LibPortal - Library Management System

Course: The Joy of Computing Using Python (noc25_cs103)
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1. Project Overview

LibPortal is a library management system built with Python and Flask. It features Role-Based Access Control (RBAC), secure authentication, book management, sentiment analysis for reviews, and a user interface.

Key Features:

- **User Authentication:** Secure registration and login with password complexity validation.
- **Role-Based Access Control:** Distinct features for Students (Issue/Return/Review) and Admins (Add Books/View Feedback).
- **Book Management:** Browse, search, issue, and return books.
- **Sentiment Analysis:** Automatic sentiment classification (Positive/Negative/Neutral) of user reviews using `TextBlob`.
- **Persistent Data:** All data is stored in JSON files (`books.json` , `users.json` , `reviews.json`).

2. How to Run

1. Install dependencies: `pip install flask textblob`
2. Run the application: `python app.py`
3. Open browser at: `http://127.0.0.1:5000`

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3. Source Code

app.py (Main Application Logic)

```
from flask import Flask, render_template, request, redirect, url_for, session, flash

from werkzeug.security import generate_password_hash, check_password_hash

import database
import utils

import random
import os

import re

app = Flask(__name__)
app.secret_key = 'key_for_libportal' #Removed during submission

# Initialize DB
database.init_db()
database.init_db()

# --- Helpers ---
def get_current_user():
    if 'user_id' in session:
        users = database.get_users()
        for user in users:
            if user['id'] == session['user_id']:
                return user
    return None

def login_required(f):
    def wrapper(*args, **kwargs):
        if 'user_id' not in session:
            return redirect(url_for('login'))
        return f(*args, **kwargs)
    wrapper.__name__ = f.__name__
    return wrapper

def admin_required(f):
    def wrapper(*args, **kwargs):
        user = get_current_user()
        if not user or user['role'] != 'admin':
            flash("Access denied: Admins only.")
            return redirect(url_for('dashboard'))
        return f(*args, **kwargs)
    wrapper.__name__ = f.__name__
    return wrapper

# --- Routes ---

@app.route('/')
def index():
    return redirect(url_for('login'))

@app.route('/register', methods=['GET', 'POST'])
def register():
    if request.method == 'POST':
        username = request.form['username']
        password = request.form['password']
        role = request.form.get('role', 'student') # Default to student

        # Password Validation
        if len(password) < 8:
            flash('Password must be at least 8 characters long.')
            return redirect(url_for('register'))
        if not re.search(r"[A-Z]", password):
            flash('Password must contain at least one uppercase letter.')
            return redirect(url_for('register'))
        if not re.search(r"[a-z]", password):
            flash('Password must contain at least one lowercase letter.')
            return redirect(url_for('register'))
        if not re.search(r"[0-9]", password):
            flash('Password must contain at least one digit.')
            return redirect(url_for('register'))
        if not re.search(r"[!@#$%^&*(),.?\":{}|<>]", password):
            flash('Password must contain at least one special character.')
            return redirect(url_for('register'))

        users = database.get_users()
        if any(u['username'] == username for u in users):
            flash('Username already exists')
            return redirect(url_for('register'))

        new_user = {
            "id": len(users) + 1,
            "username": username,
            "password": generate_password_hash(password),
            "role": role,
            "history": [] # List of book IDs returned
        }
        users.append(new_user)
        database.save_users(users)
        flash('Registration successful! Please login.')
        return redirect(url_for('login'))
    return render_template('register.html')

@app.route('/login', methods=['GET', 'POST'])
def login():
    if request.method == 'POST':
        username = request.form['username']
        password = request.form['password']

        users = database.get_users()
        user = next((u for u in users if u['username'] == username), None)

        if user and check_password_hash(user['password'], password):
            session['user_id'] = user['id']
            session['role'] = user['role']
            return redirect(url_for('dashboard'))
        else:
            flash('Invalid credentials')

    return render_template('login.html')

@app.route('/logout')
def logout():
    session.clear()
    return redirect(url_for('login'))

@app.route('/dashboard')
@login_required
def dashboard():
    user = get_current_user()
    books = database.get_books()

    # Stats
    total_books = len(books)
    issued_books = len([b for b in books if b['status'] == 'Issued'])
    available_books = total_books - issued_books

