

AI-Powered Chatbot-Based Ticket Booking System for Museums

1st Dhanush Udesh
dept. of CSE
REVA University
Bengaluru, India
dhanushu1917@gmail.com

2nd Deepti Padmakar Jogdankar
dept. of CSE
REVA University
Bengaluru, India
deepti.pj30@gmail.com

3rd Anas Shamsuddin Syed
dept. of CSE
REVA University
Bengaluru, India
anasshams1960@gmail.com

4th Madhur Parasaniya
dept. of CSE
REVA University
Bengaluru, India
madhurparasaniya@gmail.com

Abstract—Museums function as essential institutions that safeguard cultural heritage, but their existing ticketing systems force visitors to wait in long lines while entering their premises. This paper presents an AI-enabled multilingual chatbot-based museum ticket booking system integrated with analytics and machine learning for crowd prediction. The system uses Natural Language Processing (NLP) technology to provide users with three functions which include ticket booking and information access and secure payment processing. The system uses a client-server architecture that separates its components into four parts which include chatbot processing and booking management and payment integration and an administrative dashboard. The dashboard system delivers real time information about visitor movement patterns and booking activities. A Random Forest Regression based model uses historical data to forecast upcoming visitor numbers at different time slots, which allows for better crowd management and planning operations. The proposed system reduces manual effort, improves operational efficiency, and enhances the overall visitor experience.

Index Terms—Museum Ticketing System, Chatbot, Natural Language Processing, Multilingual Systems, Random Forest Regression, Crowd Prediction, Data Analytics, Client-Server Architecture, Online Payment Integration

I. INTRODUCTION

The function of museums extends beyond artifact display because they serve as centers which maintain historical knowledge while sharing new research findings and providing educational opportunities to visitors. The traditional ticketing system, which relies on physical counters, cannot meet current needs because more visitors seek entry while digital services gain importance. The system experiences excessive waiting times which prevent people

from receiving service because the available staff cannot manage the high demand times. The process of manual ticketing operates at a slow pace because it generates multiple mistakes and it becomes impossible to manage large audiences. The development of technology brings about a new revolution. Artificial intelligence together with web based tools creates a more intelligent and efficient public services system. The most notable feature of chatbots. The system enables visitor assistance through live support which uses simple language to address visitor inquiries and ensures seamless operation. The system enables users from different language groups to access its features, which makes museums more accessible to all visitors. The paper presents a multilingual AI-powered chatbot system which enables museum ticket booking through its automated ticketing process, which increases operational efficiency together with improved visitor experience. The system combines natural language processing for conversational dialogue with a secure payment gateway that enables instant payments and an administrator dashboard which enables staff to observe system operations while collecting visitor information in real time. The system employs a machine learning based crowd prediction model which operates on Random Forest Regressor for visitor trend detection, which helps museums achieve better capacity management.

II. THE KEY CONTRIBUTIONS OF THIS WORK INCLUDE

The project will create a chatbot which can communicate in multiple languages to handle automatic ticket booking and provide information to users. The project will implement secure online payment processing which will enable businesses to automate their payment operations from start to finish. The project will create an analytics module which enables organizations to track and analyze

their visitor activities. The team uses machine learning methods to predict crowd movements and optimize space usage.

III. RELATED WORKS

Researchers have studied automated ticketing systems and chatbot technologies and advanced visitor management systems during the last three years. The majority of online ticket booking platforms still operate with traditional web pages which provide basic functions but lack both visual appeal and personalized user experience. The platforms provide limited support during actual time and they face difficulties when customers request assistance beyond their fundamental inquiries. Natural language processing improvements have turned chatbots into a vital technology for modern business operations. Developers create chatbots which understand users' intended meanings and maintain functional dialogue. The technology decreases employee tasks while enhancing response times. Researchers have explored the possibility of combining chatbots with ticketing and reservation systems which enable users to book tickets and access information through chat-based interactions. The system simplifies user experience while creating a more approachable design yet the system omits advanced functions which include real time data analysis and forecasting abilities. Data analytics has emerged as the primary method for visitor management since it enables organizations to track visitor movements while enhancing their operational efficiency. Research studies continue to demonstrate that public institutions which include museums and cultural centers achieve better results when they base their choices on actual data. Random Forest Regression machine learning models have shown excellent prediction capabilities for structured data through their performance in predictive analytics tasks. The models successfully detect intricate patterns and connections between different elements in his data.

