Practical No. 06

Aim: To explain the system design and architecture for an AI Stock Analyzer project using an Entity-Relationship (E-R) diagram, Data Flow Diagrams (DFDs), and a Sequence Diagram.

Problem Statement: The AI Stock Analyzer is a system designed to empower users with advanced stock market analysis and AI-driven predictions. The system must support user registration and authentication to provide a personalized experience. Users should be able to search for specific stocks, view historical price data through interactive charts, and add stocks to a personal watchlist for easy monitoring. The core functionality is to provide AI-generated predictions on a stock's future performance based on historical data and market trends. The system will interface with external financial data APIs to fetch real-time and historical stock information.

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1. E-R Diagram (Entity-Relationship Diagram)

An E-R Diagram, or Entity-Relationship Diagram, is used to analyze and model the structure of a database. It visually represents the system's main data entities, their attributes, and the relationships between them.
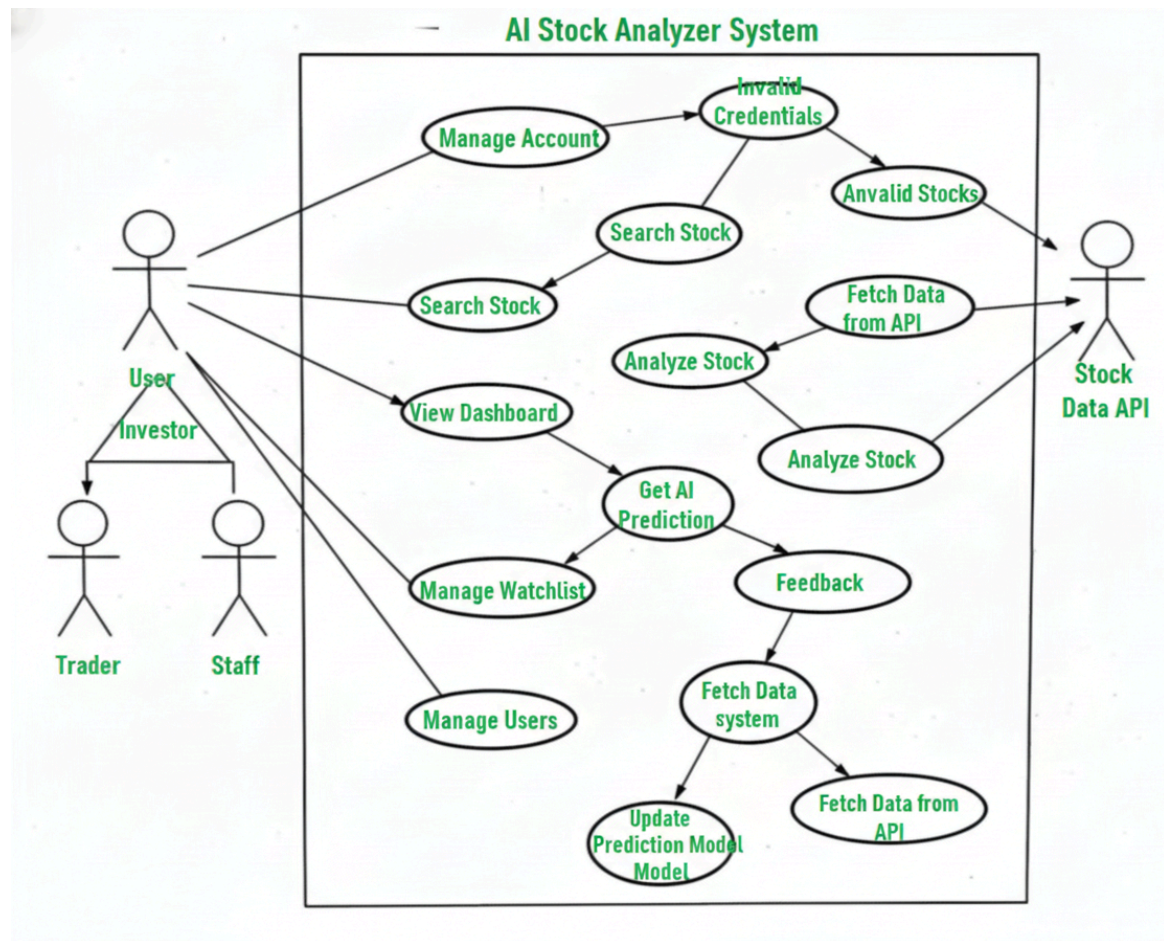
The AI Stock Analyzer database is designed to keep track of users, stocks, and analytical data with the following considerations:

- The system tracks users with a unique ID, personal details, and login credentials.
- It maintains a catalog of stocks, each identified by a unique ticker symbol.
- Users can create personalized watchlists to follow multiple stocks.
- The system stores historical time-series data (like open, close, high, low prices) for each stock.
- AI-generated predictions are stored with references to the specific stock and the date of the prediction.

Entities and their Attributes:

- **User Entity**: Represents a registered user of the system.
    - **Attributes**: `UserID` (Primary Key), `FirstName`, `LastName`, `Email`, `PasswordHash`.
- **Stock Entity**: Represents a financial stock available for analysis.
    - **Attributes**: `StockID` (Primary Key), `TickerSymbol`, `CompanyName`.
- **Watchlist Entity**: A linking entity that connects users to the stocks they are following.
    - **Attributes**: `WatchlistID` (Primary Key), `UserID` (Foreign Key), `StockID` (Foreign Key).
- **HistoricalData Entity**: Stores the daily price and volume information for a stock.
    - **Attributes**: `DataID` (Primary Key), `StockID` (Foreign Key), `Date`, `OpenPrice`, `ClosePrice`, `High`, `Low`, `Volume`.

