Film Equipment Management System

1. Problem Statement

Description

In video production studios, managing a wide range of equipment such as cameras, microphones, lighting gear and other accessories is a come task that needs to be addressed. Th challenge lies in efficiently managing inventory, issuing equipment to users, tracking due dates, and applying late fees on overdue returns. Many studios rely on manual systems which are prone to errors.

Relevance

Efficient equipment management is crucial in many ways. Working in a studio, I have personally experienced some of the following issues. Firstly, the availability of correct equipment largely impacts the productivity and scheduling of production. Delays in equipment availability lead to costly production delays. Secondly, equipment is expensive and a significant investment for studios. Loss, damage or inefficient utilization of equipment can lead to financial losses. Lastly, keeping track of who has borrowed what equipment and when, is vital for maintaining operational discipline and accountability among users and staff.

Challenges

- Inventory visibility and control: provide real-time insight into equipment inventory, avoiding underutilized or overbooked equipment.
- User management: provide different access to different types of users, ensuring each user has the appropriate permissions and responsibilities.
- Automated tracking and notifications: system to track due dates for equipment and notify users accordingly, preventing overdue situations.
- Damage and loss management: provide a systematic approach to assessing and determining the fines associated with damage or lost equipment.
- Scalability: with an automated system, having inventory and number of users grow will be less cumbersome as there will be no need for manual management.

2. System Features

Functional Requirements

- Equipment catalogue with search functionality.
    - Keeps track of all equipment with their specifications and rental cost.
    - Enables users to quickly find specific equipment.
- User accounts with role-based access.

    - Clerks can issue and receive equipment, update equipment status, and manage late fees.
    - Members can browse the catalogue and request equipment loans
- Equipment borrowing and returning.
    - Automated check-in and out processes that record time and date of loans and returns.
- Automated notifications for overdue equipment.
    - A system that alerts users via email or SMS when the due date for borrowed equipment is approaching or being exceeded.
    - Updates to equipment status.

Non-Functional Requirements

- Usability
    - Intuitive user interfaces specific to different user roles.
    - Accommodate various devices.
- Scalability
    - Efficiently handle an increase in equipment items, number of users and transaction volume.
    - Ability to easily add features like new types of equipment or more user roles.
- Security
    - Secure handling of user data with role-based access to prevent any unauthorized access to certain functions.
- Performance
    - Quick response times for search and check-out functionalities with reliable data retrieval and updates.
- Reliability
    - High availability with minimal downtime and backups to prevent data loss.
- Maintainability
    - System design that allows for easy maintenance and updates with features to detect and address issues quickly.

3. Design Approach

Overview

- I aim to use encapsulation to ensure that data integrity is maintained, and the system remains robust against misuse. I hope to do this by encapsulating the internal state of objects from access and modification by external classes that haven't gone through a method.
- Inheritance will be used to promote code reusability and logical hierarchy. Equipment class will define properties and methods common to all types of equipment such as IDs, status, and maintenance checks. Specific types of equipment like Camera or Microphone will inherit from Equipment and add attributes or behaviours specific to each type.

- I will attempt to use polymorphism to handle equipment related processes such as calculating depreciation or scheduling maintenance. Implemented by overriding methods in subclasses allowing objects to be managed through base class references while behaviours are determined by their actual classes.

