

Movie Theater Ticketing Project

Software Requirements Specification

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Group 9

Kristine Alba, Amy Bernal Chavarria, Danna Bundogji

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| 9/20/2025 | Added Purpose and Scope | Kristine Alba | First revision |
| 9/21/2025 | Expanded Definitions and References | Kristine Alba | Added technical details |
| 9/22/2025 | Completed General Description section | Danna Bundogji | Wrote system overview |
| 9/23/2025 | Refined Scope, added Assumptions | Amy Bernal C | Improved clarity |
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| 9/25/2025 | Reviewed and edited grammar, formatting | All members | Polished version for submission |

Document Approval

The following Software Requirements Specification has been accepted and approved by the following:

| Signature | Printed Name | Title | Date |
|-----------|----------------|--------------------|------|
| | Dr. Gus Hanna | Instructor, CS 250 | |
| | Kristine Alba | Software Eng. | |
| | Danna Bundogji | Software Eng. | |
| | Amy Bernal C | Software Eng. | |

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1. Introduction

1.1 Purpose

The purpose of this Software Requirements Specification is to define the functional and nonfunctional requirements of the Movie Ticketing System. This document is primarily intended for the software development team, quality assurance engineers and project managers to design, implement and test the system. Secondary audiences will include managers and administrators who need to understand the system's capabilities for operational purposes.

1.2 Scope

The system product is the Movie Ticketing System (MTS), a browser-based ticketing platform supporting both online customers (website) and in-person customers via digital kiosks and boxoffice terminals. It will manage movie listings, showtimes, seat reservations, ticket sales, discounts, membership handling, feedback collection, and administrative operations for a San Diego theater chain (20 theaters). The initial release focuses on core ticketing features; some features (nearby-theater search, extensive third-party integrations) are deferred to future iterations.

The MTS will improve speed, scalability, and of ticket sales. Goals include providing a secure and user friendly browser-based platform accessible in English and Spanish, support up to 650 concurrent users and prevent scalping through unique NFT-style tickets, deliver consistent pricing, localized currency display, and enforce transaction rules (20-ticket max, 2-week advance window), and reduce downtime and errors found in the legacy system.

1.3 Definitions, Acronyms, and Abbreviations

| | |
|--------------------------------|--------------------------------------------------------------|
| SRS | Software Requirements Specification |
| UI | User Interface |
| DBMS | Database Management System |
| Admin | Authorized staff user with elevated privileges |
| Regular Seat / Regular Theater | General admission theater (150 seats) |
| Deluxe Seat / Deluxe Theater | Reserved seating theater (75 seats) |
| NFT Ticket | Non-fungible token representation ensuring ticket uniqueness |

1.4 References

- IEEE Std 830-1998, "IEEE Recommended Practice for Software Requirements Specifications," IEEE, 1998.
- PCI Security Standards Council, "PCI Data Security Standard (PCI DSS) Documentation," (payment security).

- Perforce Software, “How to Write a Software Requirements Specification (SRS) Document,”
<https://www.perforce.com/blog/alm/how-write-software-requirements-specification-srsdocument>
- Relevant Software, “Software Requirements Specification: What It Is, How to Write It,”
<https://relevant.software/blog/software-requirements-specification-srs-document/>
- draw.io (diagrams.net), UML Class Diagrams for MTMS.

1.5 Overview

The remaining sections of this document provide a detailed description of the Movie Theater Ticketing System requirements. Section 2 gives a general description of the product including its functions, user characteristics, constraints, and assumptions. Section 3 specifies the detailed functional and non-functional requirements, including interface requirements, business rules, and use cases. Section 4 presents analysis models such as sequence diagrams, data flow diagrams, and state transition diagrams. Section 5 describes the change management process for handling modifications to this SRS.

2. General Description

2.1 Product Perspective

The Movie Ticketing System (MTS) is designed as a replacement for the legacy ticketing software used by the San Diego theater chain. It will be a browser-based platform that supports access through customer websites, mobile browsers, kiosks, and box office terminals. The system will operate independently but connect with external services such as payment gateways, email and SMS notifications, and blockchain infrastructure for NFT-based ticket verification. Its role is to unify online and in-person ticket sales, provide real-time seat management, and deliver a secure, reliable experience for both customers and theater staff.

