Learning Management System (LMS)

(Pattern- Client-Server)

1. Introduction

This project implements a lightweight Learning Management System (LMS) using Python. It enables role-based access for students and instructors to register, authenticate, and interact with learning resources. The system comprises a **client-server architecture** integrating GUI components, socket-based communication, and a persistent SQLite database.

2. System Architecture

2.1 Architectural Pattern

The system follows a Client-Server Architectural Pattern, where the client application (Tkinter-based GUI) communicates with a centralized server over TCP/IP sockets. The server manages business logic, handles database operations, and ensures role-based access to system resources. This design provides modularity, central control, and the capability to handle multiple concurrent client connections using threading.

2.2 Components Overview

1. **Client Interface:** Built using Tkinter for graphical user interactions.
2. **Server Backend:** Manages client requests, authentication, and data transactions.
3. **Database Layer:** SQLite database for storing user accounts, course data, and learning resource URLs.

System Architecture and Workflow

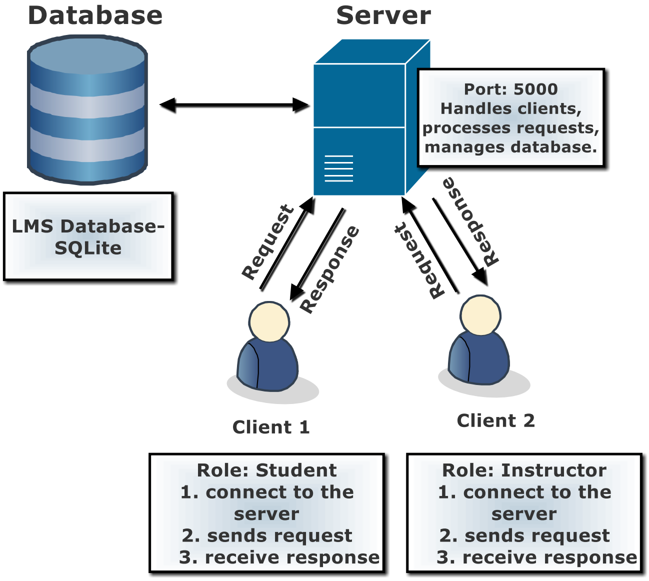
This system follows a **client-server model**. The architecture is composed of the following primary components:

- **Client Application (GUI):** A Tkinter-based desktop interface enabling users to interact with the LMS. It handles user registration, login, course selection, and displays course-specific resources.
- **Server Application:** A Python-based multi-threaded server handling client requests, managing database operations, and responding to user actions like registration, authentication, and resource queries.
- **Database (SQLite):** A lightweight relational database storing user data, course information, and associated learning resources. It serves as the backend storage engine for the server.

Technical Workflow:

1. The **User** (Student or Instructor) interacts with the **Client GUI**.
2. The **Client** establishes a socket connection with the **Server**.
3. The **Client** sends structured requests (e.g., login, registration, resource upload, or retrieval) to the **Server**.

4. The **Server** processes these requests by interacting with the **SQLite database**.
5. Processed results (success, error messages, or retrieved data) are sent back to the **Client GUI** for display.



System Architecture Diagram

4. Technologies Used

- **Python –** Core language for client and server logic.
- **Tkinter –** GUI framework for user-facing interfaces.
- **Socket –** TCP-based communication for client-server interactions.
- **Threading –** Enables concurrent handling of multiple client sessions.
- **SQLite –** Persistent, lightweight relational database for storing data.

5. Conclusion

This Learning Management System demonstrates a distributed application architecture leveraging Python's networking, GUI, and database libraries. It successfully integrates client-server communication, concurrency management, and persistent data storage to simulate a functional educational platform. The project highlights essential concepts in software engineering such as modular design, architectural pattern implementation, and data handling.