Functional and Non-functional Requirements

Q1. A national airline company aims to develop a comprehensive flight booking and management system. The system should allow customers to search for flights, compare prices, book tickets, select seats, and receive e-tickets. It should also enable users to check in online, manage their frequent flyer accounts, and receive real-time updates on flight statuses. Internally, the system must handle flight scheduling, crew assignments, maintenance logs, and comply with international aviation regulations. The platform needs to support multiple languages and currencies, be highly available, secure against cyber threats, and provide fast response times even during peak booking periods.

1. Identify two functional and two non-functional requirements from the given scenario.

Answer:

Functional Requirements

- The system must allow customers to search for flights, compare prices, book tickets, select seats, and receive e-tickets.
- The system must handle flight scheduling, crew assignments, and maintenance logs while ensuring compliance with international aviation regulations.

Non-functional Requirements

- (Accessibility) The platform needs to support multiple languages and currencies to cater to an international customer base.
- (Reliability and Security) The system must be highly available, provide fast response times even during peak booking periods, and be secure against cyber threats.

Q2. A healthcare provider network wants to implement a telemedicine platform that connects patients with doctors via video conferencing. The platform should enable patients to schedule virtual appointments, share medical records securely, receive prescriptions, and access follow-up care instructions. Doctors should be able to access patient histories, provide consultations, and update medical records. The system must ensure compliance with healthcare privacy laws (like HIPAA), offer high-quality video streaming, be accessible on various devices, and provide multilingual support. Additionally, it should be user-friendly for patients of all ages and technical abilities.

1. Identify two functional and two non-functional requirements from the given scenario.

Answer:

Functional Requirements

- The platform should enable patients to schedule virtual appointments, share medical records securely, receive prescriptions, and access follow-up care instructions.
- Doctors should be able to access patient histories, provide consultations via video conferencing, and update medical records.

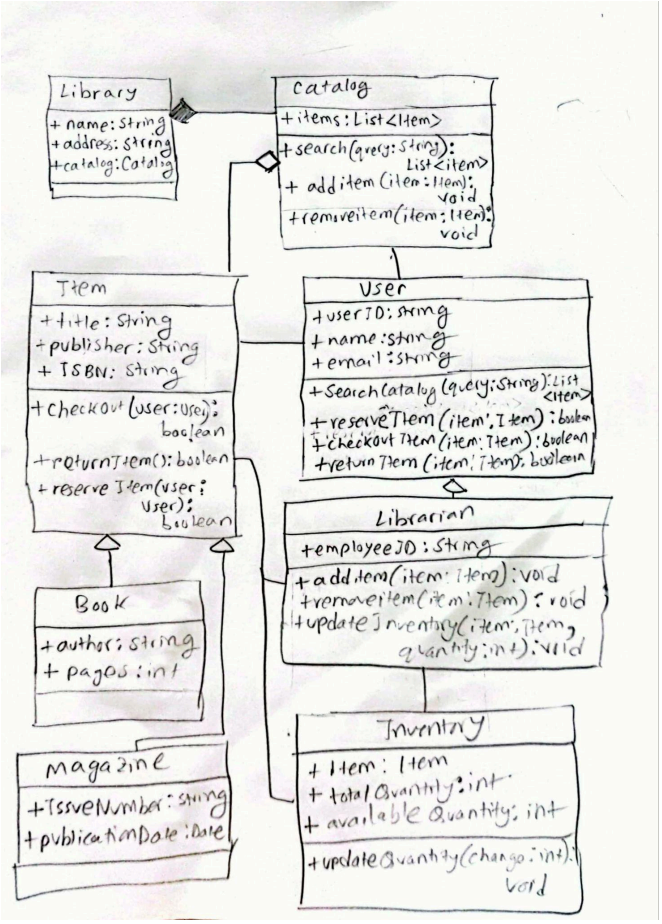
Non-functional Requirements

- (Legislative) The system must ensure compliance with healthcare privacy laws (like HIPAA).
- (Accessibility) It should be user-friendly for patients of all ages and technical abilities.

Class Diagram

Q1. Develop a class diagram for a library management system for a single library branch. The system should manage various items like books and magazines. Users can search the catalog, reserve items, and check out and return them. The system should track the inventory. Librarians can add or remove items from the catalog and update inventory.

Answer:



1. Librarians are just a special kind of user who has access to the functions of adding and removing items and updating the inventory, i.e. the librarian still has access to the normal functionality of the User.
2. Additional attributes as seemed necessary
3. The lifetime of a library's catalog is tied to the library itself, so composition
4. Catalog has a set of items, so aggregation
5. Books and magazines are specializations of the generalized item class, with which all the other classes interact (i.e. are associated with)

Software Architecture

Q1. A company is developing an application to process large amounts of data collected from weather sensors. The data must pass through multiple steps: cleaning, analysis, and report generation. Each step is independent and transforms the data before passing it to the next step. The company wants a design that clearly shows each step separately and allows easy updates or changes to each processing step.

Which software architecture should the company use? Justify your choice.

Answer:

Pipe-Filter Architecture.

This architecture is chosen because it clearly separates each data-processing step into independent components, known as filters. Each filter transforms data and passes it to the next step through defined channels or pipes.

Pros and their relevance to this scenario:

- **Clear separation of concerns:** Each step (cleaning, analysis, and reporting) is independently maintained, making the system easy to understand and manage.
- **Flexibility:** It is easy to add new processing steps or modify existing ones without disrupting the entire system, which is beneficial as weather data processing methods frequently evolve.
- **Reusability:** Filters can be reused or adapted for different data processing tasks, increasing efficiency.

Cons and why they aren't issues here:

- **Potential overhead from data conversion between filters:** While typically an issue in performance-critical systems, the clear structure and independence offered by this architecture outweigh these minor inefficiencies in this scenario.
- **Complexity in synchronization:** Normally an issue when dealing with tightly coupled processes; however, in this case, each step is independent, making synchronization relatively straightforward and manageable.

Q2. A banking company wants to develop a new online banking application. The application needs to provide a user-friendly interface, handle complex business logic for transactions and account management, securely store customer data, manage interactions with the database, and ensure robust security measures. The company emphasizes that each aspect of the system (user interface, business logic, security, data storage) must be clearly separated to allow independent development and easier maintenance.

Apply your chosen software architecture to this scenario using an Architecture Diagram.

Answer:

Layered Architecture:

- Presentation Layer: Handles the user interface and user interactions.
- Business Logic Layer: Manages transactions, account management, and business rules.
- Security Layer: Manages authentication, authorization, encryption, and security checks.
- Persistence Layer: Handles storage and retrieval of customer data.
- Database Layer: Directly interacts with the database.