    # Recommendations
    recommendations = utils.get_recommendations(user['history'], books)

    # My Issued Books
    my_books = [b for b in books if b['issued_to'] == user['id']]

    return render_template('dashboard.html', user=user,
                           total=total_books, issued=issued_books,
available=available_books,
                           recommendations=recommendations, my_books=my_books)
```

```
@app.route('/books')
@login_required
def books():
    search_query = request.args.get('q', '').lower()
    all_books = database.get_books()
    reviews = database.get_reviews()

    # Calculate sentiment for each book
    book_sentiments = {}
    for book in all_books:
        book_reviews = [r['sentiment'] for r in reviews if r['book_id'] == book['id']]
        if book_reviews:
            # Simple logic: Majority wins, or "Mixed"
            pos = book_reviews.count('Positive')
            neg = book_reviews.count('Negative')
            neu = book_reviews.count('Neutral')

            if pos > neg and pos > neu:
                sentiment = "Positive"
            elif neg > pos and neg > neu:
                sentiment = "Negative"
            elif neu > pos and neu > neg:
                sentiment = "Neutral"
            else:
                sentiment = "Mixed"
            book_sentiments[book['id']] = sentiment
        else:
            book_sentiments[book['id']] = "No Reviews"

    if search_query:
        filtered_books = [b for b in all_books if search_query in b['title'].lower() or
search_query in b['author'].lower()]
    else:
        filtered_books = all_books

    return render_template('books.html', books=filtered_books, user=get_current_user(),
sentiments=book_sentiments)

@app.route('/admin/feedback')
@admin_required
def admin_feedback():
    reviews = database.get_reviews()
    books = database.get_books()
    users = database.get_users()

    # Enrich reviews with book and user names
    enriched_reviews = []
    for review in reviews:
        book = next((b for b in books if b['id'] == review['book_id']), None)
        user = next((u for u in users if u['id'] == review['user_id']), None)
        if book and user:
            enriched_reviews.append({
                "book_title": book['title'],
                "username": user['username'],
                "content": review['content'],
                "sentiment": review['sentiment']
            })

    return render_template('admin_feedback.html', reviews=enriched_reviews)

@app.route('/add_book', methods=['POST'])
```

```python
@app.route('/add_book', methods=['POST'])
@admin_required
def add_book():
    title = request.form['title']
    author = request.form['author']
    genre = request.form['genre']

    books = database.get_books()
    new_book = {
        "id": len(books) + 1,
        "title": title,
        "author": author,
        "genre": genre,
        "status": "Available",
        "issued_to": None
    }
    books.append(new_book)
    database.save_books(books)
    flash('Book added successfully!')
    return redirect(url_for('books'))

@app.route('/issue/<int:book_id>')
@login_required
def issue_book(book_id):
    books = database.get_books()
    user = get_current_user()

    for book in books:
        if book['id'] == book_id:
            if book['status'] == 'Available':
                book['status'] = 'Issued'
                book['issued_to'] = user['id']
                database.save_books(books)
                flash(f'You have issued {book["title"]}')
            else:
                flash('Book is not available')
            break
    return redirect(url_for('books'))

@app.route('/return/<int:book_id>')
@login_required
def return_book(book_id):
    books = database.get_books()
    users = database.get_users()
    user = get_current_user()

    for book in books:
        if book['id'] == book_id and book['issued_to'] == user['id']:
            book['status'] = 'Available'
            book['issued_to'] = None

            # Update user history for recommendations
            # We need to find the user object in the list to update it
            for u in users:
                if u['id'] == user['id']:
                    if book_id not in u['history']:
                        u['history'].append(book_id)
                    break

            database.save_books(books)
            database.save_users(users)
            flash(f'You have returned {book["title"]}')
            flash(f'You have returned {book["title"]}')
            break
    return redirect(url_for('dashboard'))

@app.route('/review/<int:book_id>', methods=['POST'])
@login_required
def add_review(book_id):
    content = request.form['content']
    sentiment = utils.analyze_sentiment(content)

    reviews = database.get_reviews()
    reviews.append({
        "book_id": book_id,
        "user_id": session['user_id'],
        "content": content,
        "sentiment": sentiment
    })
    database.save_reviews(reviews)
    flash(f'Review added! Sentiment analysis says: {sentiment}')
    return redirect(url_for('books'))

if __name__ == '__main__':
    app.run(debug=True)
```

