Class Diagram

Book

+ Int : BK_ID
+ String : BK_Name
+ String : BK_Author
+ String : BK_Pub
+ int : BK_Price
+ int : BK_QTY

+ addBook(String : bookData): boolean
+ updateBook(String : updateddata) : boolean
+ deleteBook(int : BK_ID) : boolean
+ issueBook(int : BK_ID, int : BOR_ID) : boolean
+ renewBook(int : BK_ID, int : BOR_ID) : boolean
+ returnBook(int : BK_ID, int : BOR_ID) : boolean
+ searchBook(int : BK_ID) : Record
+ searchBook(int : BK_Name) : Record
+ showBooks() : JTable

EmailService

+ String : SMTP_HOST
+ int : SMTP_PORT
+ String : FROM_EMAIL
+ String : FROM_PASSWORD

+ sendEmail(String toEmail, String subject, String body): boolean
+ sendEmailReminder(Borrower borrower, Book book) : boolean

Librarian

+ String : Username
+ String: Email
+ String : Password
+ String : Mobile

+ login(String : Username, String : Password, String : Email, String : Moblie): boolean
+ register(String, String, String, String): boolean
+ logout() : void

AutomatedReminder

+ List<Borrower> : borrowers

+sendReminders(List<Borrowers boolean

Logger

+ String : LOG_FILE
+ String : LOG_FILE_PATH

+ logError(String message): void
+ logInfo(String message): void
+ logException(String message): void

Borrower

+ int : BOR_ID
+ String : BOR_Name
+ String : BOR_Address
+ String : BOR_Email
+ Int : BOR_Contact
+ int : BK_Borrowed
+ int : Fine_amt

+ addBorrower(String : borrowerData): boolean
+ updateBorrower(String : updateddata) : boolean
+ deleteBorrower(int : BOR_ID) : boolean
+ searchBorrower(int : BOR_ID) : Record
+ showBorrowers() : JTable

PDFGenerator

+ String : PDF_FILE
+ String : PDF_FILE_PATH

+ generatePDF(List<Book> books): void
+ sendEmailReminder(List<Borrower> borrowers) : void
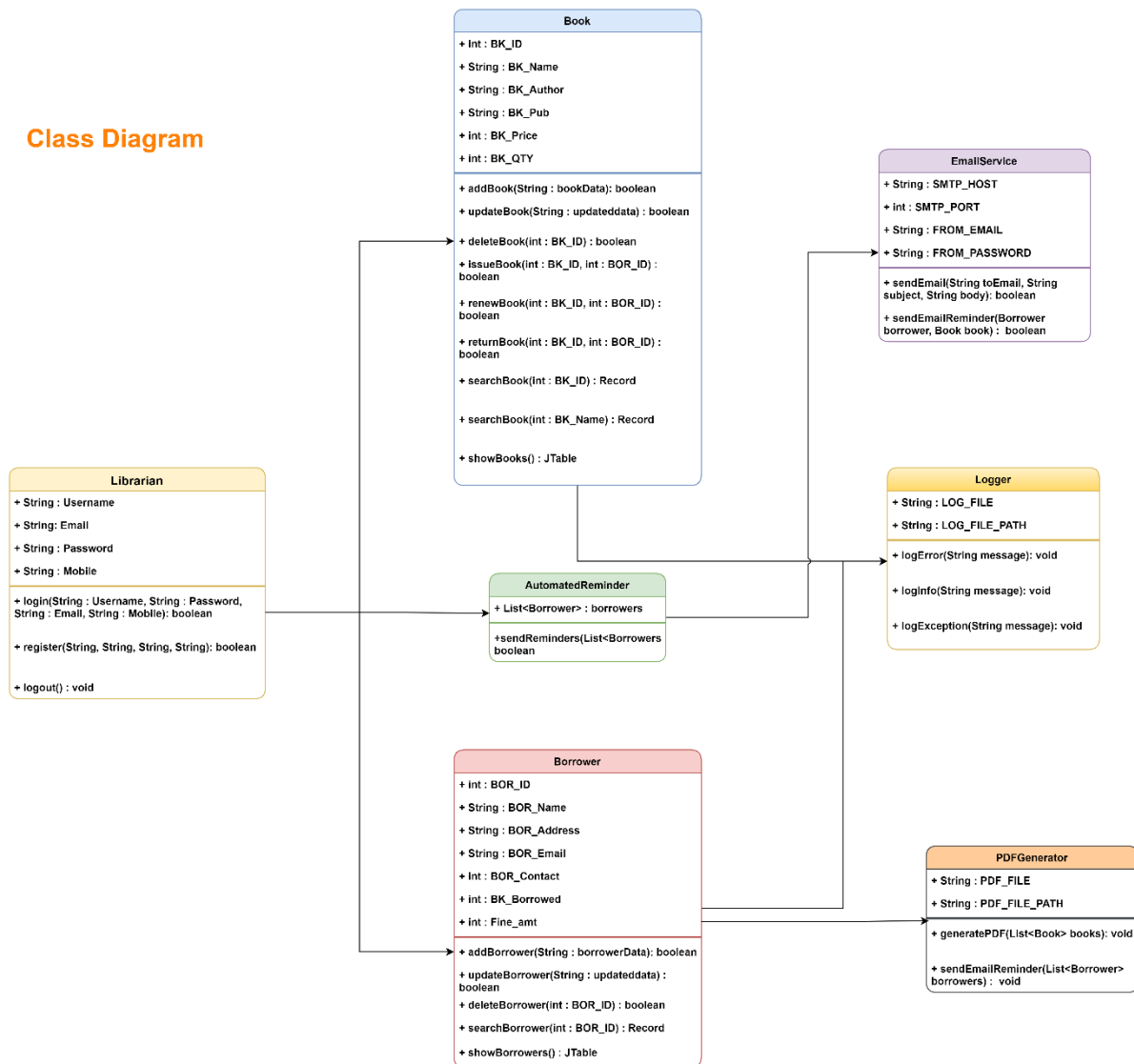
The class diagram depicts the structure of a SmartLib, detailing its key components and their relationships. Below is a description of each class and their attributes, along with a brief explanation of their interactions:

