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AI Chatbot-Based Online Ticket Booking System: A Comprehensive Study on Architecture, NLP Integration, and User Experience

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Abstract: *This research paper presents the design and implementation of an AI chatbot-based e-ticketing system developed for cultural heritage monument and event booking. The system was designed using Python and Flask with a*
rule-based Natural Language Processing approach to simplify online booking interaction. The project integrates monument management, event booking, user authentication, chatbot-assisted navigation, and administrative management into a unified web platform. The application follows MVC architecture and implements secure session handling, password hashing, and role-based access control to improve security and usability.
Experimental testing in a controlled local environment demonstrated improved interaction flow, simplified ticket booking, and reduced manual navigation compared to traditional form-based systems.

Keywords: AI Chatbot-Based Online Ticket Booking System: A Comprehensive Study on Architecture, NLP Integration, and User Experience

I. INTRODUCTION

Digital transformation has significantly changed how users interact with online ticket booking systems. Traditional booking portals generally require users to navigate through multiple pages and manually fill forms, which may increase complexity and reduce user convenience. Conversational AI systems provide an alternative interaction method by enabling users to communicate naturally with the platform. The proposed AI chatbot-based e-ticketing system was developed as a prototype platform inspired by heritage monument and cultural event ticket booking requirements. The system combines chatbot-assisted interaction with a responsive web interface to help users browse monuments, view events, check pricing, and complete bookings more efficiently. The project was implemented locally for academic and research purposes. The main objective of this study was to explore how lightweight NLP techniques and modular web architecture can improve usability, security, and user experience in ticket booking systems.

II. PROPOSED SYSTEM ARCHITECTURE

The proposed system follows a modular MVC-based architecture divided into multiple layers. 1. Presentation Layer: Built using HTML5, CSS3, and JavaScript, this layer provides interactive user interfaces for booking, monument browsing, login, chatbot interaction, and administration. 2. Application Layer: The Flask framework handles routing, REST API processing, business logic, booking validation, and chatbot responses. 3. NLP Processing Layer: A rule-based NLP engine implemented using Python regular expressions identifies user intents such as monument search, booking requests, event queries, and support requests. 4. Database Layer: SQLite was used for persistent storage of users, bookings, monument records, and event details. 5. Security Layer: PBKDF2-HMAC-SHA256 hashing, session management, rate limiting, and role-based access control were implemented to improve authentication and prevent unauthorized access.

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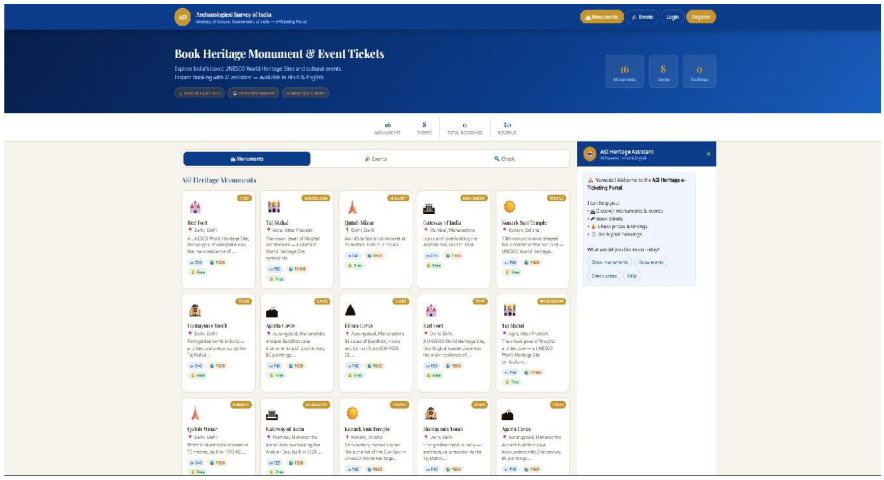
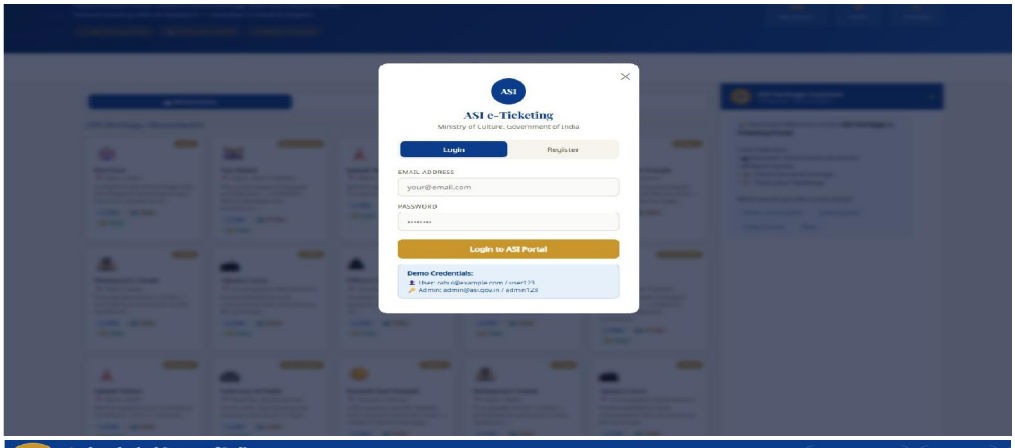
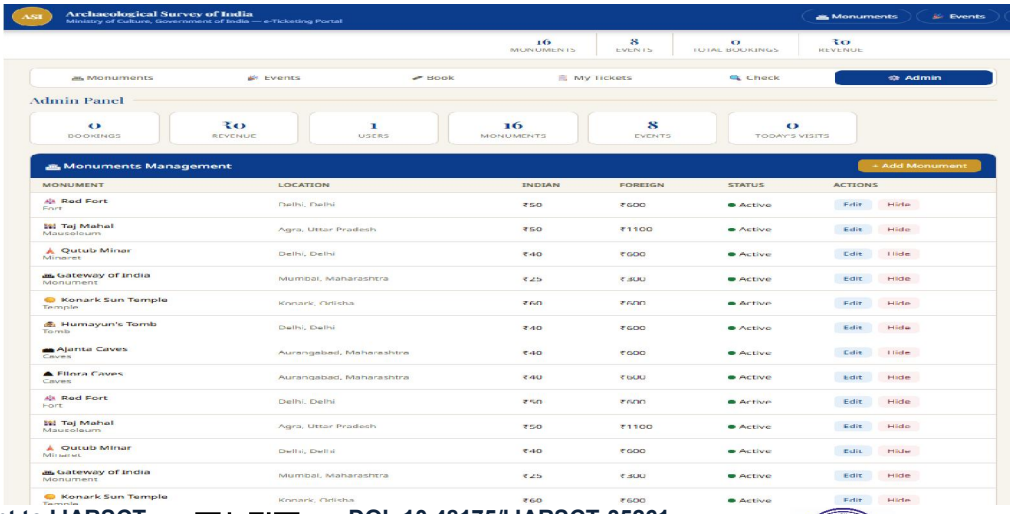
III. SYSTEM INTERFACE & IMPLEMENTATION

