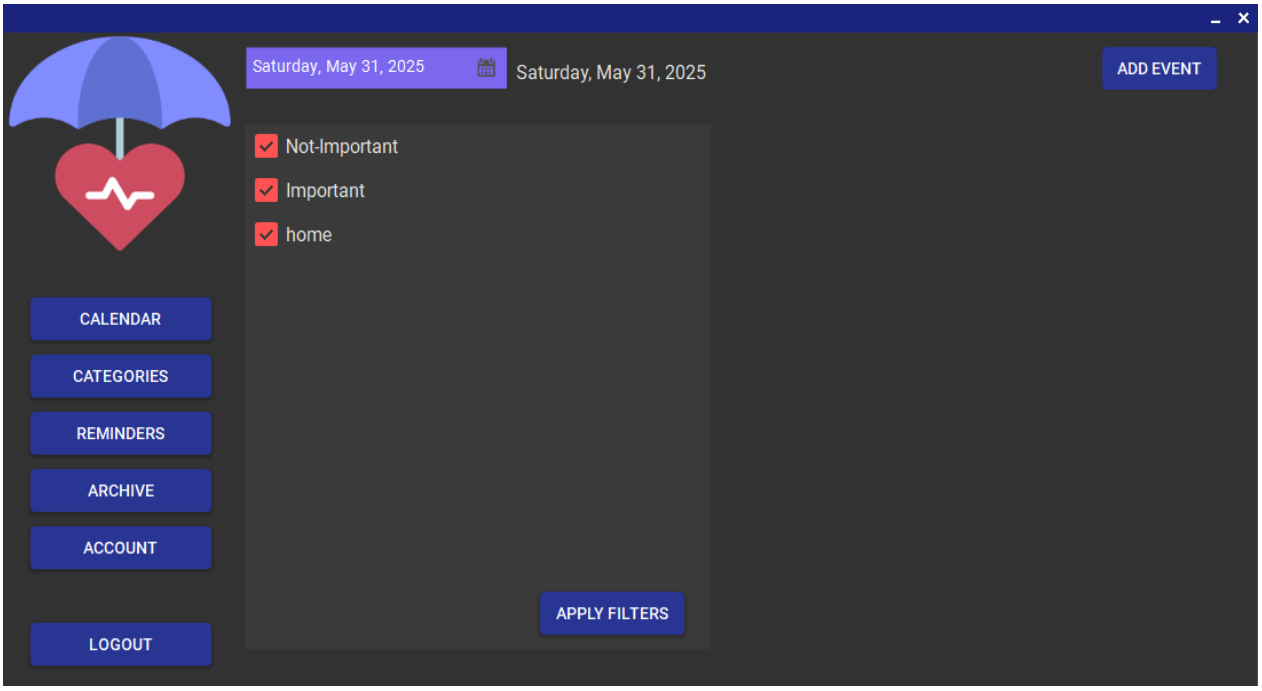
2.2. User Registration



2.3. Logging In

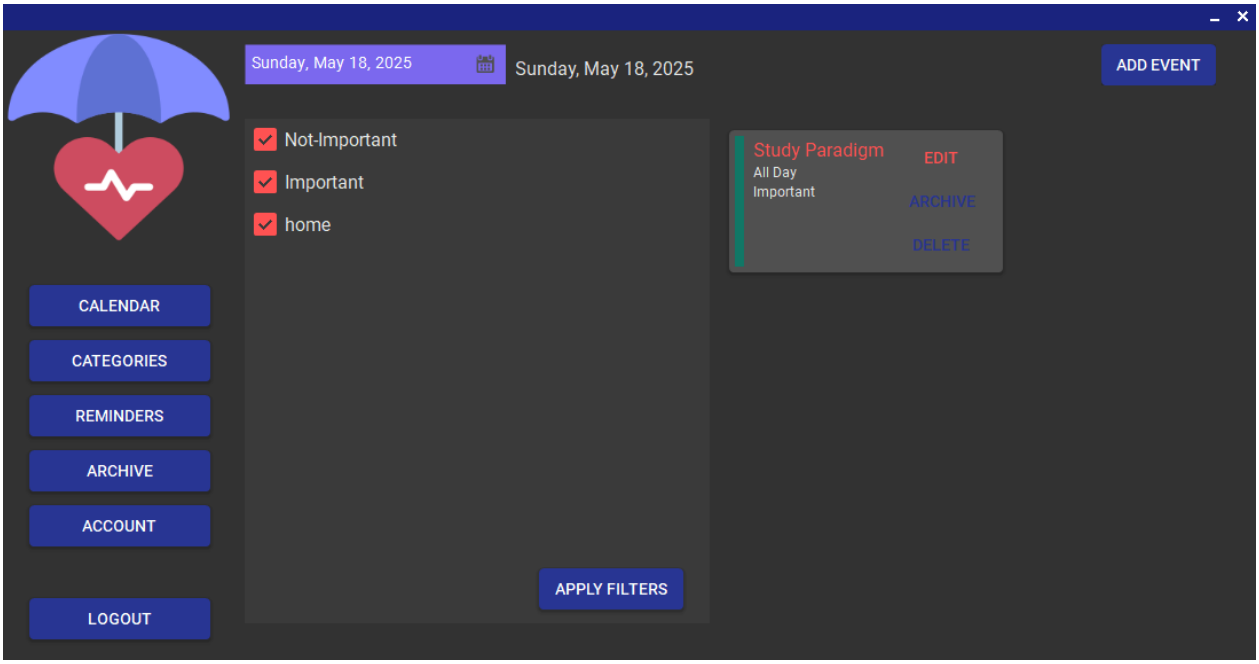


2.4. Main Dashboard Overview

