VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

A Mini Project Report on

"VolunteerHub: A Volunteer Management System"

Submitted in the partial fulfillment for the requirements for the conferment of degree of

BACHELOR OF ENGINEERING

In

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

By

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Certificate

This is to certify that the project report entitled "**VolunteerHub: A Volunteer Management System**" is a bonafide record of the work carried out by **Adithya S (USN: 1BY23AI007)** and **Aditya B (USN: 1BY23AI009)**, students of BMS Institute of Technology and Management, in partial fulfillment for the award of the degree of Bachelor of Engineering in Artificial Intelligence and Machine Learning during the academic year 2024-25.

The project work has been carried out under our supervision and guidance, and it meets the academic standards required for a mini-project in the Database Management Systems course. The implementation demonstrates a practical application of database concepts and web development skills as outlined in the curriculum.

To the best of our knowledge, this work has not been submitted, either in part or full, to any other university or institution for the award of any degree or diploma.

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Declaration

We, **Adithya S (USN: 1BY23AI007)** and **Aditya B (USN: 1BY23AI009)**, hereby declare that this project report entitled "**VolunteerHub: A Volunteer Management System**" is the authentic record of work carried out by us under the supervision and guidance of **Dr. Archana Bhat**, Assistant Professor, Department of AI & ML, BMS Institute of Technology and Management.

We confirm that:

- This work is original and has been conducted by us as part of our academic curriculum.
- The implementation and findings presented are the result of our own efforts and investigation.
- All sources of information and assistance received during the project have been duly acknowledged.
- The report has been prepared according to the guidelines provided by the institution.
- This project report has not been submitted to any other university or institution for the award of any degree or diploma.

We understand the institute's policy on plagiarism and declare that this project is free from any form of plagiarism. We are fully aware that any deviation observed in this declaration will result in disciplinary action as per institute norms.

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Adithya S
Aditya B

Abstract

VolunteerHub is a comprehensive web-based volunteer management system designed to streamline the process of organizing volunteer events, tracking participation, and rewarding volunteers through a points-based system. The system addresses a critical challenge faced by educational institutions: how to efficiently manage volunteer activities and motivate student participation.

The platform provides dual interfaces for both administrators and volunteer students. Administrators can create events, manage volunteers, assign roles, track participation, and manage a rewards system. Students can browse available volunteer opportunities, register for events, track their earned points, and redeem rewards.

Built using Python with Flask framework and SQLite database, VolunteerHub implements secure authentication, data validation, and role-based access control. The system's points-based incentive mechanism effectively encourages student participation in volunteer activities while providing administrators with valuable insights through comprehensive analytics.

This project demonstrates the application of database management principles in creating a practical solution that benefits both administrators and volunteers in educational settings.

Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviation	Full Form
DBMS	Database Management System
SQL	Structured Query Language
HTML	HyperText Markup Language
CSS	Cascading Style Sheets
UI	User Interface
API	Application Programming Interface
SHA	Secure Hash Algorithm
CRUD	Create, Read, Update, Delete

Chapter 1

Introduction

1.1 Background

Volunteer programs are essential components of educational institutions, fostering community engagement, leadership skills, and social responsibility among students. However, managing these programs effectively presents significant challenges, including tracking participation, motivating students, and administering rewards for involvement. Traditional methods of volunteer management often rely on manual record-keeping, which can be time-consuming, error-prone, and lacking in engagement mechanisms.

1.2 Problem Statement

Educational institutions face several challenges in volunteer management:

- Inefficient tracking of volunteer participation across multiple events
- Lack of incentive mechanisms to encourage student involvement
- Administrative burden of manually managing event registrations and attendance
- Difficulty in maintaining transparent records of volunteer contributions
- Limited tools for recognizing and rewarding dedicated volunteers

1.3 Project Objectives

The VolunteerHub project aims to address these challenges through the following objectives:

- Design and implement a database system to efficiently store and retrieve volunteer data
- Create a secure authentication system with separated user and admin roles
- Develop a point tracking mechanism to incentivize volunteer participation
- Build a reward system allowing volunteers to redeem points for benefits

- Implement a user-friendly interface for both administrators and volunteers
- Provide detailed analytics and reporting features for volunteer activities
- Enable administrators to manage events and track volunteer participation

1.4 Scope of the Project

VolunteerHub is designed to serve as a comprehensive platform for volunteer management within educational institutions. The system covers:

- User registration and authentication
- Event creation and management
- Volunteer registration for events
- Role assignment for volunteers
- Points tracking and management
- Rewards creation and redemption
- Analytics and reporting capabilities

The system is specifically designed for educational institutions but could be adapted for other organizations that manage volunteer activities.

Chapter 2

Literature Survey

2.1 Existing Volunteer Management Solutions

Several volunteer management systems exist in various contexts, each with specific strengths and limitations. Traditional approaches often involve spreadsheet-based tracking or paper records, which present challenges in scalability and engagement. More recently, digital solutions have emerged, offering improvements in efficiency and user experience.