The following screenshots show the implemented user interface, login module, chatbot integration, and administrative management dashboard developed for the prototype system.







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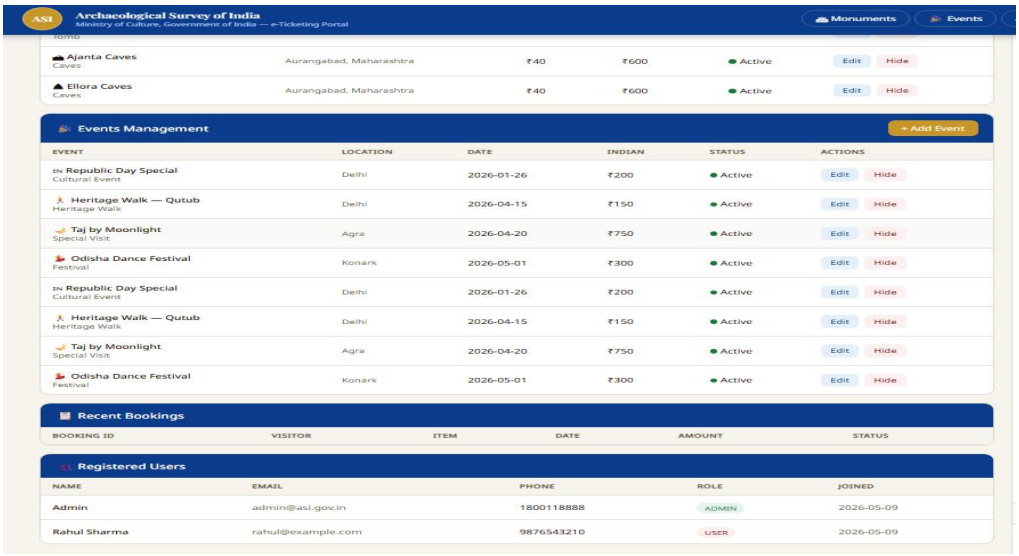

IV. WORKFLOW AND PROCESSING

The system workflow begins when a user accesses the portal and interacts with the AI chatbot or navigation interface. The user can browse monuments, check event schedules, view ticket prices, and initiate booking requests. The chatbot processes user input using predefined rule-based intent matching and redirects the user to appropriate modules. Booking details are validated through backend APIs before reservation confirmation. Upon successful booking, records are stored in the SQLite database and displayed in the user dashboard. Administrative users can manage monuments, events, ticket pricing, and booking records using the admin dashboard.

V. TECHNOLOGIES USED

Technology	Purpose
Python 3	Core backend programming language
Flask	REST API and web application framework
SQLite	Database management
HTML/CSS/JavaScript	Frontend interface
Rule-Based NLP	Intent detection and chatbot response
PBKDF2-HMAC-SHA256	Secure password hashing
MVC Architecture	System structure organization
Role-Based Access	Admin and user differentiation

VI. RESULTS AND PERFORMANCE ANALYSIS

Prototype testing was performed in a local environment using multiple user booking scenarios. The chatbot-assisted workflow demonstrated smoother interaction compared to traditional multi-form navigation. The implemented system reduced repeated navigation steps and improved accessibility for users unfamiliar with complex booking interfaces. The admin management system also simplified CRUD operations for monuments and cultural events.

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Metric	Observation
Booking Navigation Complexity	Reduced
User Interaction Flow	Improved
Manual Data Entry	Reduced
Admin Management Efficiency	Improved
Local Prototype Stability	Stable During Testing

VII. LIMITATIONS AND FUTURE SCOPE

Although the system demonstrated stable functionality during prototype testing, several limitations remain. The current chatbot uses rule-based NLP instead of machine learning-based language models, which limits conversational flexibility. The system also operates locally and has not been tested under large-scale concurrent traffic conditions. Future enhancements may include multilingual support, voice-based interaction, cloud deployment, recommendation systems, and machine learning-based conversational models.

VIII. CONCLUSION

This paper presented the design and implementation of an AI chatbot-based e-ticketing platform for heritage monuments and cultural events. By combining Flask-based backend development, rule-based NLP, REST APIs, and secure authentication mechanisms, the system provides an efficient and user-friendly booking experience. The project highlights how conversational interfaces can simplify digital booking systems and improve accessibility for users. The modular architecture also enables future scalability and feature integration.

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