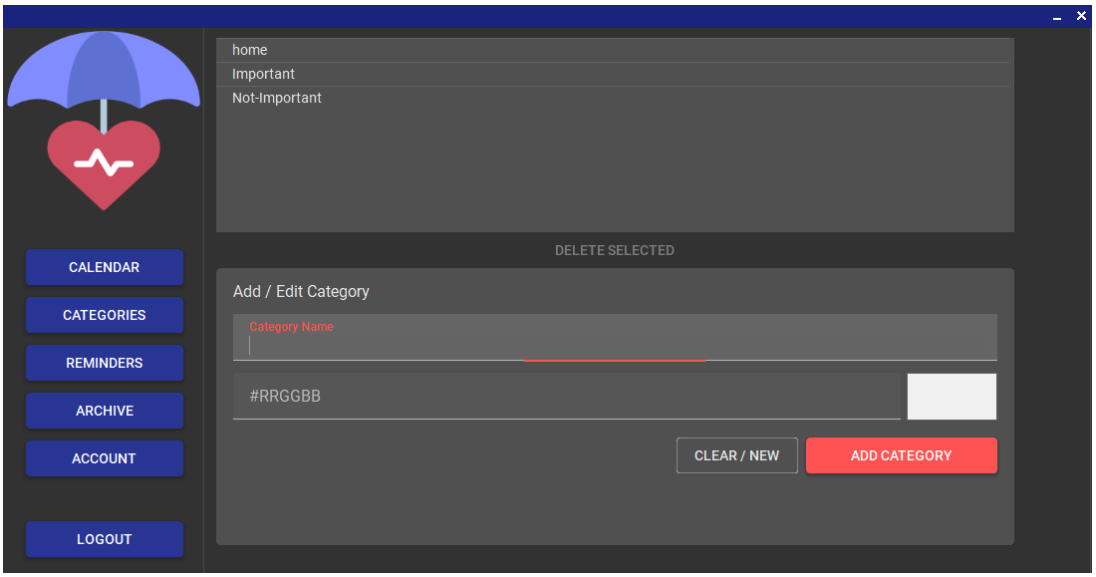


3. Using reLIFE Scheduler - Key Features:

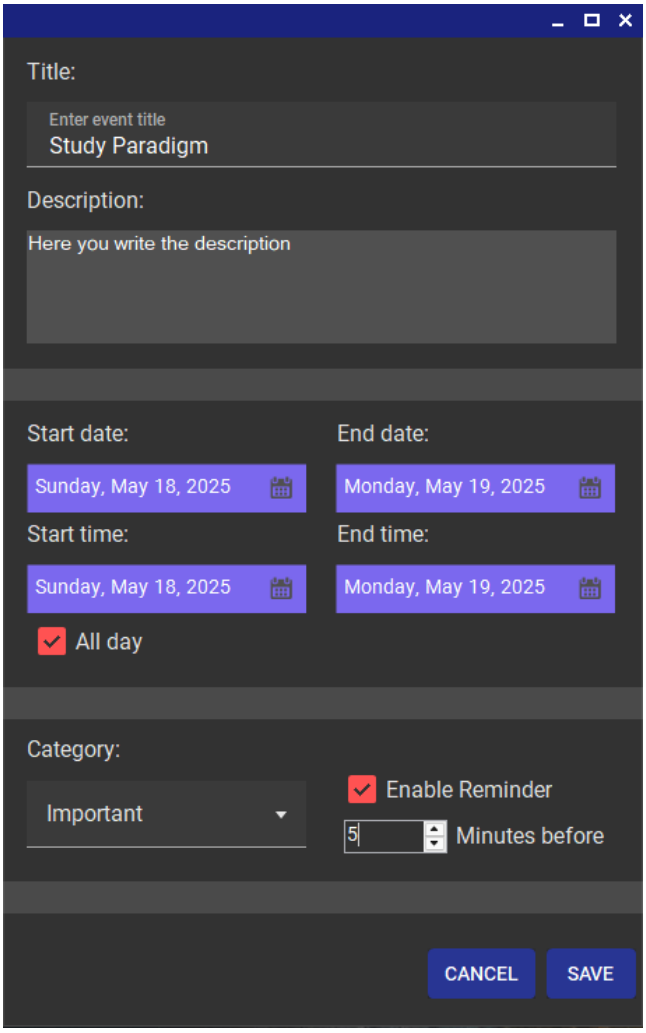
3.1. Calendar View (CalendarViewForm)