2.2 Review of Research Papers

2.3 Comparative Analysis

Based on the literature review presented in Table 2.1, several key features emerge as essential for effective volunteer management systems:

- User-friendly interfaces for both administrators and volunteers
- Robust tracking mechanisms for volunteer activities
- Incentive systems to encourage participation
- Transparent record-keeping and reporting capabilities
- Security measures to protect user data

Our VolunteerHub system incorporates these features while addressing specific gaps identified in existing solutions, particularly in the areas of points-based motivation, user experience, and comprehensive analytics.

2.4 Gap Analysis

While existing research and solutions offer valuable insights, several gaps remain:

- Limited integration between incentive systems and educational institution reward structures

Table 2.1: Literature Survey

Authors	**Year & Publication**	**Title**	**Key Findings**	**Relevance to Project**
Brown and Davis	2021, ACM Conference on Computer Supported Cooperative Work	PointsWork: A Points-Based Incentive System for Student Volunteer Management	Gamified elements increased volunteer participation by 37% on average among college students	Directly informed our points-based incentive system design
Kumar, Singh, and Tripathi	2023, IEEE Transactions on Engineering Management	BlockVMS: Blockchain-Based Volunteer Management System for Transparent Community Service	Blockchain enhances transparency, trustworthiness, and immutability in volunteer record-keeping	Influenced our approach to secure and transparent record-keeping
Wang, Li, and Chen	2022, ACM Conference on Human Factors in Computing Systems	Gamification in Volunteer Engagement: A Systematic Review	Leaderboards, point systems, and achievement badges were most effective for sustaining long-term participation	Guided our implementation of engagement features
González-Pérez and García-Holgado	2022, Advances in Human-Computer Interaction, Springer	Digital Platform for Volunteer Management: A Case Study in Higher Education	Centralized digital management positively impacts both administrative efficiency and student engagement	Validated our approach to centralized management
Sharma and Dhiman	2021, IEEE Access	A Comprehensive Review of Volunteer Management Systems: Challenges and Future Directions	User experience, data security, and incentive mechanisms are critical in modern volunteer platforms	Provided framework for addressing key challenges in volunteer systems

- Insufficient attention to the ease of administrative tasks
- Lack of comprehensive systems that address the entire volunteer lifecycle from registration to recognition

VolunteerHub aims to address these gaps through its integrated approach to volunteer management.

Chapter 3

Software Requirements

3.1 Functional Requirements

3.1.1 User Management

- User registration with email verification
- User authentication with secure password management
- User profile management
- Role-based access control (admin/volunteer)

3.1.2 Event Management

- Create, read, update, and delete volunteer events
- Set event details including date, location, points value
- Associate volunteers with events
- Track event status and completion

3.1.3 Volunteer Registration

- Allow students to browse available events
- Enable registration for selected events
- Assign and manage volunteer roles
- Track registration status

3.1.4 Points System

- Award points for volunteer participation
- Track points history for each user
- Allow manual point adjustments by administrators
- Generate points reports

3.1.5 Rewards System

- Create and manage available rewards
- Set point requirements for each reward
- Process reward redemptions
- Track redemption history

3.1.6 Reporting and Analytics

- Generate participation reports
- Track volunteer engagement metrics
- Analyze point distribution patterns
- Monitor reward redemption trends

3.2 Non-Functional Requirements

3.2.1 Performance

- The system should load pages within 2 seconds under normal conditions
- The system should support at least 100 concurrent users
- Database queries should execute in less than 1 second

3.2.2 Security

- Passwords must be stored using secure hashing algorithms (SHA-256)
- User sessions must expire after 30 minutes of inactivity
- All input must be validated to prevent injection attacks
- Role-based access control must be strictly enforced

3.2.3 Usability

- The user interface should be intuitive and require minimal training
- The system should be accessible on mobile and desktop devices
- Error messages should be clear and actionable
- The design should follow consistent patterns across all pages

3.2.4 Reliability

- The system should have 99.9% uptime during operating hours
- Regular database backups should be performed
- The system should handle input errors gracefully without crashing

3.2.5 Maintainability

- The codebase should follow consistent naming conventions and style guidelines
- The system should be modular to allow for future extensions
- Documentation should be provided for all major components

3.3 Hardware and Software Requirements

3.3.1 Hardware Requirements

- Server: Any modern dual-core processor
- RAM: 4GB or higher
- Storage: 1GB for application and database
- Network: Internet connection

3.3.2 Software Requirements

- Operating System: Windows/Linux/macOS
- Python 3.8+
- Flask Framework
- SQLite Database
- Web Browser (Chrome/Firefox/Edge)

3.3.3 Development Tools

- IDE: Visual Studio Code
- Version Control: Git
- Database Management: SQLite Browser
- Testing: Python unittest framework

Chapter 4

System Design

4.1 Architecture Overview

VolunteerHub follows a classic three-tier architecture consisting of:

- Presentation Layer: Web interface for users and administrators
- Application Layer: Business logic implemented in Flask
- Data Layer: SQLite database for persistent storage

