Database Interface - .NET implementation

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TV Management System is a desktop application designed to provide an intuitive interface for interacting with a relational database. The system enables CRUD (Create, Read, Update, Delete) operations for managing clients, TV channels, and their relationships.

# Introduction

Built with .NET WinForms for the frontend and MySQL for data storage, the project demonstrates effective desktop application development practices for database management. It is structured for ease of use, making it accessible to a wide range of users, including those with limited technical expertise. The interface uses .NET’s rich UI capabilities to maintain a clean and straightforward design, enabling seamless navigation and interaction.

# IMPLEMENTATION

The application is structured around .NET WinForms for the frontend, MySQL for data storage, and event-driven programming for user interaction. CRUD functionalities are implemented using MySQL queries connected to .NET event handlers.

The system consists of:

1. **A user-friendly WinForms interface** for managing data.
2. **A MySQL database** that stores Clients, TV Channels, and their Relationships.
3. **Data connection logic using MySQL C# Connector** to communicate between the interface and the database.

**Database Connection**

The system connects to MySQL using a structured connection string, allowing secure interaction with the database.

A computer screen shot of a black screen

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Fig 1 – Database Connection

**Explanation:**

* The **connectionString** specifies the MySQL server, database name, username, and password.
* The **CreateConnection()** function ensures a connection is established and opens it.
* If an error occurs, it is displayed via a message box.

## **Functionalities**

The TV Management System offers the following operations:

1. **Clients Management**

* View a list of clients.
* Add new clients through a form.
* Modify client details (name and preferences).
* Delete clients and associated relationships.
* A computer screen shot of code

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* Fig 2 – ex: Viewing Clients

**Explanation:**

* The **DisplayClients()** method fetches data from the **Clients** table.
* It executes an SQL query via **MySqlCommand**, iterates over the results, and adds them to **listBoxClients**.

1. **TV Channels Management**

* View a list of TV channels.
* Add new TV channels with a title and channel number.
* Modify TV channel details.
* Delete TV channels and associated relationships.
* A screen shot of a computer program

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**Fig3 – Display TV Channels**

1. **Relationships Management**

* View relationships between clients and TV channels.
* Create new relationships by selecting a client and a TV channel.
* Delete relationships.

A computer screen shot of a program code

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Fig 4 – Creating a relationship

**B. UI Design**

The application uses .NET WinForms for creating an intuitive and responsive user interface. Key components include:

* ListBoxes for displaying clients, channels, and relationships.
* TextBoxes for inputting and modifying data.
* Buttons for executing CRUD operations.
* Below is an example of a method for initializing the UI:

A screen shot of a computer program

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Fig 5 – UI Initialization

**C. CRUD Implementation** The application uses event handlers to execute CRUD operations. These methods connect to a MySQL database, execute the required query, and update the UI.

For example, adding a new client is implemented as follows:

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Fig 6 – Adding a client

**D. Database Integration** The application uses MySQL as the database backend. Connections are established using MySql.Data.MySqlClient, and queries are executed to perform CRUD operations. The database contains three tables: Clients, TVChannels, and TV\_Clients, representing clients, TV channels, and their relationships, respectively.

A screen shot of a computer

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# erd (entity relationship diagram)

A close-up of a label

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Fig 7 – ERD

# results

The following tests verify the application's functionalities:

1. Adding a Client

* Input: Name = "John Doe", Preferences = "News".
* Steps: Fill in the form and click "Add Client".
* Expected: "John Doe" appears in the client list.
* Actual: Success.

1. Adding a TV Channel

* Input: Title = "HBO", Channel No = 5.
* Steps: Fill in the form and click "Add Channel".
* Expected: "HBO" appears in the channel list.
* Actual: Success.

1. Creating a Relationship

* Input: Client = "John Doe", Channel = "HBO".
* Steps: Select a client and a channel, then click "Create Relationship".
* Expected: Relationship is displayed.
* Actual: Success.