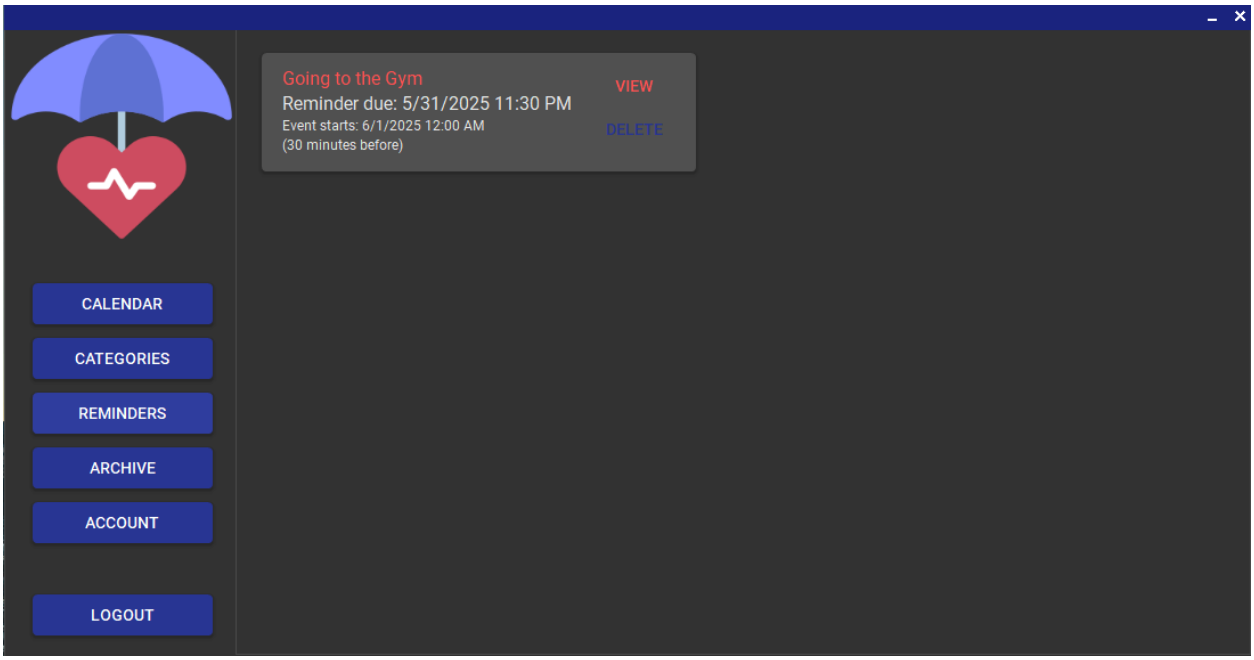
3.2. Managing Categories (CategoryManagerForm)



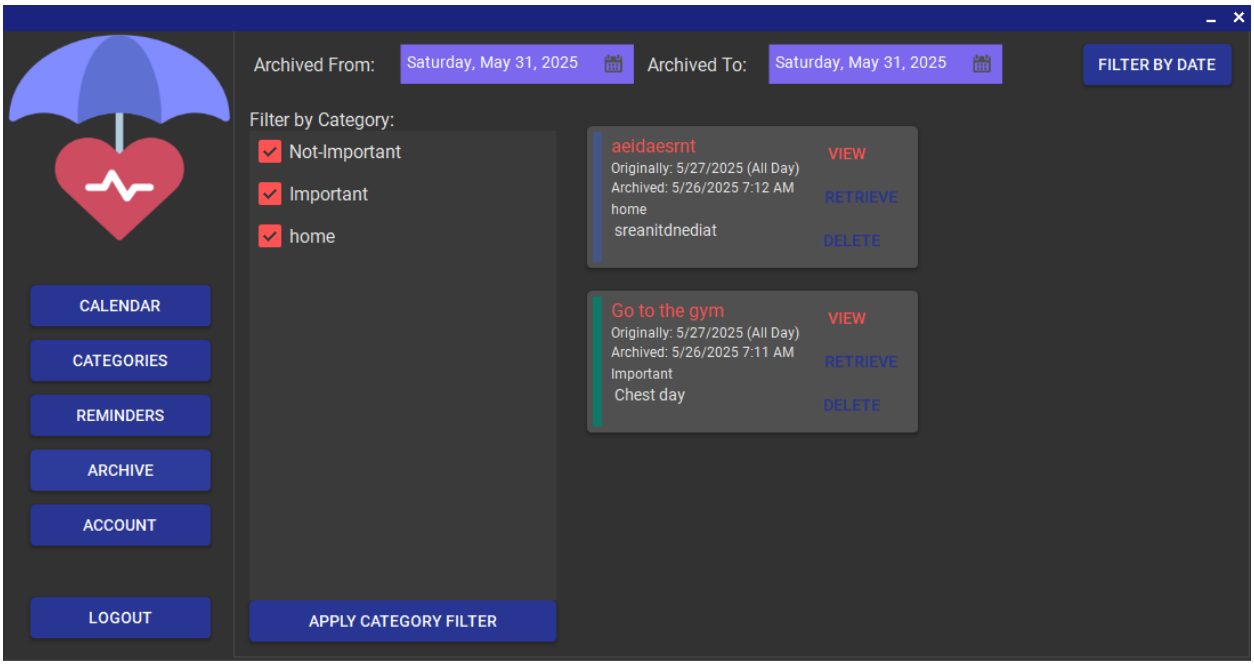
3.3. Event Form (EventForm - Add/Edit)