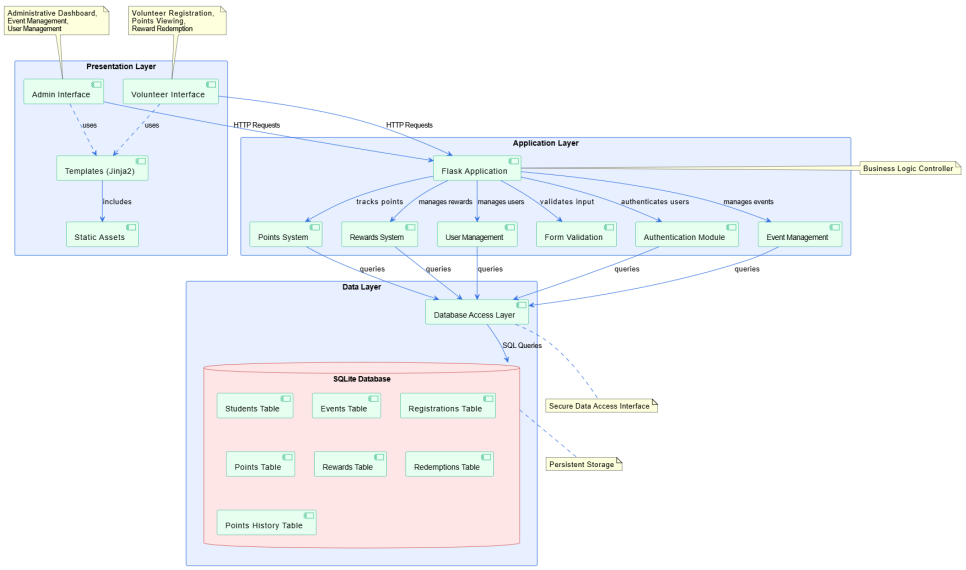


Figure 4.1: System Architecture Diagram

This architecture provides separation of concerns, making the system more maintainable and extensible while ensuring efficient data management.

4.2 Database Design

4.2.1 Entity-Relationship Diagram

The database design is centered around students, events, registrations, points, and rewards, with appropriate relationships between these entities.

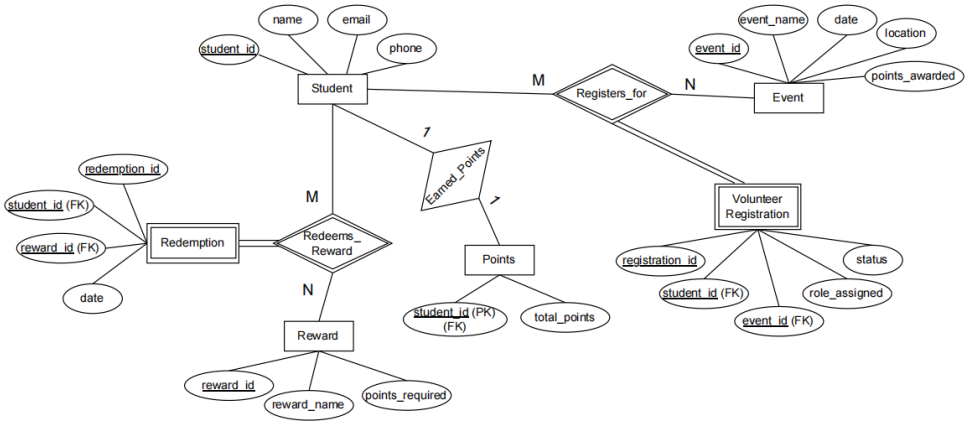


Figure 4.2: Entity-Relationship Diagram

4.2.2 Database Schema

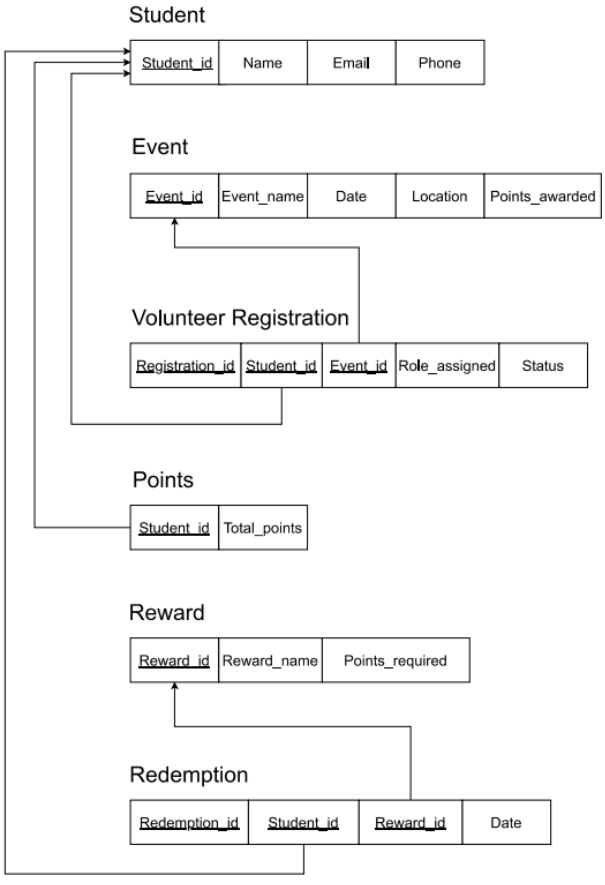


Figure 4.3: Database Schema Diagram

4.2.3 Table Descriptions

Students Table

Stores information about student volunteers.