database.py (Data Persistence)

```
import json
import os

DATA_DIR = 'data'
BOOKS_FILE = os.path.join(DATA_DIR, 'books.json')
USERS_FILE = os.path.join(DATA_DIR, 'users.json')
REVIEWS_FILE = os.path.join(DATA_DIR, 'reviews.json')

def init_db():
    if not os.path.exists(DATA_DIR):
        os.makedirs(DATA_DIR)

    if not os.path.exists(BOOKS_FILE):
        # Initial dummy data
        books = [
            # Technology & Computer Science
            {"id": 1, "title": "The Joy of Python", "author": "Guido van Rossum",
"genre": "Technology", "status": "Available", "issued_to": None},
            {"id": 2, "title": "Flask Web Development", "author": "Miguel Grinberg",
"genre": "Technology", "status": "Available", "issued_to": None},
            {"id": 3, "title": "Clean Code", "author": "Robert C. Martin", "genre":
"Technology", "status": "Available", "issued_to": None},
            {"id": 4, "title": "The Pragmatic Programmer", "author": "Andrew Hunt",
"genre": "Technology", "status": "Available", "issued_to": None},
            {"id": 5, "title": "Introduction to Algorithms", "author": "Thomas H.
Cormen", "genre": "Technology", "status": "Available", "issued_to": None},
            {"id": 6, "title": "Design Patterns", "author": "Erich Gamma", "genre":
"Technology", "status": "Available", "issued_to": None},
            {"id": 7, "title": "You Don't Know JS", "author": "Kyle Simpson", "genre":
"Technology", "status": "Available", "issued_to": None},
            {"id": 8, "title": "Cracking the Coding Interview", "author": "Gayle
Laakmann McDowell", "genre": "Technology", "status": "Available", "issued_to": None},
            # Data Science & AI
            {"id": 9, "title": "Data Science from Scratch", "author": "Joel Grus",
"genre": "Data Science", "status": "Available", "issued_to": None},
            {"id": 10, "title": "Deep Learning", "author": "Ian Goodfellow", "genre":
"Data Science", "status": "Available", "issued_to": None},
            {"id": 11, "title": "Hands-On Machine Learning", "author": "Aurélien Géron",
"genre": "Data Science", "status": "Available", "issued_to": None},
            {"id": 12, "title": "Pattern Recognition and Machine Learning", "author":
"Christopher Bishop", "genre": "Data Science", "status": "Available", "issued_to":
None},
            {"id": 13, "title": "Python for Data Analysis", "author": "Wes McKinney",
"genre": "Data Science", "status": "Available", "issued_to": None},

            # Fiction & Classics
            {"id": 14, "title": "Harry Potter and the Sorcerer's Stone", "author": "J.K.
Rowling", "genre": "Fiction", "status": "Available", "issued_to": None},
            {"id": 15, "title": "To Kill a Mockingbird", "author": "Harper Lee",
"genre": "Fiction", "status": "Available", "issued_to": None},
            {"id": 16, "title": "1984", "author": "George Orwell", "genre": "Fiction",
"status": "Available", "issued_to": None},
            {"id": 17, "title": "The Great Gatsby", "author": "F. Scott Fitzgerald",
"genre": "Fiction", "status": "Available", "issued_to": None},
            {"id": 18, "title": "Pride and Prejudice", "author": "Jane Austen", "genre":
"Fiction", "status": "Available", "issued_to": None},
            {"id": 19, "title": "The Catcher in the Rye", "author": "J.D. Salinger",
"genre": "Fiction", "status": "Available", "issued_to": None},
            {"id": 20, "title": "Brave New World", "author": "Aldous Huxley", "genre":
"Fiction", "status": "Available", "issued_to": None},
            {"id": 21, "title": "The Alchemist", "author": "Paulo Coelho", "genre":
"Fiction", "status": "Available", "issued_to": None},

            # Mystery & Thriller
            {"id": 22, "title": "The Adventures of Sherlock Holmes", "author": "Arthur
Conan Doyle", "genre": "Mystery", "status": "Available", "issued_to": None},
            {"id": 23, "title": "Gone Girl", "author": "Gillian Flynn", "genre":
"Mystery", "status": "Available", "issued_to": None},
            {"id": 24, "title": "The Girl with the Dragon Tattoo", "author": "Stieg
Larsson", "genre": "Mystery", "status": "Available", "issued_to": None},
            {"id": 25, "title": "The Da Vinci Code", "author": "Dan Brown", "genre":
"Mystery", "status": "Available", "issued_to": None},