Classes and Attributes:

1. **Book**

   o **Attributes:**

      ▪ title: String

      ▪ author: String

      ▪ BK_ID: int

      ▪ status: String

   o **Description:** This class represents a book in the library. It stores information about the book's title, author, ISBN, and its current status (e.g., available, checked out).

2. **Librarian**

   o **Attributes:**

      - name: String

      - employeeId: String

   o **Description:** The Librarian class represents a library staff member who manages the books and assists borrowers. It includes the librarian's name and employee ID.

3. **Borrower**

   o **Attributes:**

      - name: String

      - borrowerId: String

      - borrowedBooks: List<Book>

   o **Description:** This class represents a person who borrows books from the library. It contains the borrower's name, ID, and a list of books they have borrowed.

4. **EmailService**

   o **Attributes:**

      - email: String

   o **Description:** The EmailService class handles the sending of emails. It includes the email address from which notifications and reminders are sent.

5. **Logger**

   o **Attributes:**

      - log: List<String>

   o **Description:** The Logger class is responsible for keeping a log of library transactions and events. It stores logs in a list format.

6. **AutomatedReminder**

   o **Attributes:**

      - reminderInterval: String

   o **Description:** This class manages the automated reminder system for overdue books. It defines the interval at which reminders are sent.
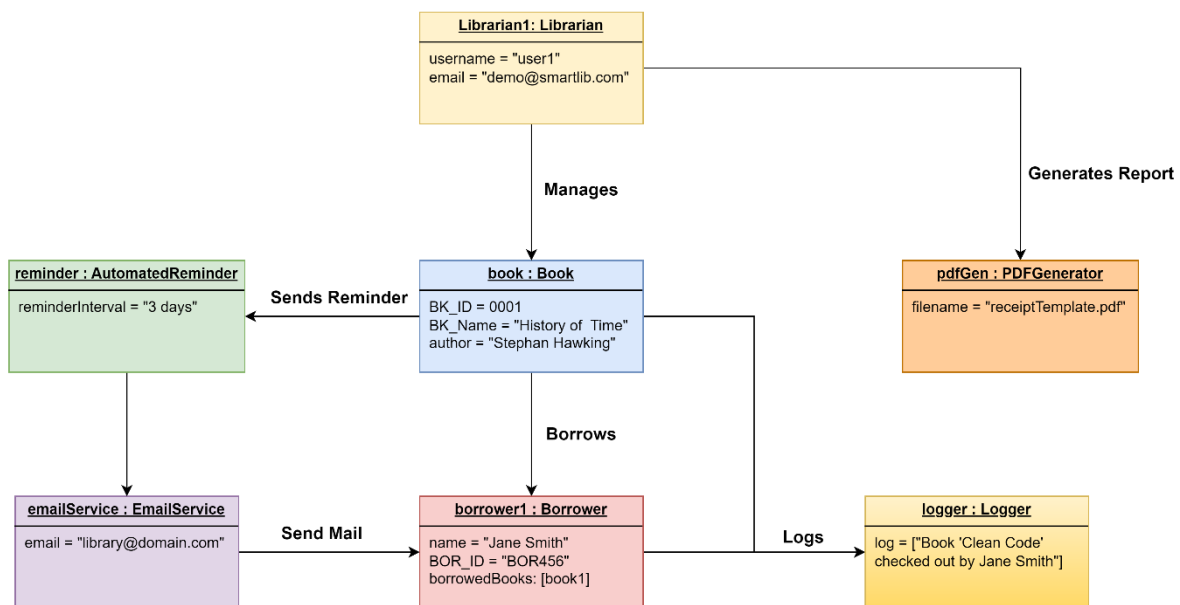
7. **PDFGenerator**