Field	Type	Constraints	Description
id	INTEGER	PRIMARY KEY, AUTOINCREMENT	Unique identifier
name	TEXT	NOT NULL	Student's full name
email	TEXT	NOT NULL, UNIQUE	Email address for login
password	TEXT	NOT NULL	Hashed password
phone	TEXT		Contact number
created_at	TIMESTAMP		Account creation time

Table 4.1: Students Table Structure

Events Table

Contains information about volunteer opportunities.

Field	Type	Constraints	Description
id	INTEGER	PRIMARY KEY, AUTOINCREMENT	Unique identifier
name	TEXT	NOT NULL	Event name
date	TEXT	NOT NULL	Event date
location	TEXT	NOT NULL	Event location
points	INTEGER	NOT NULL	Points awarded for participation
description	TEXT		Event details
created_at	TIMESTAMP		Event creation time

Table 4.2: Events Table Structure

Registrations Table

Manages the relationship between students and events.

Field	Type	Constraints	Description
id	INTEGER	PRIMARY KEY, AUTOINCREMENT	Unique identifier
student_id	INTEGER	NOT NULL, FOREIGN KEY	Reference to student
event_id	INTEGER	NOT NULL, FOREIGN KEY	Reference to event
role_assigned	TEXT		Volunteer's role
status	TEXT	DEFAULT 'Pending'	Registration status
created_at	TIMESTAMP		Registration time

Table 4.3: Registrations Table Structure

Additional Tables

Similar tables are implemented for Points, Rewards, Redemptions, and Points Adjustments, each with appropriate fields and relationships.

4.3 User Interface Design

4.3.1 User Flow Diagram

The system supports two primary user roles with distinct flows:

- **Admin Flow**: Event creation → Volunteer management → Points administration → Rewards management
- **Student Flow**: Event browsing → Registration → Participation → Points earning → Rewards redemption

4.3.2 Key Interface Components

- Authentication interfaces (login/signup)
- Role-specific dashboards
- Event management interfaces
- Registration management screens
- Points tracking displays
- Rewards browsing and redemption interfaces

4.4 Security Design

Security has been a primary consideration throughout the development process:

- **Authentication**: SHA-256 password hashing with salting
- **Authorization**: Role-based access control for all routes
- **Input Validation**: Server-side validation of all form submissions
- **Session Management**: Secure session handling with timeouts
- **Database Security**: Parameterized queries to prevent SQL injection

Chapter 5

Implementation

5.1 Development Environment

The development environment for VolunteerHub consists of:

- Python 3.8+ as the primary programming language
- Visual Studio Code as the integrated development environment
- Git for version control
- SQLite as the database management system
- Flask as the web framework

5.2 Database Implementation

5.2.1 Database Initialization

The database is initialized with the necessary tables using SQLite's CREATE TABLE statements. Foreign key constraints ensure referential integrity between related tables.

```
def init_db():
    """Initialize the database with tables if they don't exist"""
    conn = get_db_connection()
    cursor = conn.cursor()

    # Create Student table
    cursor.execute('''
    CREATE TABLE IF NOT EXISTS students (
        id INTEGER PRIMARY KEY AUTOINCREMENT,
        name TEXT NOT NULL,
        email TEXT UNIQUE NOT NULL,
        password TEXT NOT NULL,
        phone TEXT,
        created_at TIMESTAMP
    )
    ''')
```

```
17
18      # Create Events table
19      cursor.execute('''
20      CREATE TABLE IF NOT EXISTS events (
21          id INTEGER PRIMARY KEY AUTOINCREMENT,
22          name TEXT NOT NULL,
23          date TEXT NOT NULL,
24          location TEXT NOT NULL,
25          points INTEGER NOT NULL,
26          description TEXT,
27          created_at TIMESTAMP
28      )
29      ''')
30
31      # Additional tables created similarly...
32
33      conn.commit()
34      conn.close()
```

Listing 5.1: Database Initialization Code

5.2.2 Data Access Layer

A set of functions provides a clean interface for interacting with the database, abstracting SQL queries and ensuring consistent data handling.

5.3 Application Layer Implementation

5.3.1 Flask Application Structure

The application is structured around Flask's routing system, with separate route handlers for different functional areas:

- Authentication routes (login, signup, logout)
- Admin routes (dashboard, student management, event management)
- User routes (registration, points viewing, reward redemption)

5.3.2 Key Components

Authentication System

User authentication is implemented using session-based login with password hashing for security.

```
1 @app.route('/login', methods=['GET', 'POST'])
2 def login():
3     if request.method == 'POST':
4         email = request.form.get('email')
5         password = request.form.get('password')
```

```
6
7           user = db.verify_user(email, password)
8           if user:
9               session['user_id'] = user['id']
10              # Additional session setup...
11              return redirect(url_for('user_dashboard'))
12          else:
13              flash('Invalid email or password', 'error')
14
15      return render_template('login.html')
```