IV. PROPOSED SYSTEMS

The system provides users with a chatbot that enables them to book tickets and retrieve museum information while executing payment processing tasks from a single interface. The system operates differently from traditional booking systems because users interact with it through natural language conversations which provide a more welcoming experience and support multiple languages so that users from different linguistic backgrounds can use it without encountering communication obstacles. The museum staff uses a dedicated dashboard which operates independently from the public area of the museum. Staff members can monitor all visitor bookings while they track incoming visitors and make necessary updates to facility information. The museum uses analytics and predictive modeling tools to obtain actual visitor data which helps

them understand visitor behavior and make better decisions for future developments.

A. System Architecture

The system follows a modular client-server architecture that needs three main components to operate: [1] User Interface Layer: It creates a web based interface which users can access through both desktop computers and mobile devices. The system provides three main functions which users can access through the interface: The chatbot interaction interface, ticket booking interface and museum information display system. [2] Application Layer: The Application Layer operates as the system's main functional component which manages all system operations through its execution of the following tasks. The system supports three essential functions which include processing chatbot interactions, executing payment transactions and providing access to administrative dashboard features. [3] Data Layer: The system uses a central database to handle storage and management of Booking records, Payment transactions and Analytics data. The system achieves its ability to scale and maintain performance through its layered architectural design which also supports efficient data processing.

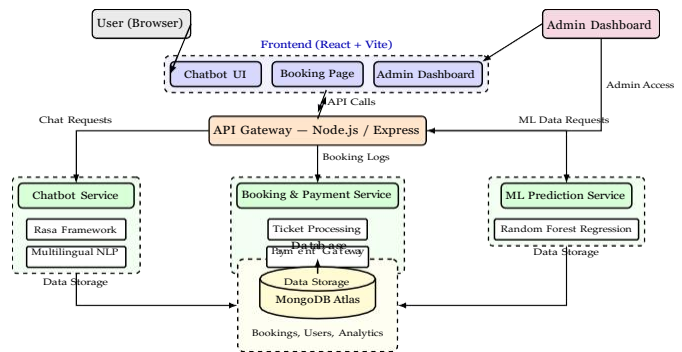


Fig. 1. System Architecture of the Proposed Museum Chatbot and Ticket Booking System

B. Chatbot Module

Users interact with the system through the chatbot because it serves as their primary connection point. The system uses natural language processing technology to create conversational experiences which users find simple and natural. The system greets users and identifies their preferred language while providing answers to their museum inquiries. The service assists users in purchasing tickets by requesting their date and time information along with their desired ticket quantity before directing them to the payment process. The system verifies the booking after the customer completes the payment process. The chatbot operates through an intent based framework. The system uses user intent detection to provide relevant responses that maintain interaction accuracy.

C. Multilingual Support

The system provides multiple language options to enable all users to access its content. Users choose their preferred language at the beginning which leads the chatbot to use that language throughout their conversation. The system achieves this goal through three main methods which include present tense language response datasets and user intent mapping to multilingual output systems and user selection based response flow changes. The system allows users from different backgrounds to access its features with minimal effort.

D. Ticket Booking Module

The ticket booking module handles every step of reserving a visit. Users select their desired date and time slot and ticket type through the chatbot. The system provides three main capabilities which include The system enables users to check ticket availability at any time The system sends users an instant booking confirmation The system controls visitor access through its time slot capacity limits. The museum operates its visitor limit system to maintain optimal crowd levels which enhance visitor satisfaction during their museum experience.

E. Payment Integration

The system includes a secure online payment gateway which allows users to purchase tickets without needing to use cash. After you confirm your booking the system automatically takes you to the payment page. The payment process requires four steps which include secure transaction processing and instant payment verification and automatic booking confirmation and storage of transaction records. The entire system functions as a complete automated solution because all of its processes run without human involvement.