            {"id": 26, "title": "And Then There Were None", "author": "Agatha Christie",
"genre": "Mystery", "status": "Available", "issued_to": None},

            # Fantasy & Sci-Fi
            {"id": 27, "title": "The Hobbit", "author": "J.R.R. Tolkien", "genre":
"Fantasy", "status": "Available", "issued_to": None},
            {"id": 28, "title": "Dune", "author": "Frank Herbert", "genre": "Sci-Fi",
"status": "Available", "issued_to": None},
            {"id": 29, "title": "The Name of the Wind", "author": "Patrick Rothfuss",
"genre": "Fantasy", "status": "Available", "issued_to": None},
            {"id": 30, "title": "Ender's Game", "author": "Orson Scott Card", "genre":
"Sci-Fi", "status": "Available", "issued_to": None},
            {"id": 31, "title": "A Game of Thrones", "author": "George R.R. Martin",
"genre": "Fantasy", "status": "Available", "issued_to": None},

            # History & Biography
            {"id": 32, "title": "Sapiens: A Brief History of Humankind", "author":
"Yuval Noah Harari", "genre": "History", "status": "Available", "issued_to": None},
            {"id": 33, "title": "Educated", "author": "Tara Westover", "genre":
"Biography", "status": "Available", "issued_to": None},
            {"id": 34, "title": "Becoming", "author": "Michelle Obama", "genre":
```

```
"Biography", "status": "Available", "issued_to": None},
            {"id": 35, "title": "Steve Jobs", "author": "Walter Isaacson", "genre":
"Biography", "status": "Available", "issued_to": None},
            {"id": 36, "title": "Guns, Germs, and Steel", "author": "Jared Diamond",
"genre": "History", "status": "Available", "issued_to": None},
            {"id": 37, "title": "The Diary of a Young Girl", "author": "Anne Frank",
"genre": "Biography", "status": "Available", "issued_to": None},

            # Science & Philosophy
            {"id": 38, "title": "Cosmos", "author": "Carl Sagan", "genre": "Science",
"status": "Available", "issued_to": None},
            {"id": 39, "title": "A Brief History of Time", "author": "Stephen Hawking",
"genre": "Science", "status": "Available", "issued_to": None},
            {"id": 40, "title": "Thinking, Fast and Slow", "author": "Daniel Kahneman",
"genre": "Psychology", "status": "Available", "issued_to": None},
            {"id": 41, "title": "Meditations", "author": "Marcus Aurelius", "genre":
"Philosophy", "status": "Available", "issued_to": None},
            {"id": 42, "title": "The Selfish Gene", "author": "Richard Dawkins",
"genre": "Science", "status": "Available", "issued_to": None},
            {"id": 43, "title": "Beyond Good and Evil", "author": "Friedrich Nietzsche",
"genre": "Philosophy", "status": "Available", "issued_to": None},

            # Business & Self-Help
            {"id": 44, "title": "Atomic Habits", "author": "James Clear", "genre":
"Self-Help", "status": "Available", "issued_to": None},
            {"id": 45, "title": "Rich Dad Poor Dad", "author": "Robert Kiyosaki",
"genre": "Business", "status": "Available", "issued_to": None},
            {"id": 46, "title": "Zero to One", "author": "Peter Thiel", "genre":
"Business", "status": "Available", "issued_to": None},
            {"id": 47, "title": "The Power of Habit", "author": "Charles Duhigg",
"genre": "Self-Help", "status": "Available", "issued_to": None},
            {"id": 48, "title": "How to Win Friends and Influence People", "author":
"Dale Carnegie", "genre": "Self-Help", "status": "Available", "issued_to": None},
            {"id": 49, "title": "Deep Work", "author": "Cal Newport", "genre": "Self-
Help", "status": "Available", "issued_to": None},
            {"id": 50, "title": "Shoe Dog", "author": "Phil Knight", "genre":
"Business", "status": "Available", "issued_to": None}
        ]
        save_data(BOOKS_FILE, books)

    if not os.path.exists(USERS_FILE):
        users = []
        save_data(USERS_FILE, users)

    if not os.path.exists(REVIEWS_FILE):
        save_data(REVIEWS_FILE, [])

def load_data(filename):
    if not os.path.exists(filename):
        return []
    with open(filename, 'r') as f:
        try:
            return json.load(f)
        except json.JSONDecodeError:
            return []

def save_data(filename, data):
    with open(filename, 'w') as f:
        json.dump(data, f, indent=4)

def get_books():
```