Listing 5.2: Authentication Implementation

Points Management System

Points are tracked and updated through a dedicated system that maintains point balances and transaction history.

```
1  def update_student_points(student_id, points_to_add):
2      """Update a student's points balance"""
3      conn = get_db_connection()
4      cursor = conn.cursor()
5
6      # Get current points
7      cursor.execute("SELECT points FROM points WHERE student_id =
           ?", (student_id,))
8      result = cursor.fetchone()
9
10     if result:
11         # Update existing points record
12         new_points = result['points'] + points_to_add
13         cursor.execute("""
14             UPDATE points SET
15             points = ?,
16             updated_at = CURRENT_TIMESTAMP
17             WHERE student_id = ?
18         """, (new_points, student_id))
19     else:
20         # Create new points record
21         cursor.execute("""
22             INSERT INTO points (student_id, points, created_at)
23             VALUES (?, ?, CURRENT_TIMESTAMP)
24         """, (student_id, points_to_add))
25
26     # Record the points transaction
27     cursor.execute("""
28         INSERT INTO points_history
29         (student_id, points_change, reason, created_at)
30         VALUES (?, ?, ?, CURRENT_TIMESTAMP)
31     """, (student_id, points_to_add, "Event participation"))
32
33     conn.commit()
```

```
    conn.close()
    return True
```

Listing 5.3: Points Management Implementation

Rewards System

The rewards system allows administrators to create rewards and students to redeem them using their earned points.

5.4 User Interface Implementation

5.4.1 Template System

The application uses Jinja2 templates for rendering HTML with dynamic content. Base templates provide consistent layout and styling across the application.

5.4.2 Frontend Technologies

The frontend utilizes:

- HTML5 for structure
- CSS3 for styling
- JavaScript for client-side interactions
- Responsive design principles for multi-device support

5.5 Application Screenshots

5.5.1 Home Page

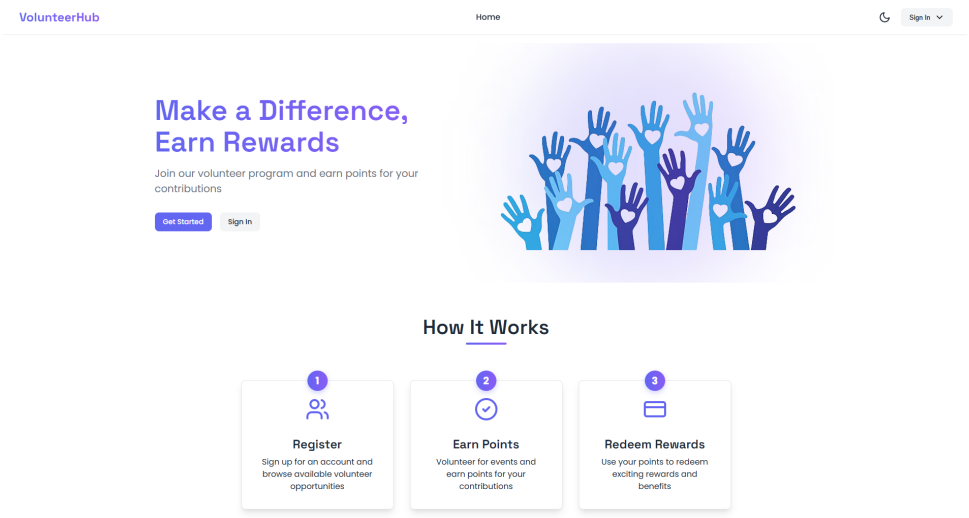
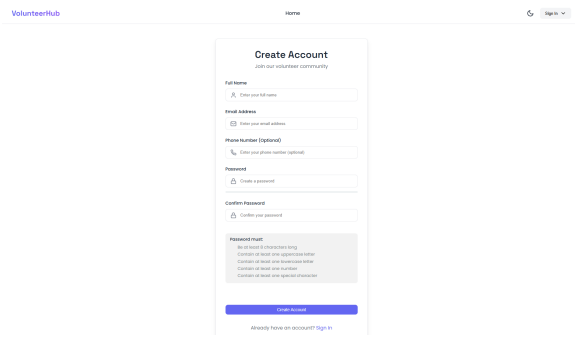
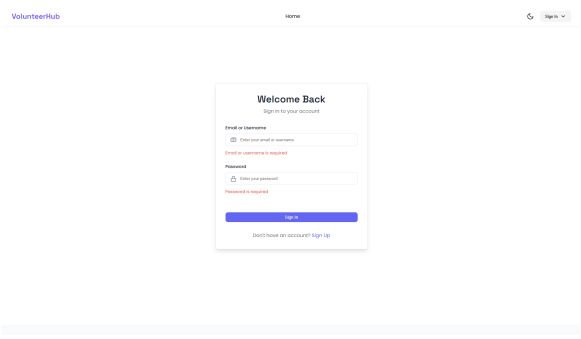