F. Admin and Analytics Module

The administrative module provides a centralized interface which enables system operation management together with visitor data analysis. The admin functions include the following tasks. The system allows users to monitor bookings as they occur. The system enables users to control chatbot interactions and their corresponding material. Users can access their transaction history through the system. The system allows users to create both reports and analytical data. The analytics features include the following functions: The system allows users to analyze the number of visitors to their site, determines their busiest operational times, allows users to monitor which languages their visitors prefer and tracks both revenue and booking activities to display current business patterns. The data insights enable organizations to make decisions based on information, which results in better operational efficiency.

G. ML-Based Crowd Prediction

The system uses an AI-based crowd prediction system which analyzes historical booking records to predict upcoming visitor numbers. The system enables administrators to optimize their operational choices through identification of busy times. The model which was constructed using Random Forest Regression enables optimization of time slot distribution and crowd management and resource planning which results in enhanced system efficiency and proactive operations.

V. METHODOLOGY

The system operates through its modular design which consists of multiple independent layers. This design enables simple expansion and upkeep tasks while maintaining system reliability. The system architecture consists of independent modules which communicate with one another through defined interface standards. System updates can be performed through the addition of new languages and museum installations and the introduction of different payment methods without requiring complete system modifications. The system architecture consists of three primary operational layers which include User Interaction Layer and Application Logic Layer and Data Management Layer.

A. User Interaction Layer

Chatbot Interface: The chatbot serves as the starting point for users. The platform functions as a web based conversational interface which enables users to enter their questions and requests through typing. The system requires users to select their preferred language at the beginning and maintains that selection throughout their interaction. The chatbot system has been built to manage three different types of tasks. The first task involves users requesting ticket reservations. The second task requires users to ask questions about museum related matters. The third task needs users to request help with system navigation. The system applies predefined conversational flows to maintain uniformity in its responses while delivering precise answers.

Museum Information Interface: The system provides a direct information interface for users who do not prefer to chat. The current interface allows users to browse through its content. The system presents museum history information together with exhibit details and opening hours and operational guidelines in an organized format. The system provides two types of user interface options which enable users to choose their preferred method of interaction.

B. Chatbot Processing and Conversation Flow

The chatbot operates through an intent based system which analyzes user inputs to identify specific predefined intents that include booking requests and information queries and help commands. The system uses detected user

intent to choose the correct response for every user interaction. Rasa technology drives the ticket booking system which lets users start their booking process by entering their visit date and time slot and selecting ticket types and quantities while the system verifies seat availability. The system redirects users to the payment gateway after they complete their confirmation process. The structured method reduces potential errors while it supports an uninterrupted and dependable process for booking activities.

C. Ticket Booking and Capacity Management

The booking system handles ticket reservations and keeps visitor numbers in check. The system checks the database for real time availability when someone picks a time slot. The reservation proceeds when there are enough tickets but the user must choose another slot when there are not enough tickets. The process controls museum visitor numbers while maintaining smooth visitor movement throughout the museum.

D. Payment Gateway Integration

The payment process operates through an online payment gateway which enables secure transactions while maintaining complete automated operations that use no cash. Users proceed to the payment page after they complete their booking details review and confirmation process. The backend server verifies the transaction after payment success while the system stores booking details in the database and generates an electronic ticket which receives confirmation. This method maintains data integrity while it prevents any unintentional booking of reservations.

E. Backend Processing and Data Management

The backend server operates the main application through its ability to handle all chatbot interactions while verifying bookings and payment status and controlling all database information. The central database stores all visitor information as well as booking information and payment records and chatbot logs and language preferences and visit times. The database design maintains data integrity while enabling efficient retrieval of information needed for analytics and reporting purposes.

F. Admin Portal Implementation

The admin portal serves as a secure access point for authorized staff who require role specific access rights. The system gives administrators complete authority to handle all daily operational activities. The system enables users to handle bookings and payment tracking while updating chatbot data and managing museum content and producing comprehensive reports. The tools enable admins to monitor system operations while simplifying their management tasks.