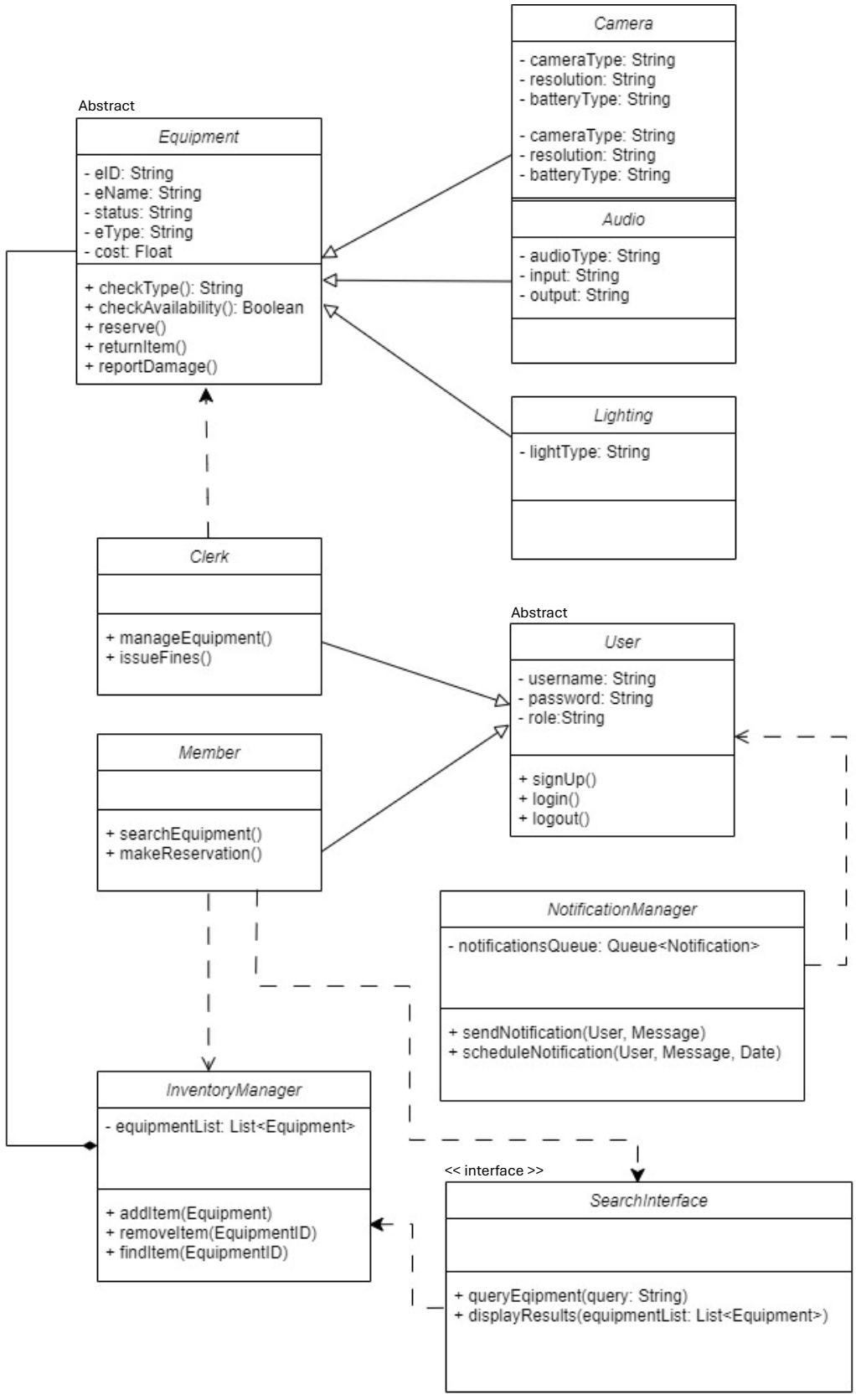
Structure

- I would like to use modular design to divide the system into modules like User Management, Equipment handling, Notification Systems, Admin Tools, etc. Each module will have specific functionalities, reducing dependence and making the system easy to maintain and scale.
- Using interfaces and abstract classes, I'm going to try and enforce a standard for similar behaviours using classes to define them.