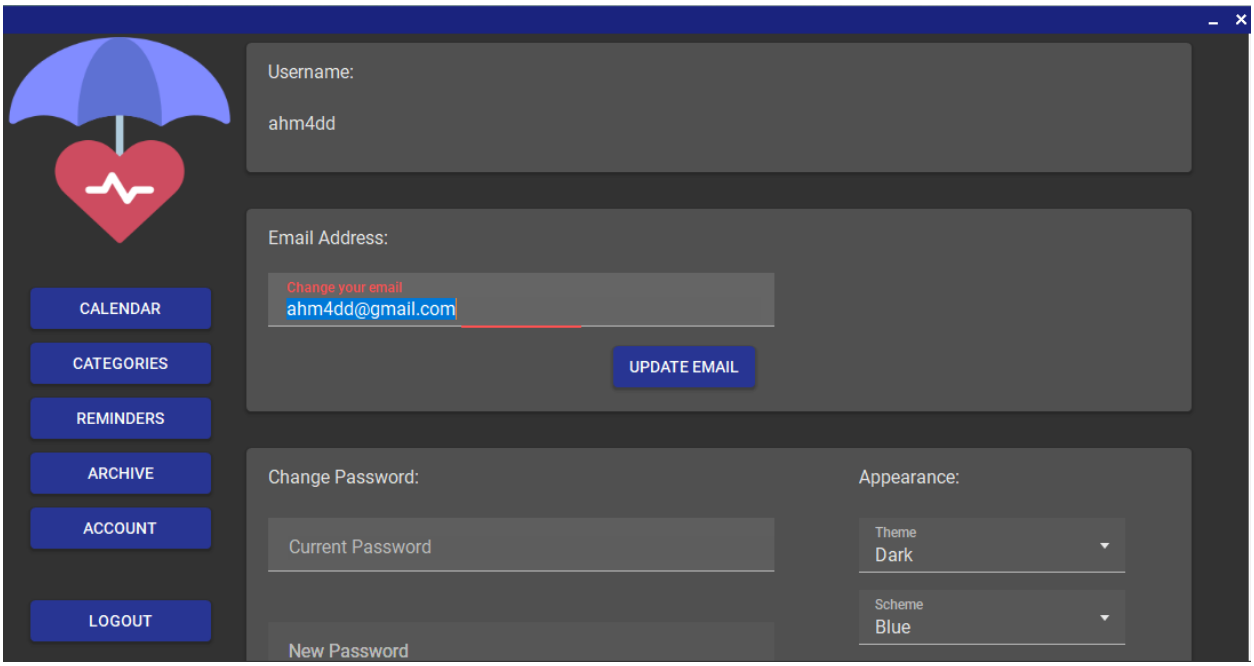
3.4. Managing Reminders (ReminderListViewForm)