2.2 Product Functions

The system will allow administrators to manage movie listings, schedules, and pricing across theaters. Customers will be able to browse movies, select seats, reserve tickets, and complete secure payments online or in person. The system will issue digital tickets, either as QR codes or NFT-based tokens, and support validation at the theater. It will also enforce transaction rules, such as ticket limits and advance booking windows. Additional functions include membership management, application of discounts, collection of customer feedback, and generation of sales and occupancy reports for managers.

2.3 User Characteristics

The system will serve three main groups of users. Customers will include the general public, with varying levels of technical knowledge, and will require simple, multilingual interfaces in English and Spanish. Theater staff, such as cashiers and ushers, will use the system for ticket sales, refunds, and validation, and will need fast and reliable performance during busy times. Administrators and managers will be technically skilled users responsible for theater setup,

monitoring, and reporting. Accessibility features will be included to support users with vision or hearing impairments.

2.4 General Constraints

The system must support high performance, handling millions of users during peak demand. All communications will be secured with HTTPS, and the system must comply with PCI-DSS standards for payment data. It should scale easily to support multiple theaters at once and run on modern web browsers, kiosks, and scanning hardware. Interfaces must be available in English and Spanish. Legal and regulatory compliance, such as GDPR and U.S. consumer protection standards, must also be ensured.

2.5 Assumptions and Dependencies

The system assumes the theater chain will provide reliable internet connections, kiosk hardware, and scanning devices. A third-party payment processor is expected to always be available and functional. Online access is required for customers, as offline ticketing is not included in the initial release. The NFT ticket feature depends on blockchain services and stable transaction costs. Currency conversion will depend on external APIs, and future integrations with digital wallets or third-party apps will require cooperation from those platforms.

3. Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

Costumer UI

Input: Costumers select movies, showtimes and seats.

Output: System displays available seats, prices and booking confirmation. Requires for updates to appear within 3 seconds of user action.

Management Dashboard

Input: Managers enter or edit movie schedules, seat availability and pricing.

Output: Dashboard confirms updates and syncs with costumer's UI.
Requires for the changes to be reflected on all interfaces within 10 seconds.

3.1.2 Hardware Interfaces

Scanners:

Input: Scans tickets barcodes or QR codes.

Output: System validates tickets.

Requires for the validation to occur within 1 second.

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Self Service Kiosks

Input: Customers are able to select movies, showtimes, seats and payment method.

Output: Printed ticket or digital QR code sent to email. Requires completing transaction under 3 minutes.

Ticket Printers

Input: Customer touch selections for movie, showtime, seats and payment methods.

Output: Physical paper ticket printed for customer.

Requires the transaction to be completed within 5 seconds.

3.1.3 Software Interfaces

Input: Store movie schedules, ticket reservations, users accounts and payment records.

Output: Real time data.

Requires supporting concurrent access from at least 650 users without delay.

3.1.4 Communications Interfaces

Email and SMS Notifications.

Input: Confirmation message including ticket, movie info and purchase details.

Output: Delivery to customer email or phone number. Requires messages to be sent within 3 minutes of purchase.

3.2 Functional Requirements

The system must provide customers with the ability to browse movies, select seats, purchase tickets and receive confirmations while also giving administrators tools to manage schedules, customer support and sales.

3.2.1 Concurrency & Scalability

3.2.1.1 Introduction

The system must support high volumes of concurrent users.

3.2.1.2 Inputs

Multiple simultaneous requests from online and kiosk users.

3.2.1.3 Processing

Load balancing, horizontal scaling, and caching.

3.2.1.4 Outputs

Stable service availability under heavy load.

3.2.1.5 Error Handling

If limits are exceeded, queuing system activates.

3.2.2 Platform Accessibility

3.2.2.1 Introduction

The system must be browser-based and synchronized.

3.2.2.2 Inputs

User login or guest access via browser or kiosk

3.2.2.3 Processing

Retrieve current showtimes and seating from central DBMS.

3.2.2.4 Outputs

Unified, up-to-date UI across web and kiosks.

3.2.2.5 Error Handling

Display connection error if database unavailable.

3.2.3 Anti-Bot/Anti-Scalping

3.2.3.1 Introduction

Prevent automated ticket scalping.

3.2.3.2 Inputs

Ticket purchase attempts.

3.2.3.3 Processing

CAPTCHA, device fingerprinting, anomaly detection.