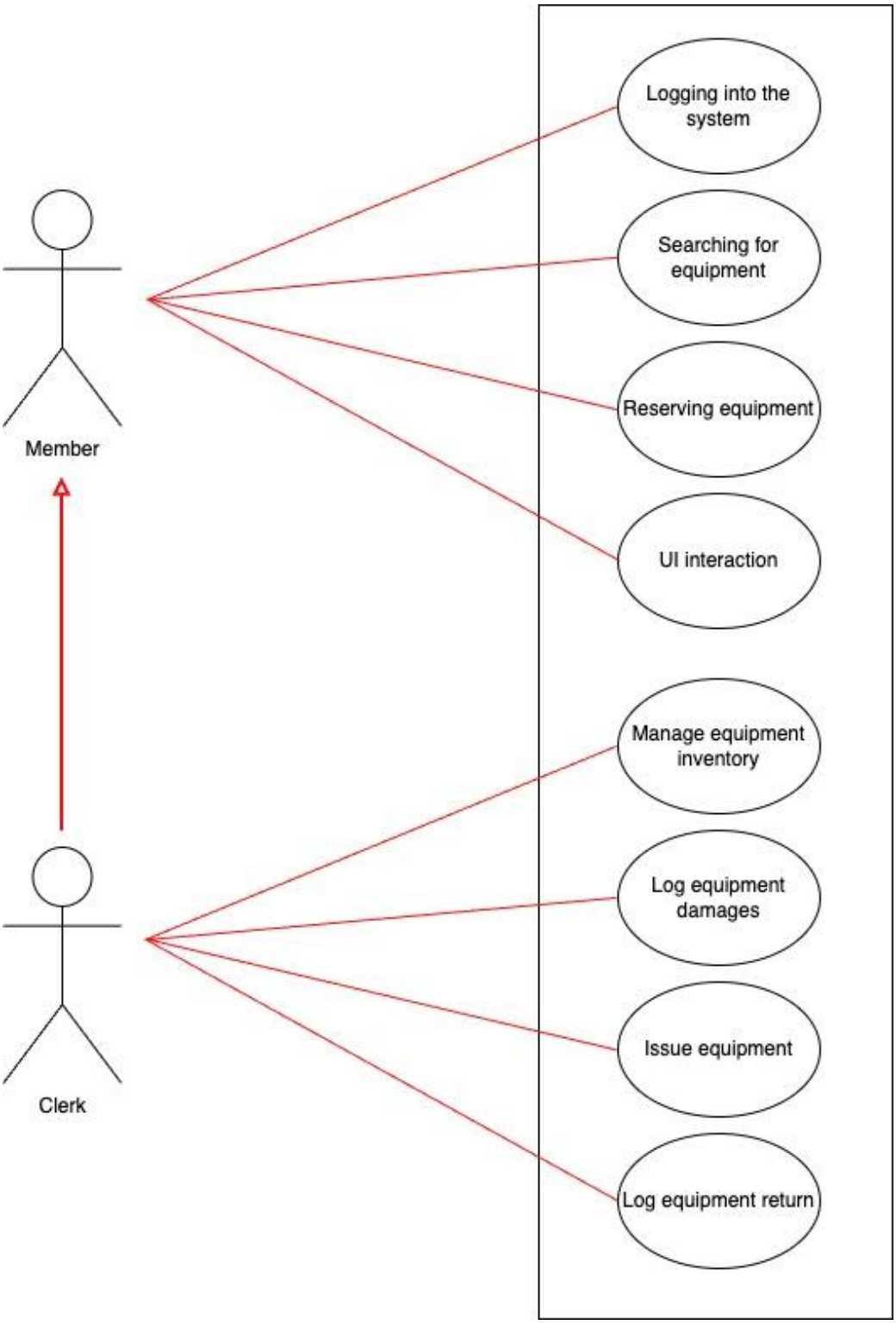
Key Classes

- Equipment
    - Base class that will be extended by specific equipment types, adding special attributes or overriding behaviours where applicable.
    - Includes methods to check availability, reserve equipment, return items and report damages.
- User
    - Base class for Clerk and Member subclasses
    - Includes methods to log in and out and update profiles. Clerk would have methods to manage equipment and issue fines. Member would have methods to search equipment and make reservations.
- InventoryManager
    - Manager between equipment and users, taking care of the logistics of equipment reservations, issuances, and returns.
    - Includes methods to add, remove, find, check in and out items.
- NotificationManager
    - Manages all communications to users about due dates, overdue items and any other alerts.
    - Includes methods to schedule, send and cancel notifications.
- Search Interface
    - Interface for users to search for equipment that displays results
    - Includes methods to search through the equipment and display the results