Figure 5.1: VolunteerHub Home Page

5.5.2 User Authentication



(a) Sign Up Page



(b) Sign In Page

Figure 5.2: User Authentication Interfaces

5.5.3 Admin Interfaces

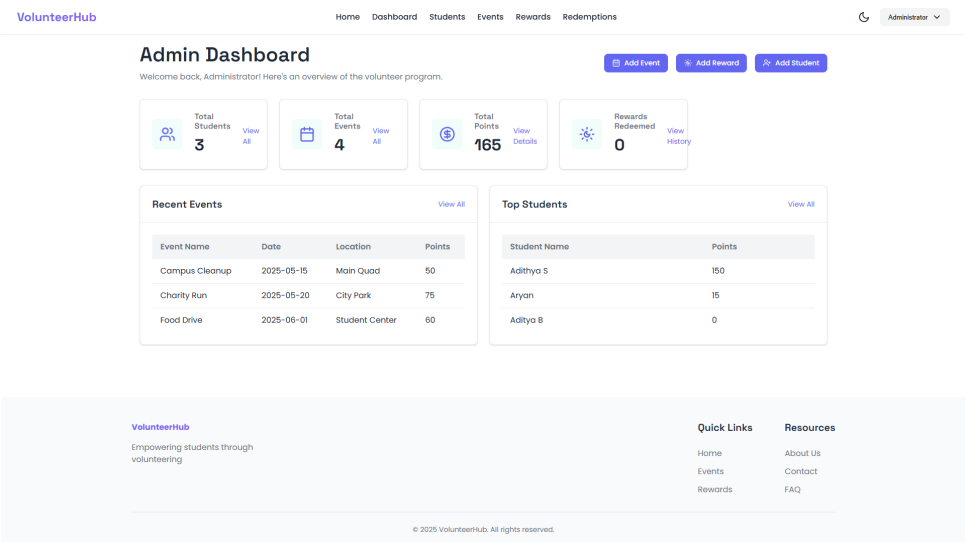
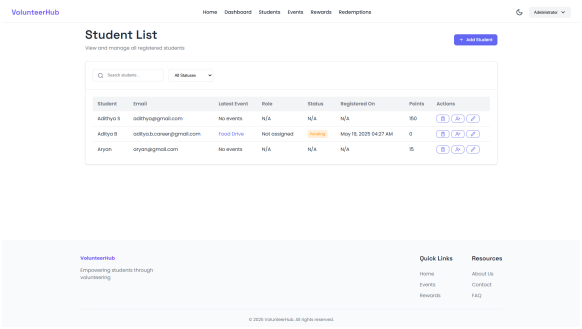
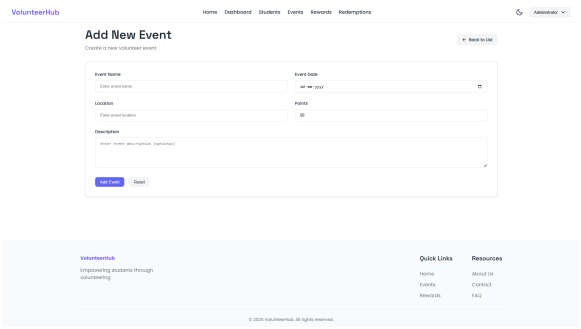