3.2.3.4 Outputs

Valid transactions only from verified users.

3.2.3.5 Error Handling

Block suspicious transactions, alert admin.

3.2.4 Ticketing Rules

3.2.4.1 Introduction

Ticket limits and purchase windows.

3.2.4.2 Inputs

User selects number of tickets, and showtime

3.2.4.3 Processing

Validate against rules (≤ 20 tickets, within 14 days, before +10 minutes of showtime).

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3.2.4.4 Outputs

Approved or rejected ticket request.

3.2.4.5 Error Handling

Show clear error message for rule violations.

3.2.5 Account and Session Management

3.2.5.1 Introduction

Support optional accounts and enforce single session.

3.2.5.2 Inputs

User login credentials.

3.2.5.3 Processing

Authenticate and verify concurrent sessions.

3.2.5.4 Outputs

Account dashboard with loyalty, history, and payment info.

3.2.5.5 Error Handling

Notify user if account is already logged in elsewhere.

3.2.6 Payment and Currency

3.2.6.1 Introduction

Handle ticket payments and pricing.

3.2.6.2 Inputs

Credit card, PayPal, or Bitcoin payment info.

3.2.6.3 Processing

Validate payment, convert currency if needed.

3.2.6.4 Outputs

Transaction confirmation.

3.2.6.5 Error Handling

Reject invalid or declined payments.

3.2.7 Ticket Delivery

3.2.7.1 Introduction

Deliver secure, unique tickets.

3.2.7.2 Inputs

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Purchase confirmation.

3.2.7.3 Processing

Generate NFT/unique token, attach to QR code.

3.2.7.4 Outputs

E-ticket emailed or printed physical ticket.

3.2.7.5 Error Handling

Retry delivery or notify user of failure.

3.2.8 Feedback System

3.2.8.1 Introduction

Collect quick customer feedback.

3.2.8.2 Inputs

User selection of smiley face or rating

3.2.8.3 Processing

Store feedback linked to transaction.

3.2.8.4 Outputs Confirmation message.

3.2.8.5 Error Handling

If feedback storage fails, discard without blocking purchase flow.

3.2.9 Discounts

3.2.9.1 Introduction

Apply eligible discounts.

3.2.9.2 Inputs

Discount selection (student, veteran/military, senior, child).

3.2.9.3 Processing

Verify eligibility and applying pricing rules.

3.2.9.4 Outputs

Adjusted ticket price.

3.2.9.5 Error Handling

Show error if discount conditions not met.

3.2.10 Loyalty Accounts

3.2.10.1 Introduction

Store user history and reward points.

3.2.10.2 Inputs

Registration info, transactions.

3.2.10.3 Processing

Update loyalty points and purchase history.

3.2.10.4 Outputs Loyalty dashboard.

3.2.10.5 Error Handling

Notify user of registration or update errors.

3.2.11 Administrative Functions

3.2.11.1 Introduction

Admin management of system.

3.2.11.2 Inputs

Admin login, showtime/movie data.

3.2.11.3 Processing

Add, edit, or override system records.

3.2.11.4 Outputs

Updated listings, sales reports, override logs.

3.2.11.5 Error Handling

Reject unauthorized actions and log attempts.

3.2.12 Logging & Auditing

3.2.12.1 Introduction

Maintain comprehensive daily logs for purchases, sessions, and admin actions.

3.2.12.2 Inputs

All relevant system events.

3.2.12.3 Processing

Append logs with timestamps, IDs, and metadata to secure storage.

3.2.12.4 Outputs

Searchable audit trails for compliance and debugging.

3.2.12.5 Error Handling

Failover to secondary log store and alert ops.

3.2.13 Queueing System

3.2.13.1 Introduction

Virtual waiting room to fairly handle spikes for popular showings.

3.2.13.2 Inputs

Surge of requests for a single showing.

3.2.13.3 Processing

Admit users into a queue, throttle requests, allocate tickets in order.

3.2.13.4 Outputs

Queue position and ETA shown to user.

3.2.13.5 Error Handling

Show fallback message and attempt requeue if transient error.

3.2.14 Review Integration

3.2.14.1 Introduction

Surface critic scores/quotes from external review sources when permitted.

3.2.14.2 Inputs

Movie selection; external API/scrapper responses.

3.2.14.3 Processing

Aggregate and cache scores; respect ToS and rate limits.