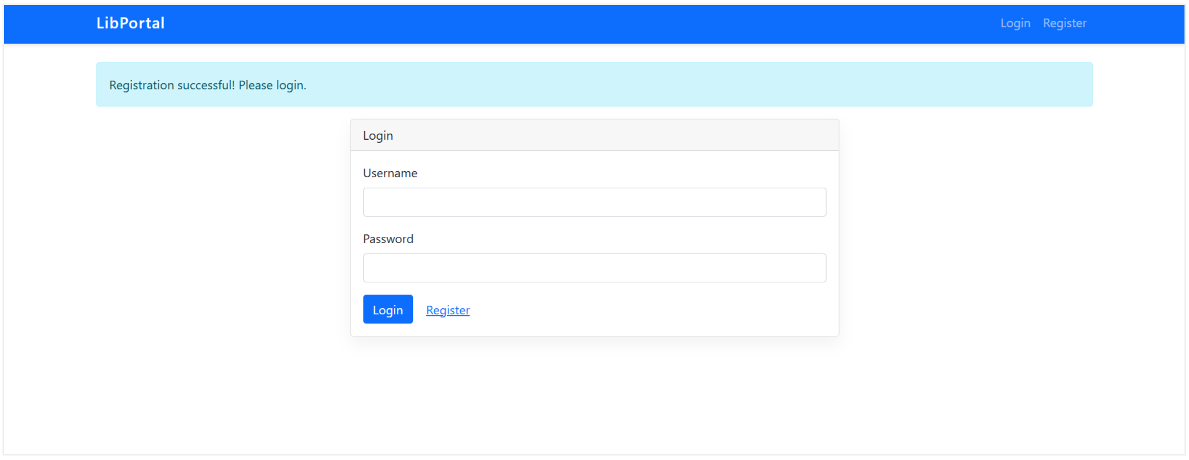
```
def get_books():
    return load_data(BOOKS_FILE)

def save_books(books):
    save_data(BOOKS_FILE, books)

def get_users():
    return load_data(USERS_FILE)

def save_users(users):
    save_data(USERS_FILE, users)

def get_reviews():
    return load_data(REVIEWS_FILE)

def save_reviews(reviews):
    save_data(REVIEWS_FILE, reviews)
```