G. Analytics and Reporting Mechanism

The analytics module takes all the data the system collects and turns it into real insights. Our statistical analysis of booking and transaction records helps us identify patterns and trends that matter most to our research. The reports provide more than basic information because they display daily and monthly visitor counts and show ticket distribution across categories and track user language preferences and display revenue trends across different time periods. The details assist the team with planning activities and they enable better decision-making and identification of optimal resource usage areas.

H. Deployment Strategy

The system functions as a web application which users can access from multiple devices to achieve flexibility in their usage. The system uses cloud deployment to fulfill essential requirements which include scalability and availability and performance requirements. The deployment strategy includes hosting frontend and backend services on platforms like Vercel and Render, using scalable database solutions such as MongoDB Atlas, and implementing monitoring and backup mechanisms. The system can manage growing user traffic because of its design which maintains consistent operational performance throughout extended periods.

VI. IMPLEMENTATION DETAILS

A. Frontend Implementation

The system implements current web development technologies to create an interactive user interface which operates at high speed. The system development uses React.js together with Vite and Tailwind CSS and JavaScript and Chart.js. The frontend of the application provides essential functions through its chatbot interface and ticket booking system and museum information pages and admin dashboard which displays analytics data. The developer team uses React.js because it provides a modular system which enables them to create components while Tailwind CSS enables designers to create consistent designs which work on different device types. Chart.js transforms unprocessed data into understandable interactive visualizations which help both users and administrators to interpret and examine data.

B. Chatbot and NLP Implementation

The system applies its authentic natural language processing capabilities through the chatbot module which uses open-source frameworks and established natural language processing tools. The system employs these technologies: The system uses Rasa as its main dialogue management system. The system uses spaCy to achieve its advanced text processing capabilities. The system uses TensorFlow through Rasa DIET model to achieve intent classification and entity recognition. The chatbot handles all tasks which include recognizing user intent, selecting essential

information, and guiding dialogues with users who speak different languages. Rasa allows us to create dialogue paths which match user requirements instead of depending on pre-prepared answers. The DIET model increases accuracy for detecting user requests and their specific elements which makes the chatbot an effective contact method for users.

C. Chatbot API and Integration

The system operates its chatbot as a separate service which communicates with its backend through application programming interfaces. The system depends on Rasa Server to handle its REST API requests while FastAPI manages all required custom services. The system maintains separate paths for main application logic and chatbot logic which enables better system performance through independent updates and expansion capability. User requests move through the entire system without experiencing any delays. The chatbot system processes user interactions by extracting their intents and details about entities which it sends to the backend system. The backend system manages all aspects of ticket booking and transaction processing.

D. Backend and Business Logic

The system’s core processing center operates as the backend which connects all system components through its primary functions. The system uses Node.js and Express.js as its backend development framework. The backend handles all ticket reservation processes which include checking available slots and validating user entries and confirming payment details and creating tickets and managing administrative login procedures. The system collects data for analytical purposes while maintaining its operational efficiency through organized processes.

E. Database Implementation

The system employs a NoSQL database for its data management needs because the database provides flexible and scalable features which are essential for the expansion of the platform. The system operates on MongoDB Atlas which enables it to process both structured and semi-structured data efficiently. The database contains essential details which include user information, booking records, payment transaction history, chatbot interaction data, visitor analytics information, and administrative content. MongoDB handles multiple data formats efficiently which makes it an ideal solution for situations that require handling unpredictable data structures such as chatbot logs and analytics use cases.

F. Payment Integration

The system implements a QR-based payment solution which provides fast secure payments through its integration of Razorpay APIs and Razorpay QR. The backend system creates a payment request which results in a QR code being shown to the user. The user scans the code

to make the payment which allows the backend to check transaction status throughout the process. The system generates and delivers the ticket after the payment receives successful confirmation. The real time workflow system helps maintain continuous operations while it reduces processing times which results in users experiencing an efficient and trouble free payment process.