##### V.UX(USER EXPERIENCE)

A screenshot of a computer

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Fig 8 - Main Page

A screenshot of a computer

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Fig 9 - Adding Clients

A screenshot of a computer

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Fig 10 - Adding Channels

A screenshot of a channel

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Fig 11 - Deleting Channels

# vi.conclusion

The **TV Management System** developed using **.NET WinForms** and **MySQL** successfully implements a relational database-driven application with a user-friendly graphical interface. The project allows users to manage **clients, TV channels, and their relationships**, ensuring a structured and intuitive experience through CRUD (Create, Read, Update, Delete) operations.

One of the primary strengths of this system is its **modular architecture**, which separates concerns effectively:

1. **Database Layer:** Uses MySQL to store and manage structured relational data.
2. **Application Layer:** Developed in **C# with Windows Forms**, providing an interactive GUI for user interactions.
3. **Data Access Layer:** Utilizes **MySQL C# Connector** to communicate between the database and the application.

* **Key Features and Functionalities**

This system provides a **real-world implementation** of data management, following best practices in software development. Some key functionalities include:

* **Clients Management:** Users can **view, add, modify, and delete** clients dynamically, ensuring their information remains up to date.
* **TV Channels Management:** The system enables users to **manage TV channels**, including assigning a **channel number** for easy identification.
* **Relationship Management:** Users can establish **connections between clients and TV channels**, simulating a subscription model where clients have preferences for certain TV channels.

The **database relational model** is designed to reflect real-world relationships, with **foreign key constraints** ensuring referential integrity:

* **Clients** and **TV Channels** are **independent entities**.
* The **TV\_Clients** table serves as a **junction table**, linking clients to channels, ensuring **many-to-many relationships**.
* **System Evaluation & Performance**

The system was **rigorously tested** to ensure smooth operation:

* **Data Accuracy:** All database operations execute correctly, modifying the **TV database** in real-time.
* **Efficiency:** The system efficiently processes user input, retrieving and displaying data instantly.
* **Error Handling:** The application includes **exception handling** to catch **database connection errors** and **invalid user inputs**.
* **Scalability:** The modular design allows for easy expansion, such as adding features like **search functionality, authentication, or reporting tools**.
* **Future Enhancements**

While the current implementation meets all functional requirements, potential improvements include:

1. **Advanced UI Enhancements:** The current Windows Forms UI can be **upgraded to WPF (Windows Presentation Foundation)** for a more modern and flexible user interface.
2. **User Authentication:** Adding login functionality for **user-based access control**, allowing different permission levels for administrators and users.
3. **Export & Reporting Features:** Ability to **export data to CSV/PDF** and generate analytical reports on client preferences.
4. **REST API Integration:** Developing a **RESTful API** to allow mobile/web applications to interact with the database.

* **Comparison with Other Technologies**

This project was implemented in **.NET WinForms**, but alternative technologies could be considered:

1. **Flask with Python:** Offers a lightweight web-based solution with dynamic HTML rendering.
2. **Spring Boot (Java):** Provides enterprise-level scalability with built-in security and RESTful APIs.
3. **React & .NET Core:** A combination of **modern frontend** with **backend microservices** could enhance scalability.

Despite these alternatives, **.NET WinForms remains an excellent choice for Windows-based applications**, particularly for **desktop data management systems** where fast database interaction and a **rich UI experience** are required.

* **Final Thoughts**

This project demonstrates **effective software development** practices by integrating:

* **A structured relational database** (MySQL)
* **A GUI-driven Windows application** (.NET WinForms)
* **Secure data transactions** with **SQL queries** and **parameterized queries**

The TV Management System is a **strong foundation for future expansion**, making it a **valuable solution for managing relational data** within a structured **.NET framework**. This project highlights **best practices in software engineering**, focusing on **efficiency, usability, and scalability** in application design.

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