utils.py (Helper Functions)

```
import random
from textblob import TextBlob

def analyze_sentiment(text):
    blob = TextBlob(text)
    polarity = blob.sentiment.polarity
    if polarity > 0.1:
        return "Positive"
    elif polarity < -0.1:
        return "Negative"
    else:
        return "Neutral"

# --- Recommendation System (Course Topic: Six Degrees/Similarities) ---
def get_recommendations(user_history, all_books):
    # Simple recommendation: Recommend books from genres the user has read
    if not user_history:
        # Random recommendation if no history
        return random.sample(all_books, min(3, len(all_books)))

    read_genres = set()
    for book_id in user_history:
        # Find book genre (inefficient but simple for small lists)
        for b in all_books:
            if b['id'] == book_id:
                read_genres.add(b['genre'])
                break

    recommendations = []
    for book in all_books:
        if book['genre'] in read_genres and book['id'] not in user_history:
            recommendations.append(book)

    if not recommendations:
        # Fallback to random
        return random.sample(all_books, min(3, len(all_books)))

    return recommendations[:3]
```

4. Screenshots

1. Login Page


LibPortal

Login Register

Registration successful! Please login.

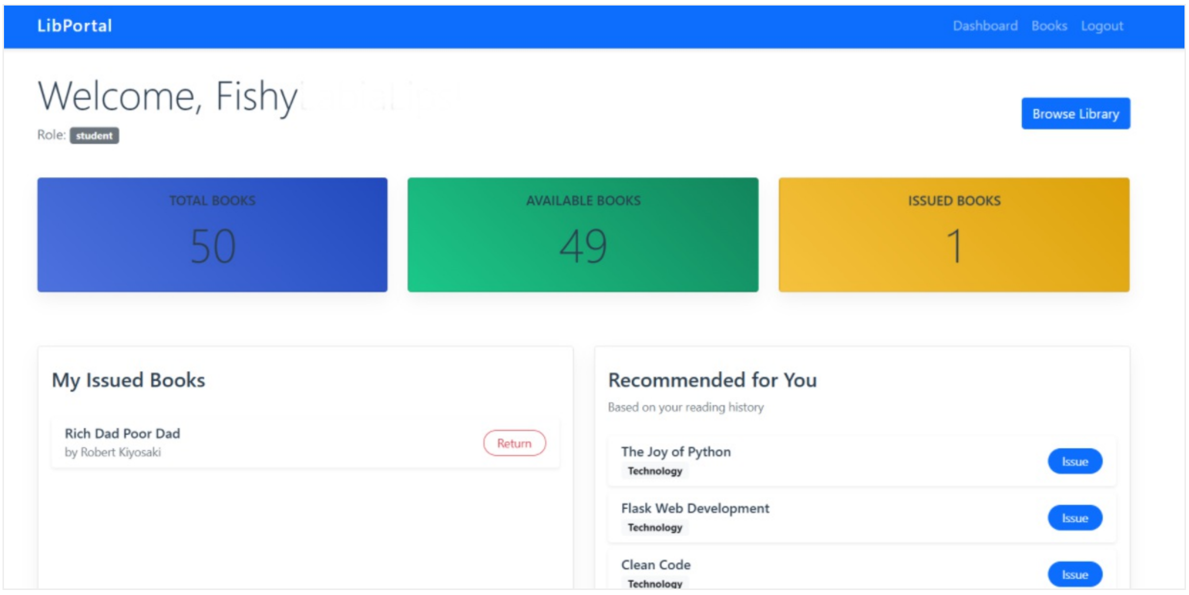
Login

Username

Password

Login Register

2. Dashboard (Student View)


LibPortal

Dashboard Books Logout

Welcome, Fishy

Role: student

Browse Library

TOTAL BOOKS 50

AVAILABLE BOOKS 49

ISSUED BOOKS 1

My Issued Books

Rich Dad Poor Dad
by Robert Kiyosaki
Return

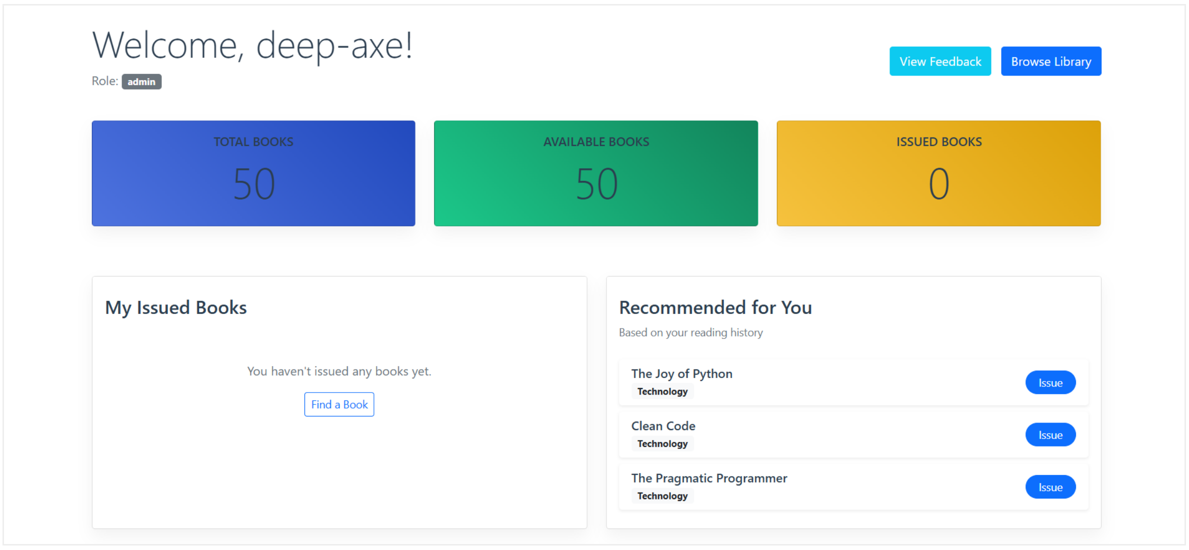
Recommended for You
Based on your reading history

The Joy of Python
Technology
Issue

Flask Web Development
Technology
Issue

Clean Code
Technology
Issue

3. Dashboard (Admin View)


Welcome, deep-axe!

Role: admin

View Feedback Browse Library

TOTAL BOOKS 50

AVAILABLE BOOKS 50

ISSUED BOOKS 0

My Issued Books

You haven't issued any books yet.