Figure 5.3: Admin Dashboard



(a) Student Management



(b) Event Creation

Figure 5.4: Admin Management Interfaces

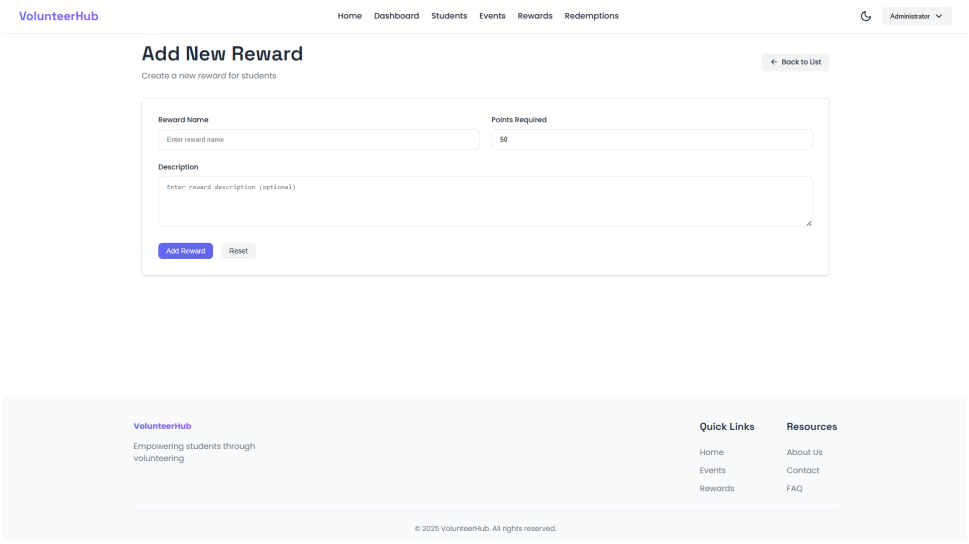


Figure 5.5: Admin Reward Management

5.5.4 Student Interfaces

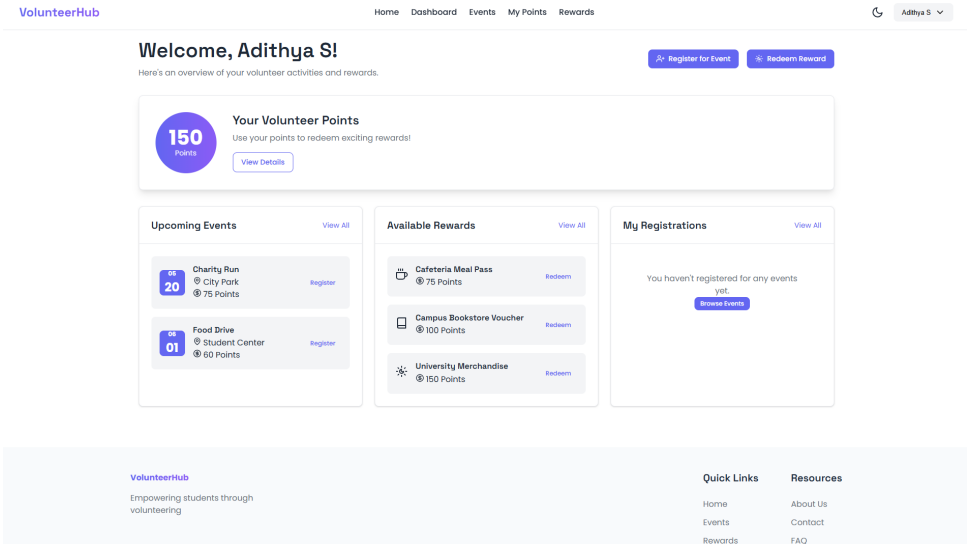
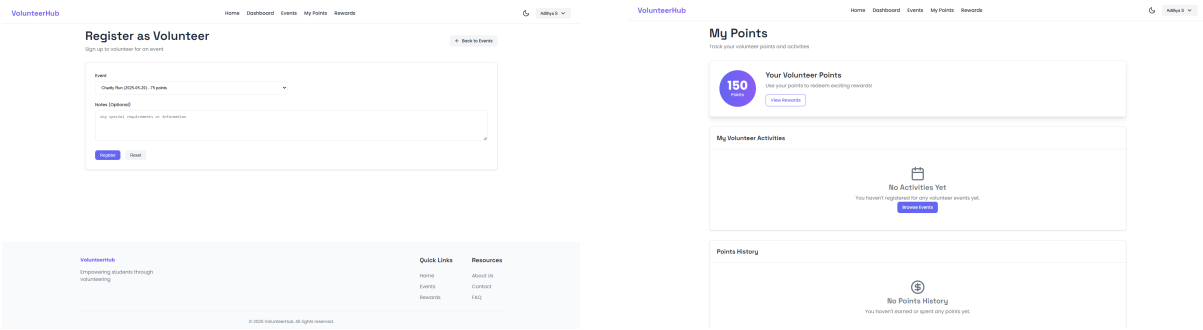
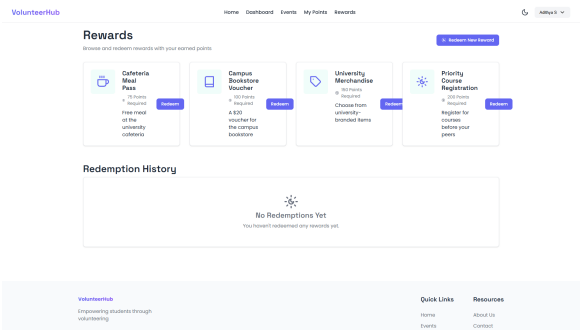


Figure 5.6: Student Dashboard

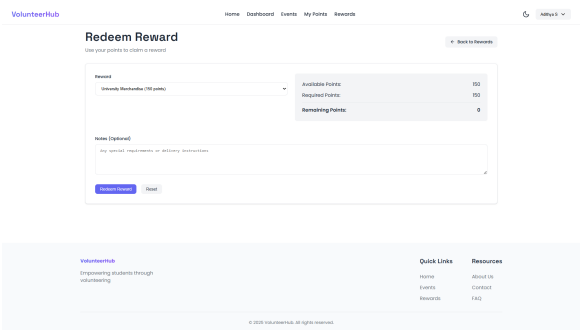


(a) Event Registration (b) Points History

Figure 5.7: Student Activity Interfaces



(a) Rewards Catalog



(b) Reward Redemption

Figure 5.8: Reward System Interfaces

5.6 Testing

5.6.1 Unit Testing

Unit tests were created for core functionality using Python's unittest framework. Key areas tested include:

- Database operations
- Authentication functionality
- Points calculation and tracking
- Reward redemption logic

5.6.2 Integration Testing

Integration tests verified the proper interaction between system components, focusing on:

- Database and application layer integration
- Route handling and template rendering
- Session management and authentication flow

5.6.3 User Interface Testing

UI testing was conducted to ensure:

- Responsive design across different screen sizes
- Form validation functionality
- Proper display of dynamic content
- Navigation flow between pages

Chapter 6

Results and Conclusion

6.1 Project Achievements

The VolunteerHub system successfully implements:

- A complete volunteer management system with dual user roles
- Secure authentication and authorization
- Comprehensive event management capabilities
- Points tracking and rewards redemption functionality
- Intuitive interfaces for both administrators and students

6.2 Evaluation Against Requirements

The implemented system meets all specified functional and non-functional requirements:

- User and event management functions are fully operational
- The points system accurately tracks volunteer participation
- The rewards system enables meaningful incentivization
- Security measures protect user data and system integrity
- Performance metrics meet specified targets

6.3 Key Learnings

Through this project, we gained valuable experience and insights in:

- Database design principles and normalization
- Web application security best practices
- Full-stack development with Flask
- User experience considerations in application design
- Points-based incentive system implementation

6.4 Conclusion

VolunteerHub provides an efficient solution for managing volunteer activities within educational institutions. The points-based system effectively incentivizes student participation while reducing administrative burden. The application successfully addresses the needs of both administrators and volunteers through intuitive interfaces and comprehensive functionality.