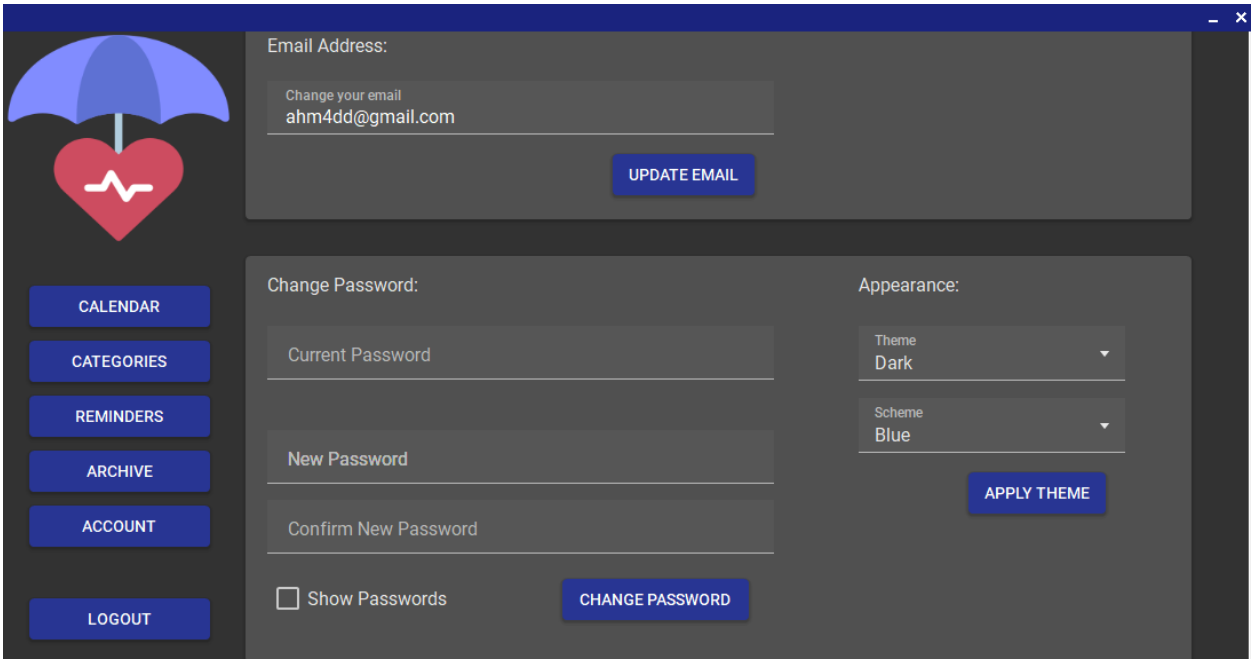


3.5. Managing Archived Events (ArchiveViewForm)

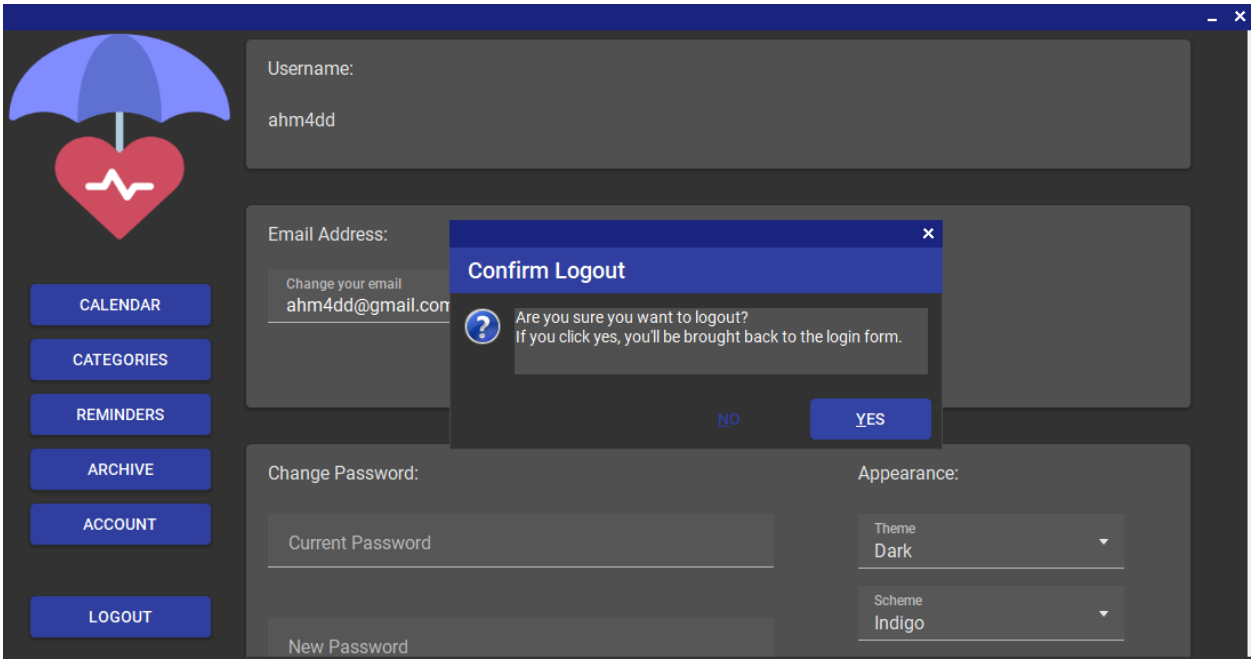


3.6. Account Settings (AccountSettingsForm)





3.7. Logging Out



Part II: Technical Documentation

1. Project Overview & Architecture

Purpose: reLIFE Scheduler is a C# WinForms desktop application for personal event management, utilizing MaterialSkin for UI theming and ADO.NET for direct SQL Server database interaction.