3.2.14.4 Outputs

Display critic scores/quotes or link to external pages.

3.2.14.5 Error Handling

Display “Reviews Unavailable” fallback and log API failures.

3.3 Use Cases

3.3.1 Purchase Ticket

Primary actor: Customer (guest or logged-in) Flow of Events:

1. Customer selects movie and showtime.

2. System displays seat map (if Deluxe) or confirms general admission availability (Regular).
3. Customer selects seats/quantity (≤ 20) and proceeds.
4. System holds selected seats for up to 5 minutes.
5. Customer enters payment info (or selected saved payment/loyalty points) and confirms.
6. System processes payment and, on success, mints unique ticket token(s), updates seat inventory, and issues e-ticket(s) (email or print).
7. System displays confirmation and prompts optional feedback. Assumptions/Entry conditions:
 1. The showtime exists and has available seats/tickets.

2. Payment gateway is reachable.
3. User is within the 14-day to 10-minute purchase window.

3.3.2 Manage Account/Loyalty

Primary actor: Registered Customer, System Flow

of Events:

1. Customer navigates to account page and logs in.
2. System authenticates user and displays account dashboard.
3. Customer views/updates personal info, payment methods, or loyalty settings; views purchase history and points.
4. System saves changes and updates loyalty balances where applicable. Assumptions/Entry conditions:
 1. Customer has an existing account (or completes registration).
 2. Authentication services are available.
 3. Single-session policy is enforced.

3.3.3 Administrative Override/Manage Showtimes

Primary actor: Administrator (staff) Flow of Events:

1. Admin logs into admin portal with elevated credentials.
2. Admin views dashboard (schedules, sales, flagged issues).
3. For showtime management: Admin adds/edits/removes movie showtimes; system validates conflicts and publishes updates.
4. For override: Admin locates order, executes permitted override (refund, reissue, release seats), and confirms action.
5. System records an audit log for every admin action Assumptions/Entry conditions:
 1. Admin credentials (and MFA if required) are valid.
 2. Admin role authorizes requested actions.
 3. Audit/logging service is operational.

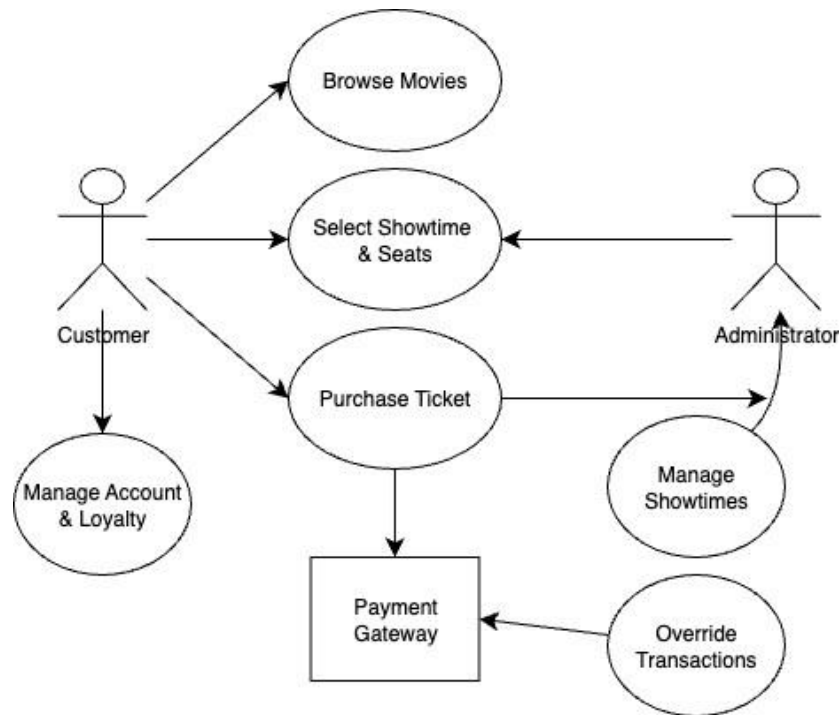


Figure 1: Movie Ticketing System Use Case Diagram

3.4 Classes / Objects

3.4.1 Movie

3.4.1.1 Attributes

- movieID: integer
- title: string
- genre: string
- duration: float
- rating: string