G. ML-Based Crowd Prediction Implementation

The system uses machine learning methods to predict crowd sizes which helps organizations improve their planning process. The system uses Python programming language together with Pandas and NumPy libraries for its data processing needs while TensorFlow serves as the framework to create and develop machine learning models. The system uses Random Forest Regression which functions as an ensemble machine learning approach to evaluate structured datasets and forecast results through its multiple input variables. This model achieves its high performance because it can identify complex relationships and deliver accurate results through its efficient processing requirements.

Time Slot Capacity (%)	Visitor Count Range	Crowd Level
0% – 40%	Low visitors	Low
41% – 70%	Moderate visitors	Medium
71% – 100%	High visitors	High

Table 1: Crowd level classification based on capacity

H. Analytics and Reporting

The analytics module processes system data to generate meaningful insights for administrators. Node.js serves as the data aggregation system while MongoDB’s Aggregation Framework processes data with high efficiency. For visualization, Chart.js delivers interactive data presentation that users can view with full clarity. The dashboard tracks key metrics such as visitor trends, revenue breakdowns, ticket categories, and user language preferences. All this information is displayed as interactive charts within the admin dashboard, which enables users to find patterns that help them make quick and informed decisions.

I. Security and Deployment

The platform achieves security and reliability through its implementation of multiple protection systems. The system secures all communications through HTTPS encryption while it uses JWT for user session authentication and role-based access control. The system uses proper input validation together with strong error handling methods to stop possible problems from developing. The deployment process requires the frontend to be deployed on Vercel while the backend operates on Render. The system uses Rasa for its chatbot functions and Random Forest Regression for crowd prediction because these two technologies power its machine learning capabilities. The system uses MongoDB Atlas for database management. The complete system operates on a cloud infrastructure

which provides efficient scaling and dependable performance while enabling users to access it from different devices at any location.

VII. ML-BASED CROWD PREDICTION MODEL

A. Motivation for Crowd Prediction

Museum crowd management requires more than maintaining order because it serves as the main method to ensure visitor safety and comfort. The traditional ticket booking systems prevent administrators from tracking customer behavior because they lack essential pattern detection features. The system lacks peak time prediction capabilities which makes it impossible to plan staff operations during busy periods. That's where crowd prediction comes in. A system that predicts future visitor volume through analysis of past booking information will enable us to create accurate forecasts. The system enables administrators to establish time slots which determine appropriate staff levels required for operational success.

B. Dataset Description

The prediction model begins its training process through the use of historical booking data which the museum maintains in its internal system. The record contains information about the date of the visit, the assigned time slot, the total number of tickets sold, the different ticket types, and the timestamps of each booking. The system collects data at both hourly and daily intervals which enables the model to recognize crowd movement patterns and seasonal trends throughout the day.

C. Data Preprocessing

The data undergoes cleaning and structuring processes before being used in model training to guarantee that all data elements meet quality and consistency standards. The process involves three steps: discarding incomplete data, standardizing numerical data, and transforming the data into time series format.

D. Random Forest Regression Model Architecture

The model uses Random Forest Regression to create a predictive analysis system which works effectively with structured data. The system estimates visitor counts for different time slots by using historical booking records and time slot and booking count and date and day type features. The model establishes non-linear relationships which link time and booking patterns and visitor behavior through its built-in time based booking patterns and visitor behavior tracking mechanisms. The ensemble method selects multiple decision trees which apply to various data subsets thus enhancing prediction accuracy while decreasing overfitting. The system learns feature based patterns through its training process because it does not depend on sequential patterns which helps actual crowd prediction scenarios. The final output is generated through tree prediction aggregation which uses averaging to compute visitor count estimates.

E. Model Training

The team develops the Random Forest model by creating multiple decision trees which they train on various parts of their dataset. The system combines predictions from all trees to achieve better accuracy results while decreasing the risk of overfitting. The team evaluates model performance through the use of Mean Squared Error (MSE) as their evaluation metric. The trained model uses historical booking data patterns to predict future visitor numbers during upcoming time slots.