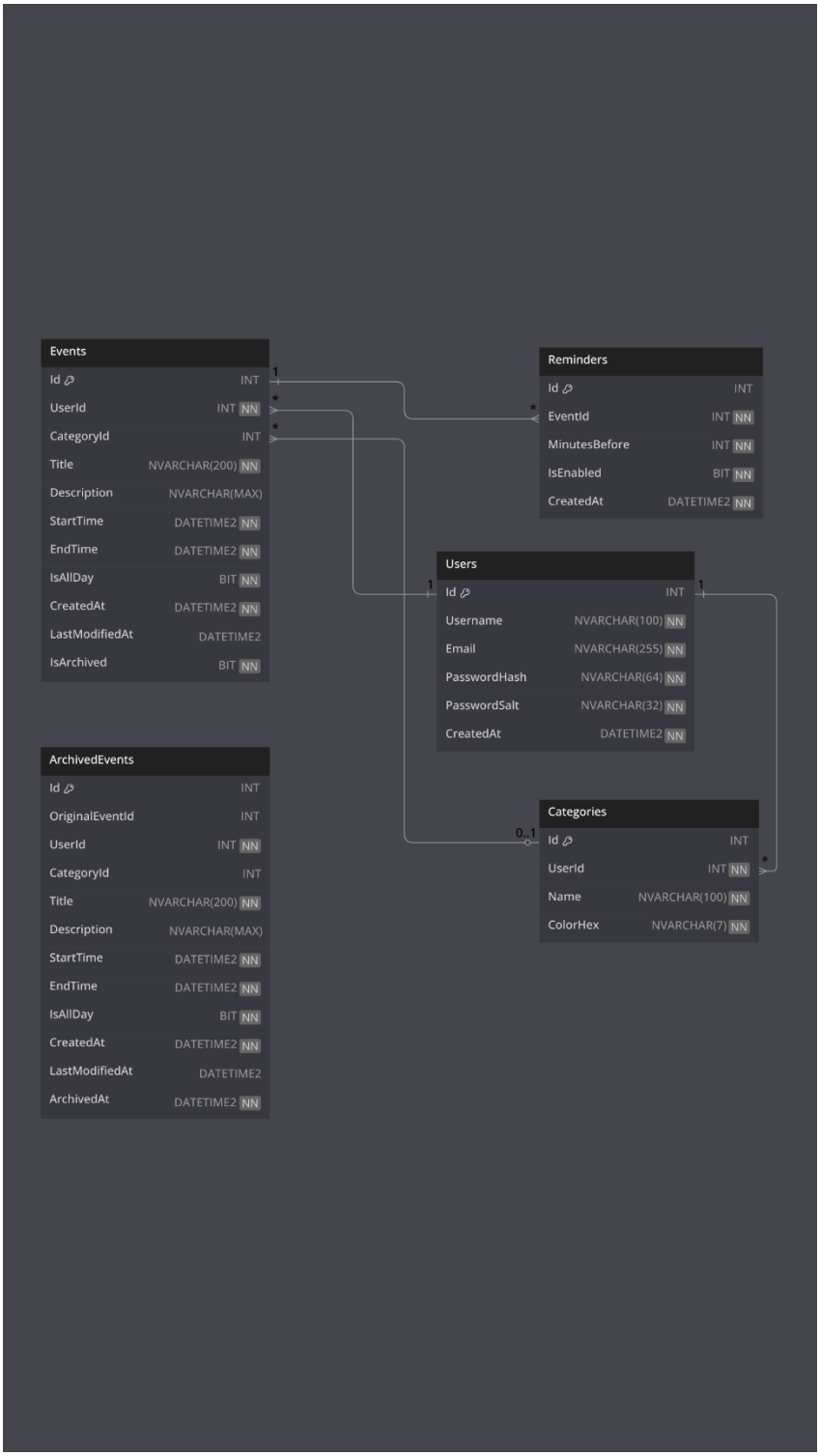
Architecture (Layered):
The application follows a layered architecture:

1. **Presentation (reLIFE.WinFormsUI):** Handles user interface (Forms like MainForm, CalendarViewForm, EventForm) and user input.
2. **Business Logic (reLIFE.BusinessLogic):** Contains services (EventService, AuthService, etc.) that implement application rules and coordinate data operations. Repositories (EventRepository, etc.) within this layer execute SQL queries.
3. **Core (reLIFE.Core):** Defines data models (User, Event, Category, etc.) as simple C# classes.

4. **Database (SQL Server):** Persistent storage of all application data.

2. Database Design

2.1. Enhanced Entity Diagram (EER)



The EER diagram visually represents the tables (Users, Categories, Events, ArchivedEvents, Reminders) and their relationships, including primary and foreign keys, and cardinalities.