Find a Book

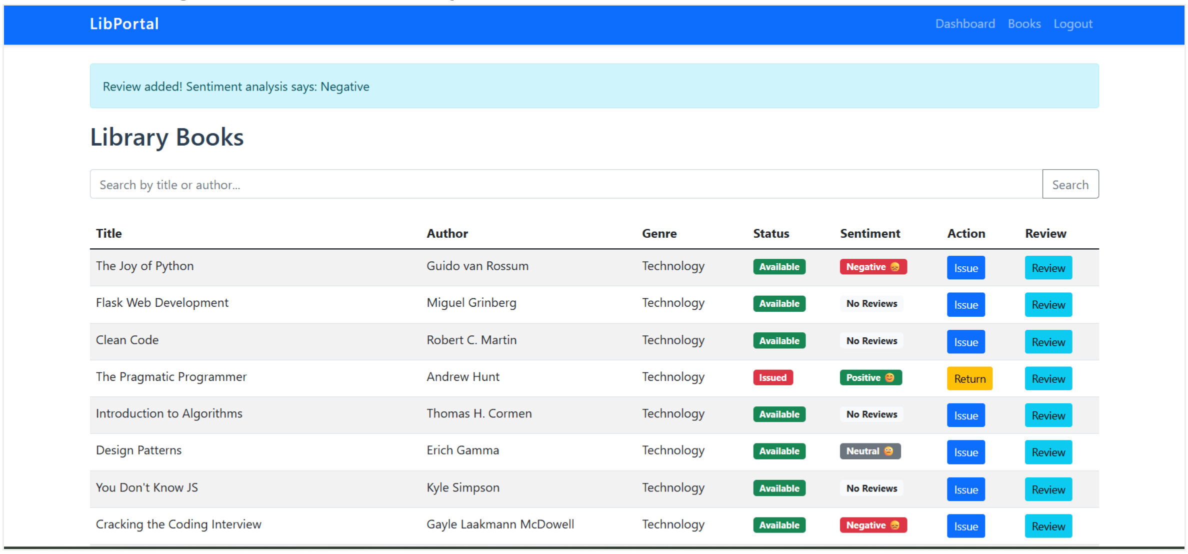
Recommended for You
Based on your reading history

The Joy of Python
Technology
Issue

Clean Code
Technology
Issue

The Pragmatic Programmer
Technology
Issue

4. Book Catalog with Sentiment Analysis



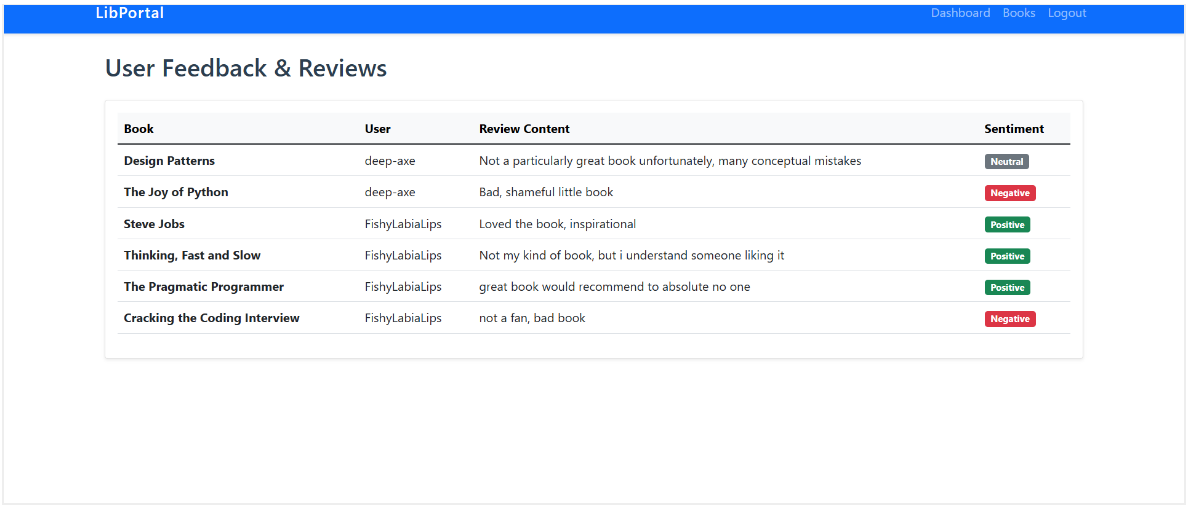
Review added! Sentiment analysis says: Negative