F. Prediction and Output

The model estimates visitor counts while it detects peak visiting times and studies crowd movement patterns throughout the day. The predictions provide administrators with the necessary information to make decisions about adjusting ticket availability and managing visitor flow and scheduling staff and resources.

G. Advantages of the Proposed Model

The Random Forest Regression model delivers dependable and precise predictions because it analyzes structured booking data to identify complex relationships. The model's ensemble design decreases overfitting while boosting its ability to make accurate predictions about new data. The model needs less computational power than machine learning methods, which makes it appropriate for use in real time systems.

H. Limitations

Although the Random Forest Regression model demonstrates effective performance, it contains certain limitations. The system needs enough precise and dependable historical information to produce trustworthy forecasts because its performance depends on the quality of actual data. The model fails to predict sudden changes because it does not include special events, holidays, and unexpected disruptions as training data elements.

VIII. RESULTS AND EVALUATIONS

A. System Performance Evaluation

The system underwent testing in various scenarios, which showed its ability to operate properly while maintaining reliable performance for all operations. The chatbot based booking system managed user interactions, ticket bookings, and payments in real time without any issues. The chatbot delivered accurate responses based on predefined intents, while users needed minimal effort to complete the booking process. Payment integration through Razorpay delivered both rapid transaction processing and secure payment methods. The system continued to operate at stable performance levels during periods of medium user activity. The system achieved successful automation of ticket booking while maintaining user friendliness and reliable operation.

B. Chatbot Performance

The evaluation of chatbot performance tested its ability to correctly identify user intentions while extracting suitable information from users. The main evaluation criteria for the system included intent recognition accuracy and response time together with the user interaction success rate. The DIET model enabled the chatbot to achieve accurate intent classification while it successfully retrieved information about date and time and ticket numbers. The system achieved fast response times which allowed users to interact with the system swiftly while they experienced natural conversation flow.

C. Booking System Efficiency

The testing of the booking module showed that it could manage bookings while maintaining essential capacity restrictions. The system successfully conducted real time ticket availability checks while it maintained accurate visitor capacity limits per time interval and processed multiple booking requests simultaneously without system errors. The method successfully stopped excessive bookings while it controlled visitor movement, which made it an effective solution for managing visitor capacity in museums.

D. Payment System Evaluation

The testing process evaluated the payment gateway's ability to handle secure and dependable transactions. The testing results showed that The system processed transactions through encrypted channels which ensured protected transmission of data. The payment verification process achieved instant completion. The system generated booking confirmation immediately after receiving payment without any waiting time. The system canceled the booking immediately after payment failure while maintaining complete record integrity.

E. Crowd Prediction Model Evaluation

The proposed Random Forest Regression model was evaluated using standard regression metrics, including Mean Squared Error (MSE) and Root Mean Squared Error (RMSE). The results demonstrate that the model successfully identifies patterns in historical booking data which it uses to forecast visitor counts during various time periods. The model successfully identifies peak visiting hours and analyzes variations in crowd flow with consistent performance. The prediction accuracy of the system depends on both the quality and quantity of its incoming data. The model successfully demonstrates its capacity to assist crowd management and operational planning through data-based insights.

F. Analytics and Visualization

The analytics module extracts valuable insights from booking and transaction data and presents them as clear, visual outputs on the admin dashboard. The system uses Chart.js to show essential metrics which include visitor

count trends, peak visiting hours, ticket category distribution, language usage statistics, and revenue trends. Administrators can use these interactive visuals to identify patterns more easily than they could with raw data which enables them to make quicker and better decisions.

G. Comparative Advantages

The system performs better than conventional ticket booking systems through multiple critical advantages. The system reduces customer waiting periods through its automatic processing system. The system enables more people to obtain tickets through its ability to support multiple languages. The system helps users navigate better through its use of chatbots. The system uses predictive analytics to improve its ability to control crowd movement. The system provides administrators with integrated analytics tools that enable them to make decisions based on data.