3.4.1.2 Functions

- getShowtimes(): retrieves all showtimes for a movie
- updateDetails(): modifies movie information
- getAverageRating(): calculates and returns average user rating

3.4.2 Showtime

3.4.2.1 Attributes

- showtimeID: integer
- movieID: integer
- theaterID: integer
- startTime: datetime
- availableSeats: integer

3.4.2.2 Functions

- reserveSeat(seatNumber): marks a seat as reserved
- cancelReservation(seatNumber): frees a reserved seat
- getRemainingSeat(): returns remaining available seats

3.4.3 Ticket

3.4.3.1 Attributes

- ticketID: string
- showtimeID: integer
- seatNumber: string
- price: decimal
- NFTToken: string

3.4.3.2 Functions

- generateQRCode(): produces a unique QR code for validation
- validateTicket(): verifies ticket authenticity at entry
- resendTicket(email): reissues a lost digital ticket

3.4.4 UserAccount

3.4.4.1 Attributes

- userID: integer
- name: string
- email: string
- passwordHash: string
- loyaltyPoints: integer

3.4.4.2 Functions

- login(email, password): authenticates user access
- redeemPoints(points): applies loyalty points to a purchase
- updateProfile(details): modifies user information

3.4.5 Payment

3.4.5.1 Attributes

- transactionID: string
- amount: decimal
- paymentMethod: string
- status: string
- timestamp: datetime

3.4.5.2 Functions

- processPayment(method, amount): handles payment through gateway

- `issueRefund(ticketID)`: processes refunds for canceled orders
- `getTransactionDetails()`: retrieves payment summary

3.5 Non-Functional Requirements

The Movie Theater Ticketing System must meet the following non-functional requirements to ensure reliability, performance and usability.

3.5.1 Performance

- The system must support up to 650 concurrent users without service degradation
- The system shall respond to 95% of all page requests within 2 seconds under normal load
- The system shall process a completed ticket purchase in ≤ 5 seconds after payment submission

3.5.2 Reliability

- The system has a mean time between failures (daMTBF) of at least 500 hours
- The system shall ensure that no more than 0.1% of transactions are lost or corrupted due to system errors

3.5.3 Availability

- The system shall provide 99.9% uptime, excluding scheduled maintenance
- The system shall automatically recover from server failure within 60 seconds using failover mechanisms

3.5.4 Security

- All communications shall use HTTPS/TLS 1.2 or higher
- Tickets shall be unique and non-replicable (NFT-backed or equivalent)
- The system shall enforce single-device login per user account
- Payment handling shall comply with PCI-DSS standards

3.5.5 Maintainability

- The system shall be modular and documented so that a new developer can resolve defects within 2 hours of investigation
- Updates shall be deployed with < 15 minutes downtime

3.5.6 Portability

- The system shall run on the latest two major versions of Chrome, Firefox, Safari, and Edge
- Kiosk terminals shall operate using standards-compliant browsers with no additional plug-ins

3.6 Inverse Requirements

*State any *useful* inverse requirements.*

3.7 Design Constraints

Specify design constraints imposed by other standards, company policies, hardware limitation, etc. that will impact this software project.

3.8 Logical Database Requirements

Will a database be used? If so, what logical requirements exist for data formats, storage capabilities, data retention, data integrity, etc.

3.9 Other Requirements

Catchall section for any additional requirements.

4. Analysis Models

List all analysis models used in developing specific requirements previously given in this SRS. Each model should include an introduction and a narrative description. Furthermore, each model should be traceable the SRS's requirements.

4.1 Sequence Diagrams

4.2 Data Flow Diagrams (DFD)

4.3 State-Transition Diagrams (STD)

5. Change Management Process

Identify and describe the process that will be used to update the SRS, as needed, when project scope or requirements change. Who can submit changes and by what means, and how will these changes be approved.

6. Software Design Specification

6.1 System Description

The Movie Theater Management System is designed to automate the management of movie showtimes, ticket booking, payment processing, and customer information. The system will provide both customers and staff an easy-to-use interface for browsing movies, purchasing tickets, and managing schedules.