   o **Attributes:**

      - template: String

   o **Description:** The PDFGenerator class is used to generate PDF documents, such as receipts or reports, based on a specified template.

Relationships:

- **Librarian to Book:** A librarian manages the books in the library. They handle the cataloging, checkout, and return processes.

- **Borrower to Book:** A borrower interacts with the book class when they check out or return books. The borrower's list of borrowed books is updated accordingly.

- **AutomatedReminder to Borrower:** The AutomatedReminder class sends reminders to borrowers for overdue books using the EmailService.

- **Logger to Librarian and Borrower:** The Logger class logs the transactions and activities performed by both the librarian and the borrower.

- **PDFGenerator to Book and Borrower:** The PDFGenerator generates PDF documents such as receipts for the transactions involving books and borrowers.

This class diagram provides a comprehensive view of the SmartLib, illustrating how the different components interact to facilitate the management and usage of library resources.

Object Diagram

The object diagram illustrates instances of the classes defined in the class diagram and shows how they interact with each other within the library management system. Below is a detailed description of each object and its attributes, as well as their relationships:

Objects and Attributes:

1. **Librarian1: Librarian**
   - **Attributes:**
     - username: "user1"

- email: "demo@smartlib.com"
  - **Description:** This object represents a librarian in the system with the username "user1" and email "demo@smartlib.com". The librarian manages library operations, including handling books and assisting borrowers.

2. **book: Book**
   - **Attributes:**
     - BK_ID: "0001"
     - BK_Name: "History of Time"
     - author: "Stephan Hawking"
   - **Description:** This object represents a specific book in the library with ID "0001", title "History of Time", and authored by Stephan Hawking.

3. **borrower1: Borrower**
   - **Attributes:**
     - name: "Jane Smith"
     - BOR_ID: "BOR456"
     - borrowedBooks: [book]
   - **Description:** This object represents a borrower named Jane Smith with the ID "BOR456". Jane has borrowed the book "History of Time".

4. **emailService: EmailService**
   - **Attributes:**
     - email: "library@domain.com"
   - **Description:** This object represents the email service used by the library system. The service sends emails from "library@domain.com".

5. **logger: Logger**
   - **Attributes:**
     - log: ["Book 'Clean Code' checked out by Jane Smith"]
   - **Description:** This object represents the logging system of the library. It keeps a log of the transaction where Jane Smith checked out the book "Clean Code".

6. **reminder: AutomatedReminder**
   - **Attributes:**
     - reminderInterval: "3 days"
   - **Description:** This object represents the automated reminder system that sends reminders every 3 days to borrowers for overdue books.

7. **pdfGen: PDFGenerator**
   - **Attributes:**
     - filename: "receiptTemplate.pdf"
   - **Description:** This object represents the PDF generator used to create documents such as receipts. It uses the template file "receiptTemplate.pdf".

Relationships:

- **Librarian1** is responsible for managing the **book** and interacting with **borrower1**.
- **borrower1** has borrowed the **book**.
- **emailService** is used by the system to send notifications and reminders to borrowers.
- **logger** keeps a record of the transactions, including the checkout of the book "Clean Code" by Jane Smith.
- **reminder** sends periodic reminders to **borrower1** using the **emailService**.
- **pdfGen** generates PDF documents, such as receipts, for library transactions.

This object diagram provides a snapshot of the system at a particular point in time, showing the specific instances of the classes and their interactions within the library management system.