IX. DISCUSSION

The museum ticket booking system which uses AI to support multiple languages functions as a revolutionary system that replaces traditional ticketing methods. The system enables faster processing while improving accessibility and creating efficient workflows. The system combines natural language processing and web applications with machine learning technology to create a contemporary museum solution. The system features a user friendly interface which enables anybody to navigate its functions. The chatbot enables users to complete their ticket reservations without complex procedures. The system becomes more accessible because it supports multiple languages which enables all users to interact without language barriers. The implementation of a protected online payment system enables total automation while eliminating the need for cash transactions. The system improves ticket reservation processes by providing complete visibility of the payment procedure. The system uses predictive modeling and analytics tools to enhance its decision-making abilities. The Random Forest Regression based model uses visitor pattern data to predict crowd behavior which helps administrators make resource allocation decisions and improve crowd management. The process of developing the system encounters multiple obstacles. The chatbot requires high-quality training data together with defined operational scenarios to achieve optimal performance. The system experiences difficulties when users present questions which are highly abnormal. The system needs consistent historical data to forecast crowd numbers but unexpected events and holidays interrupt this data flow. Unstable internet connections reduce system performance because entire web-based applications depend on consistent internet access and users in affected areas experience more difficulties when using the system.

X. CONCLUSION

This paper presents an AI-powered, multilingual chatbot system designed to simplify museum ticket booking

while providing strong visitor analytics. The system integrates an automated platform which delivers smooth operations through its combination of chatbot interaction secure payments and real-time insights while it replaces the slow and confusing conventional methods. The Rasa-powered chatbot uses natural language processing to enable users with basic dialogue skills to book tickets and get information and make payment transactions. The system offers multilingual support to help different types of visitors access its features. The admin portal enables staff members to handle bookings and payments and visitor information throughout the system. The system includes a crowd prediction model based on Random Forest Regression which uses historical data to predict future visitor patterns and enhance operational planning. The analytics module provides detailed information about how users interact with the system and how the system performs which helps organizations make decisions more quickly and accurately. The system uses an intelligent system to create a scalable solution which decreases manual work and boosts operational efficiency while providing better visitor experiences.

XI. FUTURE WORK

The system establishes essential foundation elements which enable automated ticketing systems for museums and their visitor control functions, yet its current performance can still be enhanced through additional development work. First, upgrading the chatbot with more sophisticated natural language processing think transformer based models would make conversations smarter and more attuned to context. The system will achieve major accessibility improvements through voice interaction support which allows users to interact with the system through their natural speech patterns. The system needs better crowd prediction capabilities to achieve its ultimate goals. The system uses extra data which includes weather conditions and public holiday information and local events to improve its visitor trend prediction accuracy. The platform will expand to support multiple museums and cultural sites, which will create a centralized system for managing operations across multiple locations. The system will become more effective and practical for actual museum operations through these improvement initiatives.

XII. ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to our project guide, Prof. Ravi B K, Assistant Professor, School of Computer Science and Engineering, REVA University, for his valuable guidance, continuous support, and encouragement throughout this research work. The Department of Computer Science and Engineering at REVA University provided us with essential resources needed to successfully complete this project.

REFERENCES

- [1] T. Young, D. Hazarika, S. Poria, and E. Cambria, "Recent trends in machine learning based natural language processing," *IEEE Computational Intelligence Magazine*, vol. 13, no. 3, pp. 55–75, 2018.
- [2] A. Vaswani *et al.*, "Attention is all you need," in *Advances in Neural Information Processing Systems (NeurIPS)*, 2017.
- [3] M. Schuster and K. K. Paliwal, "Bidirectional recurrent neural networks," *IEEE Transactions on Signal Processing*, vol. 45, no. 11, pp. 2673–2681, 1997.
- [4] Razorpay, "Payment Gateway Documentation," 2023. [Online]. Available: <https://razorpay.com/docs/>
- [5] MongoDB Inc., "MongoDB Atlas Documentation," 2023. [Online]. Available: <https://www.mongodb.com/docs/>
- [6] D. Jurafsky and J. H. Martin, *Speech and Language Processing*, 3rd ed., Pearson, 2021.
- [7] S. Hochreiter and J. Schmidhuber, "Long short-term memory," *Neural Computation*, vol. 9, no. 8, pp. 1735–1780, 1997.