2.2. Table Schemas (DDL Snippets)

- **Users Table:**
- CREATE TABLE Users (
- Id INT PRIMARY KEY IDENTITY(1,1),
- Username NVARCHAR(100) NOT NULL UNIQUE,
- Email NVARCHAR(255) NOT NULL UNIQUE,
- PasswordHash NVARCHAR(64) NOT NULL,
- PasswordSalt NVARCHAR(32) NOT NULL,
- CreatedAt DATETIME2 NOT NULL DEFAULT GETDATE()
-);

- **Categories Table:**
- CREATE TABLE Categories (
- Id INT PRIMARY KEY IDENTITY(1,1),
- UserId INT NOT NULL,
- Name NVARCHAR(100) NOT NULL,
- ColorHex NVARCHAR(7) NOT NULL,
- CONSTRAINT FK_Categories_User FOREIGN KEY (UserId) REFERENCES Users(Id) ON DELETE CASCADE,
- CONSTRAINT UQ_Categories_User_Name UNIQUE (UserId, Name)
-);
- CREATE INDEX IX_Categories_UserId ON Categories(UserId);

- **Events Table:**

- CREATE TABLE Events (
- Id INT PRIMARY KEY IDENTITY(1,1),
- UserId INT NOT NULL,
- CategoryId INT NULL,
- Title NVARCHAR(200) NOT NULL,
- Description NVARCHAR(MAX) NULL,
- StartTime DATETIME2 NOT NULL,
- EndTime DATETIME2 NOT NULL,
- IsAllDay BIT NOT NULL DEFAULT 0,
- IsArchived BIT NOT NULL DEFAULT 0,
- CreatedAt DATETIME2 NOT NULL DEFAULT GETDATE(),
- LastModifiedAt DATETIME2 NULL,
- CONSTRAINT FK_Events_User FOREIGN KEY (UserId) REFERENCES Users(Id) ON DELETE CASCADE,
- CONSTRAINT FK_Events_Category FOREIGN KEY (CategoryId) REFERENCES Categories(Id) ON DELETE SET NULL
-);
- CREATE INDEX IX_Events_UserId_StartTime ON Events(UserId, StartTime);

- **ArchivedEvents Table:**
- CREATE TABLE ArchivedEvents (
- Id INT PRIMARY KEY, -- Original Event.Id
- UserId INT NOT NULL,
- CategoryId INT NULL,
- Title NVARCHAR(200) NOT NULL,
- Description NVARCHAR(MAX) NULL,
- StartTime DATETIME2 NOT NULL,

- EndTime DATETIME2 NOT NULL,
- IsAllDay BIT NOT NULL DEFAULT 0,
- CreatedAt DATETIME2 NOT NULL, -- Original creation
- LastModifiedAt DATETIME2 NULL, -- Original modification
- ArchivedAt DATETIME2 NOT NULL DEFAULT GETDATE()
-);
- CREATE INDEX IX_ArchivedEvents_UserId ON ArchivedEvents(UserId);
- CREATE INDEX IX_ArchivedEvents_ArchivedAt ON ArchivedEvents(ArchivedAt);

- **Reminders Table:**
- CREATE TABLE Reminders (
- Id INT PRIMARY KEY IDENTITY(1,1),
- EventId INT NOT NULL,
- MinutesBefore INT NOT NULL,
- IsEnabled BIT NOT NULL DEFAULT 1,
- CreatedAt DATETIME2 NOT NULL DEFAULT GETDATE(),
- CONSTRAINT FK_Reminders_Event FOREIGN KEY (EventId) REFERENCES Events(Id) ON DELETE CASCADE
-);
- CREATE INDEX IX_Reminders_EventId ON Reminders(EventId);

2.3. Key Relationships & Integrity:
Referential integrity is maintained via foreign keys. ON DELETE CASCADE (e.g., Users to Events) and ON DELETE SET NULL (e.g., Events to Categories) are used. Indexes on primary keys, foreign keys, and frequently searched columns optimize query performance.

2.4. Database Interaction (ADO.NET):
The application uses ADO.NET (Microsoft.Data.SqlClient) for direct SQL Server

interaction. Repositories build and execute parameterized SQL queries. DbHelper provides the connection string.

```
    // Example: UserRepository.GetUserByUsername (Simplified)
public User? GetUserByUsername(string username)
{
  User? user = null;
  const string sql = "SELECT Id, Username, Email, PasswordHash, PasswordSalt, CreatedAt FROM Users WHERE Username = @Username;";
  using (var connection = new SqlConnection(_connectionString))
  using (var command = new SqlCommand(sql, connection))
  {
    command.Parameters.AddWithValue("@Username", username);
    connection.Open();
    using (var reader = command.ExecuteReader())
    {
      if (reader.Read())
      {
        user = new User { /* Map fields from reader */
          Id = reader.GetInt32(reader.GetOrdinal("Id")),
          Username = reader.GetString(reader.GetOrdinal("Username")),
          Email = reader.GetString(reader.GetOrdinal("Email")),
          PasswordHash = reader.GetString(reader.GetOrdinal("PasswordHash")),
          PasswordSalt = reader.GetString(reader.GetOrdinal("PasswordSalt")),
          CreatedAt = reader.GetDateTime(reader.GetOrdinal("CreatedAt"))
        };
      }
    }
```

```
    }
    return user;
}
```