The system demonstrates how database management principles can be applied to create practical solutions that address real-world challenges in volunteer management. By centralizing volunteer data and automating key processes, VolunteerHub enhances both administrative efficiency and student engagement in volunteer activities.

Chapter 7

Future Enhancements

The current implementation of VolunteerHub provides a solid foundation for volunteer management. However, several potential enhancements could further extend its capabilities:

7.1 Technical Enhancements

- **Mobile Application**: Develop a dedicated mobile app for iOS and Android to enhance accessibility
- **API Layer**: Create a RESTful API to enable integration with other campus systems
- **Advanced Analytics**: Implement data visualization tools for deeper insights into volunteer participation patterns
- **Scalability Improvements**: Transition to a more robust database system (e.g., PostgreSQL) for larger deployments

7.2 Functional Enhancements

- **Email Notifications**: Implement automated notifications for event reminders, registration confirmations, and reward redemptions
- **Calendar Integration**: Allow synchronization with popular calendar applications
- **Social Features**: Add volunteer teams, leaderboards, and social sharing capabilities
- **Attendance Tracking**: Implement QR code-based attendance verification for events
- **Volunteer Skills Database**: Create a skills inventory to better match volunteers with appropriate roles

7.3 User Experience Enhancements

- **Personalized Recommendations**: Suggest events based on past participation and interests
- **Enhanced Profile Pages**: Allow volunteers to showcase their contributions and achievements
- **Volunteer Journey Map**: Visualize volunteer growth and impact over time
- **Customizable Dashboards**: Allow users to configure their dashboard views

7.4 Administrative Enhancements

- **Report Generation**: Develop comprehensive reporting tools for administrative users
- **Bulk Operations**: Enable batch processing of volunteer approvals, point awards, etc.
- **Role-Based Permissions**: Implement more granular access controls within the admin role
- **Audit Logging**: Enhanced tracking of system operations for security and compliance

These potential enhancements would further strengthen VolunteerHub's value proposition and expand its utility within educational institutions and potentially beyond.

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Appendix A

SQL Schema

```
CREATE TABLE students (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    name TEXT NOT NULL,
    email TEXT UNIQUE NOT NULL,
    password TEXT NOT NULL,
    phone TEXT,
    created_at TIMESTAMP
);

CREATE TABLE events (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    name TEXT NOT NULL,
    date TEXT NOT NULL,
    location TEXT NOT NULL,
    points INTEGER NOT NULL,
    description TEXT,
    created_at TIMESTAMP
);

CREATE TABLE registrations (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    student_id INTEGER NOT NULL,
    event_id INTEGER NOT NULL,
    role_assigned TEXT,
    status TEXT DEFAULT 'Pending',
    created_at TIMESTAMP,
    FOREIGN KEY (student_id) REFERENCES students (id),
    FOREIGN KEY (event_id) REFERENCES events (id)
);

CREATE TABLE points (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    student_id INTEGER UNIQUE NOT NULL,
    points INTEGER DEFAULT 0,
    created_at TIMESTAMP,
    updated_at TIMESTAMP,
    FOREIGN KEY (student_id) REFERENCES students (id)
```

```
);

CREATE TABLE rewards (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    name TEXT NOT NULL,
    points_required INTEGER NOT NULL,
    description TEXT,
    created_at TIMESTAMP
);

CREATE TABLE redemptions (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    student_id INTEGER NOT NULL,
    reward_id INTEGER NOT NULL,
    points_used INTEGER NOT NULL,
    notes TEXT,
    created_at TIMESTAMP,
    FOREIGN KEY (student_id) REFERENCES students (id),
    FOREIGN KEY (reward_id) REFERENCES rewards (id)
);

CREATE TABLE points_history (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    student_id INTEGER NOT NULL,
    points_change INTEGER NOT NULL,
    reason TEXT NOT NULL,
    created_at TIMESTAMP,
    FOREIGN KEY (student_id) REFERENCES students (id)
);
```

Listing A.1: Complete Database Schema

Appendix B

Project Timeline

Day	Phase	Tasks Completed
1-2	Requirements Analysis	Problem definition, user stories, requirements specification
3-4	Design	Database design, architecture planning, UI wireframing
5-7	Implementation (Core)	Database setup, authentication, basic CRUD operations
8-10	Implementation (Features)	Points system, rewards system, admin functions
11-12	Testing	Unit tests, integration tests, UI testing
13-14	Refinement	Bug fixes, performance optimization, UI improvements
15	Documentation	Final documentation, user guides

Table B.1: Project Development Timeline