6.2 Software Architecture Overview

6.2.1 Software Architecture Diagram 6.2.2 Software Architecture Description

6.3 UML Class Diagram

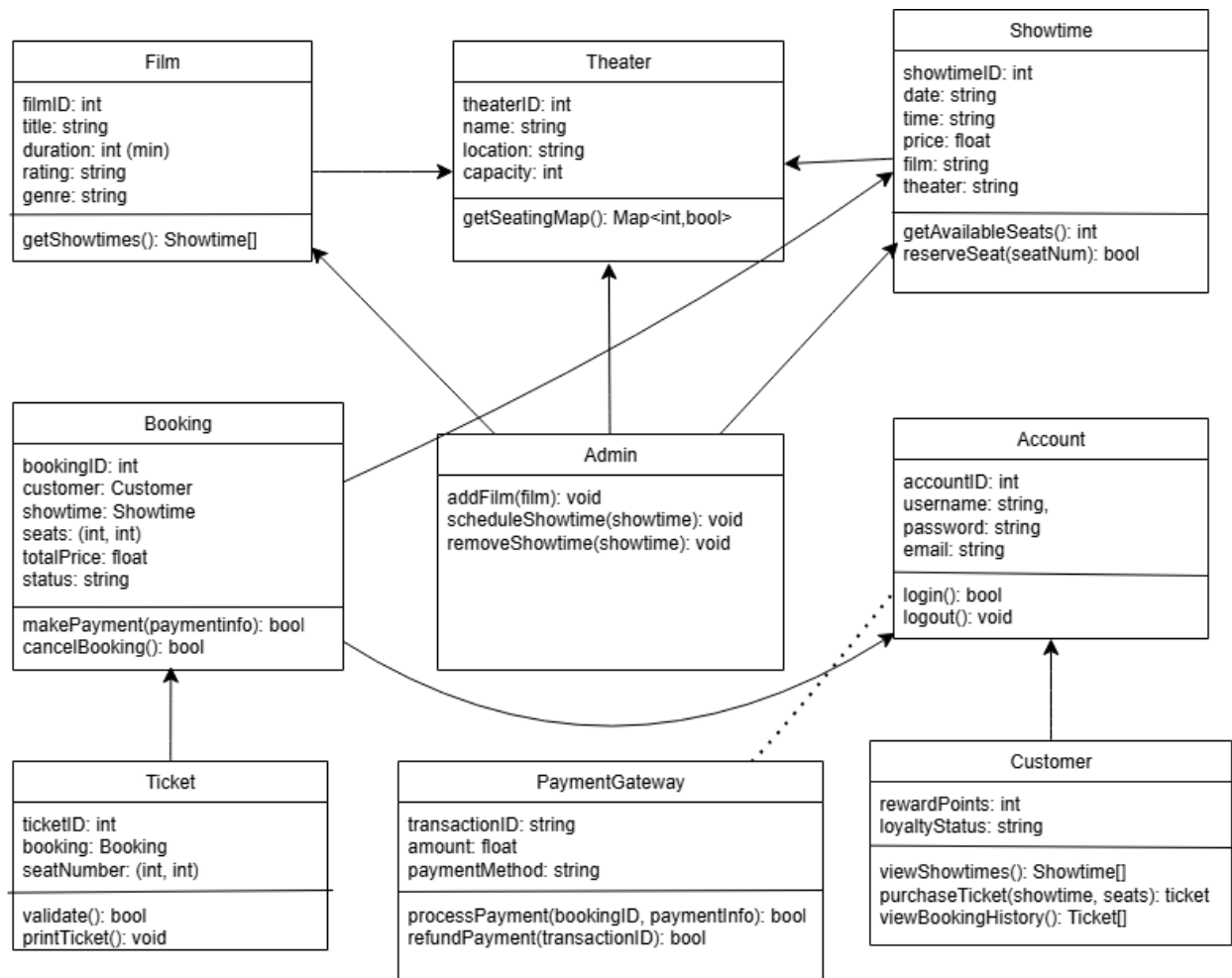


Figure 2: UML Class Diagram for Movie Theater Ticketing System

6.4 UML Class Descriptions

6.4.1 Film

This class provides info about the film selected.

6.4.1.1 Attributes

- filmID: int
- title: string
- duration: float
- rating: string
- genre: string

6.4.1.2 Operations

- getShowtimes(): Showtime[]
 - Returns available showtimes for the movie

6.4.2 Theater

This class provides info about a specific theater at different locations.

6.4.2.1 Attributes

- theaterID: int
- name: string
- location: string
- capacity: int

6.4.2.2 Operations

- getSeatingMap(): Map<int,bool>
 - o Returns seating availability for the theater

6.4.3 Showtime

This class provides info about the film's showtime including the date, time, price, and theater showing it.