2.5. Security:

User passwords are not stored directly. They are hashed using SHA256 with a unique, per-user salt via the PasswordHasher class.

```
    // Conceptual: PasswordHasher.cs
public class PasswordHasher
{
    public string HashPassword(string password, out string salt)
    {
        // 1. Generate random salt bytes
        // 2. Convert password to bytes
        // 3. Combine salt and password bytes
        // 4. Compute SHA256 hash of combined bytes
        // 5. Convert salt and hash to hex strings
        // Placeholder
        salt =
Convert.ToHexString(System.Security.Cryptography.RandomNumberGenerator.GetBytes(16));
        // Simplified hashing for example:
        using var sha256 = System.Security.Cryptography.SHA256.Create();
        byte[] hashBytes =
sha256.ComputeHash(System.Text.Encoding.UTF8.GetBytes(password + salt));
        return Convert.ToHexString(hashBytes);
    }
```

```
public bool VerifyPassword(string password, string storedHash, string storedSalt)
{
    // 1. Convert storedSalt (hex) back to bytes
    // 2. Combine entered password and retrieved salt bytes
    // 3. Hash the combination using SHA256
    // 4. Compare computed hex hash with storedHash (fixed-time comparison is ideal)
    // Placeholder
    using var sha256 = System.Security.Cryptography.SHA256.Create();
    byte[] hashBytes =
sha256.ComputeHash(System.Text.Encoding.UTF8.GetBytes(password + storedSalt));
    return Convert.ToHexString(hashBytes).Equals(storedHash,
StringComparison.OrdinalIgnoreCase);
}
}
```

3. Key Workflows (Illustrative)

3.1. Adding a New Event:
User input from EventForm is passed to EventService.AddEvent. The service validates and calls EventRepository.AddEvent, which executes a parameterized INSERT INTO Events (...) OUTPUT INSERTED.Id, ... VALUES (...) SQL query. Reminders are handled separately via ReminderService.

3.2. Displaying Active Reminders (ReminderListViewForm):
ReminderListViewForm calls ReminderService.GetActiveUpcomingReminderInfos. This service method, in turn, calls ReminderRepository.GetActiveUpcomingReminderInfosForUser.

```
// In ReminderRepository.cs - GetActiveUpcomingReminderInfosForUser SQL core
```

```
public List<ReminderInfo> GetActiveUpcomingReminderInfosForUser(int userId,
DateTime? upcomingLimit = null)
{
  // ...
  string sql = @"
    SELECT r.Id AS ReminderId, r.EventId, e.Title AS EventTitle,
        e.StartTime AS EventStartTime, r.MinutesBefore, r.IsEnabled
    FROM Reminders r
    INNER JOIN Events e ON r.EventId = e.Id
    WHERE e.UserId = @UserId AND r.IsEnabled = 1 AND e.IsArchived = 0 AND
e.StartTime > GETDATE()"
    + (upcomingLimit.HasValue ? " AND DATEADD(minute, -r.MinutesBefore,
e.StartTime) <= @UpcomingLimit" : "")
    + " ORDER BY DATEADD(minute, -r.MinutesBefore, e.StartTime) ASC;";
  // ... ADO.NET execution and mapping to List<ReminderInfo> ...
  return new List<ReminderInfo>(); // Placeholder for actual return
}
```

The form then uses the ReminderInfo DTOs (which include event details from the join) to create MaterialCard displays.

4. Future Work

- Advanced recurring event features.
- Pop-up notifications for reminders.
- Search functionality.
- User settings persistence for theme and defaults.
-

Part III: References

- **Microsoft Corporation. (Date Varies). *ADO.NET Guide*.** Microsoft Docs.
  - Retrieved from: https://docs.microsoft.com/en-us/dotnet/framework/data/adonet/
  - *Purpose: Core documentation for database interaction using ADO.NET, including `SqlConnection`, `SqlCommand`, `SqlDataReader`, and parameterized queries.*
- **Microsoft Corporation. (Date Varies). *SQL Server Documentation*.** Microsoft Docs.
  - Retrieved from: https://docs.microsoft.com/en-us/sql/sql-server/
  - *Purpose: Official documentation for SQL Server features, T-SQL syntax, database design principles, and management.*
- **Ignace Maes et al. *MaterialSkin 2 for .NET*.** GitHub Repository.
  - Retrieved from: https://github.com/material-components/material-components-web-components (Note: This seems to be the web components one. You'll need to find the **correct GitHub link for the WinForms MaterialSkin 2 library you used.** A common one is by "leocb/MaterialSkin" or "IgnaceMaes/MaterialSkin" - please verify the exact one.)
  - *Purpose: The UI library providing Material Design components and theming for the Windows Forms application.*
- **Microsoft Corporation. (Date Varies). *System.Security.Cryptography Namespace*.** Microsoft Docs.
  - Retrieved from: https://docs.microsoft.com/en-us/dotnet/api/system.security.cryptography
  - *Purpose: Documentation for cryptographic services, including `SHA256` and `RandomNumberGenerator` used for password hashing and salt generation.*
- **Microsoft Corporation. (Date Varies). *JSON configuration provider in .NET*.** Microsoft Docs.
  - Retrieved from: https://docs.microsoft.com/en-us/dotnet/core/extensions/configuration-providers#json-configuration-provider
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