Library Books

Search by title or author... | Search

Title	Author	Genre	Status	Sentiment	Action	Review
The Joy of Python	Guido van Rossum	Technology	Available	Negative 😞	Issue	Review
Flask Web Development	Miguel Grinberg	Technology	Available	No Reviews	Issue	Review
Clean Code	Robert C. Martin	Technology	Available	No Reviews	Issue	Review
The Pragmatic Programmer	Andrew Hunt	Technology	Issued	Positive 😊	Return	Review
Introduction to Algorithms	Thomas H. Cormen	Technology	Available	No Reviews	Issue	Review
Design Patterns	Erich Gamma	Technology	Available	Neutral 🙄	Issue	Review
You Don't Know JS	Kyle Simpson	Technology	Available	No Reviews	Issue	Review
Cracking the Coding Interview	Gayle Laakmann McDowell	Technology	Available	Negative 😞	Issue	Review

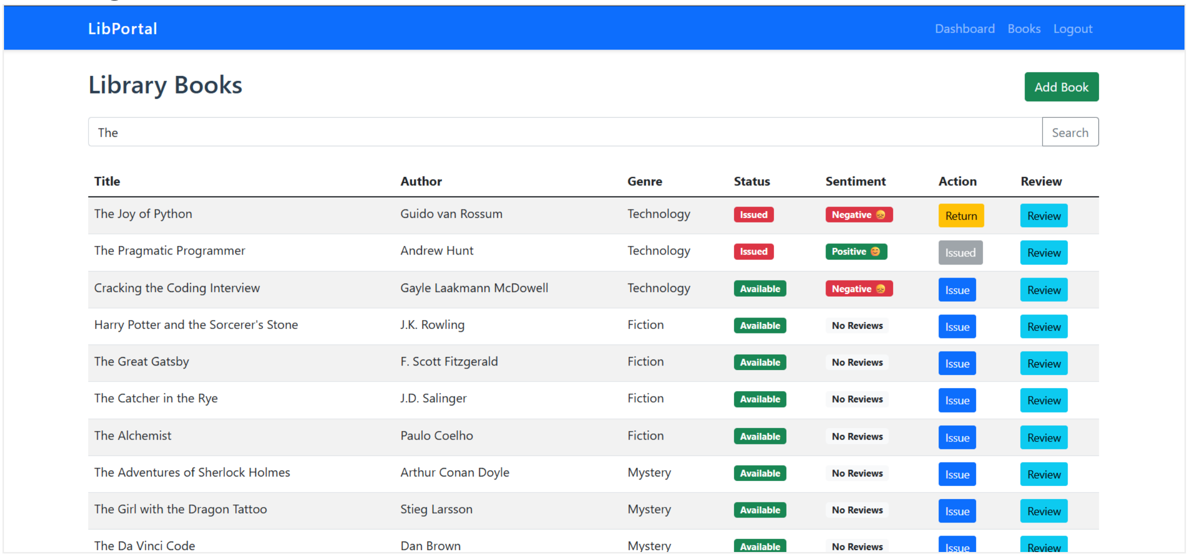
5. Admin Feedback View



User Feedback & Reviews

Book	User	Review Content	Sentiment
Design Patterns	deep-axe	Not a particularly great book unfortunately, many conceptual mistakes	Neutral
The Joy of Python	deep-axe	Bad, shameful little book	Negative
Steve Jobs	FishyLabiaLips	Loved the book, inspirational	Positive
Thinking, Fast and Slow	FishyLabiaLips	Not my kind of book, but i understand someone liking it	Positive
The Pragmatic Programmer	FishyLabiaLips	great book would recommend to absolute no one	Positive
Cracking the Coding Interview	FishyLabiaLips	not a fan, bad book	Negative

6. Catalogue Search



Library Books

The | Search

Title	Author	Genre	Status	Sentiment	Action	Review
The Joy of Python	Guido van Rossum	Technology	Issued	Negative 😞	Return	Review
The Pragmatic Programmer	Andrew Hunt	Technology	Issued	Positive 😊	Issued	Review
Cracking the Coding Interview	Gayle Laakmann McDowell	Technology	Available	Negative 😞	Issue	Review
Harry Potter and the Sorcerer's Stone	J.K. Rowling	Fiction	Available	No Reviews	Issue	Review
The Great Gatsby	F. Scott Fitzgerald	Fiction	Available	No Reviews	Issue	Review
The Catcher in the Rye	J.D. Salinger	Fiction	Available	No Reviews	Issue	Review
The Alchemist	Paulo Coelho	Fiction	Available	No Reviews	Issue	Review
The Adventures of Sherlock Holmes	Arthur Conan Doyle	Mystery	Available	No Reviews	Issue	Review
The Girl with the Dragon Tattoo	Stieg Larsson	Mystery	Available	No Reviews	Issue	Review
The Da Vinci Code	Dan Brown	Mystery	Available	No Reviews	Issue	Review