6.4.3.1 Attributes

- showtime: int
- date: string
- time: string
- price: float
- film: string
- theater: string

6.4.3.2 Operations

- getAvailableSeats(): int
 - o Returns number of available seats
- reserveSeat(seatNum): bool
 - o Reserves a seat for a user

6.4.4 Booking

This class handles booking a seat with the theater including a specific ID for the booking, the customer that's booking, the showtime of the film, seats, and price.

6.4.4.1 Attributes

- bookingID: int
- customer: Customer
- showtime: Showtime
- seats: (int, int)
- totalPrice: float
- status: string

6.4.4.2 Operations

- makePayment(paymentInfo): bool

- Processes payment for the booking
- cancelBooking(): bool
 - Cancels booking and updates availability

6.5.1 Ticket

This class provides info about tickets when booking including the seat number.

6.5.1.1 Attributes

- ticketID: int
- booking: Booking
- seatNumber: (int, int)

6.5.1.2 Operations

- validate(): bool
 - Confirms ticket authenticity
- printTicket(): void
 - Prints physical or digital ticket

6.6.1 Account

This class handles the user's info such as username, password, and email to login or logout.

6.6.1.1 Attributes

- accountID: int
- username: string
- password: string
- email: string

6.6.1.2 Operations

- login(): bool
 - Authenticates user
- logout(): void
 - Ends active session

6.7.1 Customer (inherits Account)

This class holds info about the user's account such as their loyalty status and if they have reward points.

6.7.1.1 Attributes

- rewardPoints: int
- loyaltyStatus: string

6.7.1.2 Operations

- viewShowtimes(): Showtime[]
- purchaseTicket(showtime, seats): ticket
- viewBookingHistory(): Ticket[]

6.8.1 Admin (inherits Account)

This class handles changes that admins can do such as adding films, editing showtime schedules, and removing showtimes.

6.8.1.1 Operations

- addFilm(film: Movie): void
- scheduleShowtime(showtime: Showtime): void
- removeShowtime(showtime: Showtime): void

6.9.1 Payment

This class handles transactions from users such as generating a transaction ID, the amount that is due and the payment method that the user prefers. It may process a user's payment or refund their payment.

6.9.1.1 Attributes

- transactionID: string
- amount: float
- paymentMethod: string

6.9.1.2 Operations

- processPayment(bookingID, paymentInfo): bool
 - o Processes user payments
- refundPayment(transactionID): bool
 - o Issues refunds when necessary

6.5 Development Plan and Timeline

6.5.1 Task Partitioning

| Task | Description |
|-------------------------------|---------------------------------------------------------------|
| Database Design | Create relational schema for movies, users, and bookings. |
| Backend Implementation | Build server logic for booking, payment, and admin operations |
| Frontend Development | Create responsive UIs for web and kiosk users |
| Integration & APIs | Connect backend to external payment and email systems. |
| Testing & QA | Conduct functionality, integration, and load testing |

| | |
|----------------------|----------------------------------------------------------|
| Documentation | Maintain version control, documentation, and commit logs |
|----------------------|----------------------------------------------------------|

6.5.2 Team Member Responsibilities

| Team Member | Responsibilities |
|----------------|----------------------------------------------------------------|
| Amy Bernal | Backend development, database setup, payment integration |
| Danna Bundogji | Frontend development, documentation, and testing |
| Kristine Alba | Architecture design, UML modeling, integration, and deployment |

6.5.3 Project Timeline

| Week | Task | Responsible Member |
|--------|---------------------------|--------------------|
| Week 1 | Database schema and setup | Amy Bernal |
| Week 2 | UI mockups and wireframes | Danna Bundogji |
| Week 3 | Implement booking module | Kristine Alba |
| Week 4 | Integrate payment API | Amy Bernal |
| Week 5 | System testing and fixes | Danna and Kristine |

A. Appendices

Appendices may be used to provide additional (and hopefully helpful) information. If present, the SRS should explicitly state whether the information contained within an appendix is to be considered as a part of the SRS's overall set of requirements.

Example Appendices could include (initial) conceptual documents for the software project, marketing materials, minutes of meetings with the customer(s), etc.

A.1 Appendix 1

A.2 Appendix 2