- **Prediction Entity**: Stores the output generated by the AI model for a given stock.
  - **Attributes**: `PredictionID` (Primary Key), `StockID` (Foreign Key), `PredictionDate`, `PredictedPrice`, `ConfidenceScore`.

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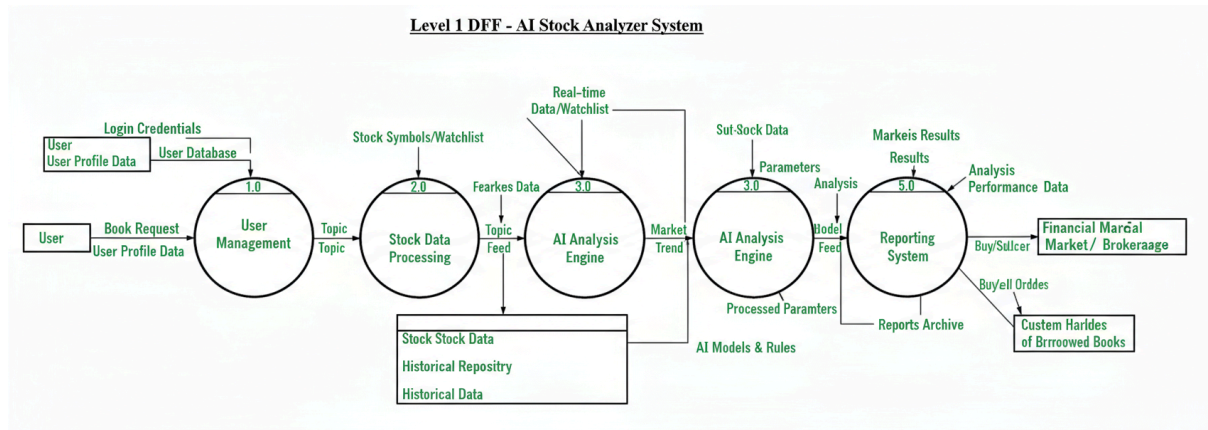## 2. Data Flow Diagram (DFD)

A Data Flow Diagram (DFD) depicts how information flows through a system. It provides a visual representation of the inputs, the processes that transform that information, and the final outputs.

- **Inputs**: The system accepts inputs like user login credentials, stock search queries, and requests to view predictions.
- **Processing**: The core processing involves authenticating users, fetching data from external stock APIs, running analysis algorithms, and generating predictions with the AI model.
- **Outputs**: The system produces outputs such as a personalized user dashboard, stock performance charts, and the display of AI-generated price predictions.
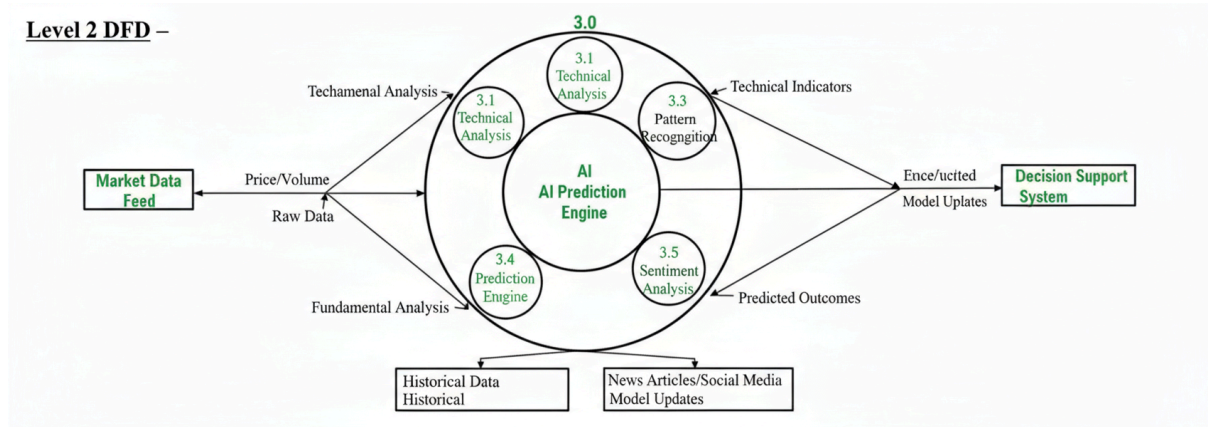
Level 0 DFD This diagram shows a high-level overview of the entire system as a single process, illustrating its interaction with external entities.

Level 1 DFD This diagram exposes more detail by breaking down the main system into its major sub-processes. It shows how data flows between these processes and interacts with data stores (databases). Key processes include:

- **User Management**: Handles registration and login.
- **Data Fetching**: Interfaces with the external API to get stock data.
- **Data Analysis & Prediction**: The core engine that processes data and runs the AI model.
- **Dashboard Presentation**: Formats and displays information to the user.

Level 1 DFF - AI Stock Analyzer System

Level 2 DFD –

3. Sequence Diagram

A Sequence Diagram details the flow of interactions between objects or components in a system over time. It is highly effective for understanding the step-by-step logic required to complete a specific task or scenario. This helps refine the system design and ensures that components collaborate correctly to achieve the desired functionality.

Conclusion

These three diagrams—the E-R Diagram, DFD, and Sequence Diagram—serve as fundamental tools in the system design and analysis of the AI Stock Analyzer. By creating these models, software engineers can thoroughly understand the problem domain, design an efficient and scalable system, and effectively communicate the architectural and functional requirements. Each diagram offers a unique and critical perspective on the system, ensuring a comprehensive and robust approach to its development