4. Initial UML Class Diagram

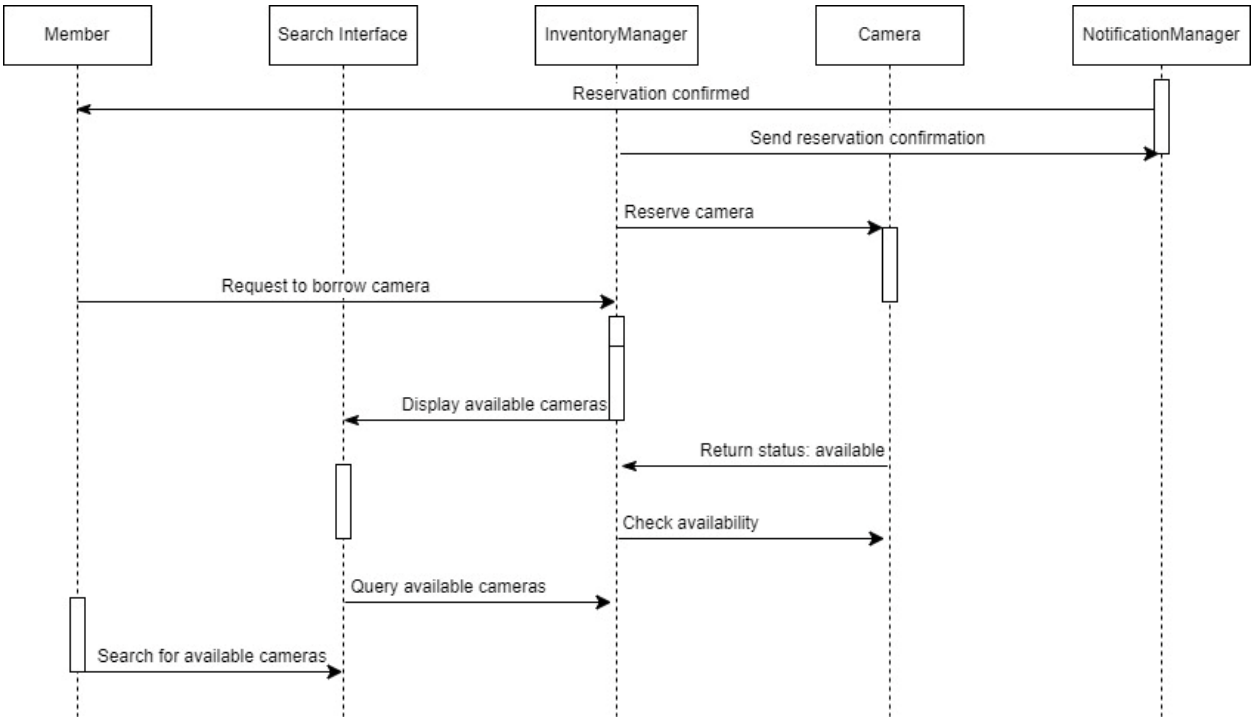


5. Use Case Diagram



6. Sequence Diagram

Equipment borrowing process:



7. Requirements Gathering

Through working in field that is extremely connected with this kind of system I was able to observe and informally interview coworkers. These are some of the things that stood out:

- Common challenges
  - Current system is manual leading to frequent error in tracking.
  - Sometimes equipment isn't returned on time and there's no quick/ automatic way to notify the member.
- Desired features
  - Real-time inventory updates, automated notifications, easy-to-use search function with filters.
- Improvements on tracking usage
  - Users would like an automated systems rather than the spreadsheets and paper forms they currently use.
- Equipment damage and loss handling:
  - System to log the condition of the equipment when it is issued and returned and calculates fines accordingly.
- Interface:
  - Users would like to see a clean, organised interface with access to main functions from the dashboard.

- They would like to see the specifications of the equipment and what the rental includes.
- Simple enough for users of all ages to use with ease.