



Darshanease: Smart Temple Queue Management System

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ABSTRACT

Large-scale religious places in India experience unpredictable visitor surges, especially during festivals and weekends. Traditional queue handling methods are often inadequate for controlling such dynamic crowds, resulting in long waiting hours, discomfort, and operational inefficiencies. This paper presents DarshanEase, an AI-driven smart queue management solution designed specifically for temple environments. The system integrates online booking, walk-in registration, real-time monitoring, dynamic time-slot allocation, and crowd forecasting using machine-learning models such as XGBoost and LSTM. DarshanEase operates through mobile and web interfaces, enabling devotees to receive updated queue status, time-slot notifications, and wait-time predictions. For temple authorities, the system provides a centralized dashboard for live analytics, decision support, and scheduling adjustments. The proposed model significantly reduces congestion, improves visitor satisfaction, and supports efficient resource planning.

KEYWORDS - Crowd management, queue optimization, LSTM, XGBoost, temple automation, real-time analytics.



I. INTRODUCTION

Temples across India act as religious, cultural, and social hubs, attracting thousands of visitors daily. During festive seasons, pilgrimages, or special rituals, the footfall can rise dramatically, often overwhelming existing queue mechanisms. Manual queue supervision, despite years of practice, fails to offer real-time adaptability and fairness for devotees. These limitations affect the visitor experience and create operational challenges for temple staff.

The increasing penetration of smartphones, digital ticketing platforms, and cloud connectivity presents a strong opportunity for technological intervention. DarshanEase leverages artificial intelligence and an integrated digital ecosystem to modernize temple queue management. The system predicts upcoming crowd levels, allocates time slots intelligently, synchronizes walk-ins with online bookings, and provides real-time communication to devotees and administrators. By automating several stages of queue control, DarshanEase aims to achieve smooth crowd flow, reduced waiting times, and improved operational transparency.

A. Problem Statement

“Indian temples struggle with crowd mismanagement during peak days. Existing booking systems cannot manage sudden surges, walk-ins, and priority groups, causing long waits and discomfort. There is a need to design and implement a smart, real-time queue management system that ensures fair, efficient, and organized crowd handling.”

II. LITERATURE SURVEY

A wide range of research has been conducted in the areas of smart queue management, crowd prediction, and automated scheduling systems. Although these studies focus on public spaces such as hospitals, tourist locations, and event gatherings, very limited work has been done specifically for temple environments, where visitor patterns are highly dynamic and influenced by cultural and religious factors. The following literature review highlights the key contributions, methodologies, and limitations of existing research relevant to this project.

[1] Several studies have explored the use of Internet of Things (IoT) sensors to track queue lengths and manage waiting times in service-based environments. These systems employ RFID tags, infrared sensors, or smart counters to estimate crowd density and transmit data to cloud servers for monitoring. While such solutions perform efficiently in structured environments like hospitals and customer service centers, they do not incorporate predictive models or dynamic scheduling. Thus, their applicability becomes limited in highly unstructured and fluctuating temple settings where visitor flow varies drastically based on time, weather, and religious events.

[2] Recent research has demonstrated the effectiveness of

[3] machine learning algorithms—including Random Forest, XG-

Boost, and LSTM networks—in predicting crowd movement in public gatherings. Time-series models such as LSTM are

especially useful for understanding seasonal or event-based variations. These studies highlight that data-driven forecasting significantly enhances crowd management by enabling authorities to prepare in advance. However, most models are developed for events like concerts or festivals, where entry and exit points are controlled. Temples, on the other hand, experience continuous footfall without fixed session timings, requiring a more adaptive forecasting approach.

[4] Tourism research has increasingly adopted artificial intelligence to optimize visitor distribution, manage congestion, and improve the overall experience. Systems developed for museums and tourist attractions use AI-powered scheduling to reduce overcrowding and maintain smooth visitor flow. These systems, however, operate in relatively predictable environments with known seasonal trends. Temples have additional complexity due to religious calendars, sudden devotee inflow during auspicious timings, and varied walk-in patterns. This creates a gap in directly applying tourism-based solutions to temple management.

[5] Computer vision models have been used to detect crowd surges, identify congested zones, and alert authorities in real time. Techniques such as density estimation and object detection provide accurate crowd monitoring without manual intervention. Although effective, these systems rely heavily on high-quality infrastructure like CCTV networks and GPU-powered servers. For many temples—especially traditional ones—such infrastructure is unavailable or costly to maintain. Additionally, vision-based systems do not inherently provide forecasting or dynamic queue scheduling, making them more suitable as supplementary tools rather than standalone solutions.

[6] Automated temple management platforms mainly focus on e-ticketing, online donations, event scheduling, and digital receipt generation. While these systems improve administrative convenience, they rarely integrate intelligent queue handling or AI-driven insights. They offer fixed slot booking that does not adapt to real-time conditions or walk-in surges. As a result, they fail to address the core problem of unpredictable crowding and lack of dynamic scheduling.

[6]A proposed IoT-driven framework for queue prediction and crowd regulation in religious venues utilizes a network of low-cost sensors to collect real-time visitor density data. This data is processed by a hybrid machine learning model that integrates historical trends and real-time inputs to forecast short-term queue lengths. The approach demonstrates the potential of combining IoT and predictive analytics to address dynamic footfall in unstructured religious settings.



III. TAXONOMY CHART

Features	Tirupati (TTD)	Sabarimala	Ujjain	DarshanEase
Block based batch queues	✓	✓	✗	✓
AI based crowd tracking and prediction	✓	✗	✗	✓
Identity Verification	✓	✗	✗	✓
Offline/ multi-channel entry(kiosk/WhatsApp)	✓	✗	✗	✓
Group/Linked Booking	✗	✗	✗	✓
Heatmaps/Real-time Dashboards	Partial: Displays screen in blocks	✗	✗	✓
Walk-in token issuance and sync	✗	✗	✗	✓
Priority for elders/special needs	Partial/Manual inside blocks	✗	✗	✓

IV. MOTIVATION

Temples in India often witness unpredictable and extremely high visitor turnout during weekends, festive periods, and auspicious occasions. This sudden rise in footfall creates long waiting lines that can be exhausting and uncomfortable, especially for elderly devotees, young children, and individuals with health-related limitations. In such situations, the rush not only affects convenience but also increases the chances of mismanagement and safety risks.

Even though some temples have adopted basic digital ticketing systems, these platforms typically operate on fixed schedules and do not adjust to real-time crowd changes. They lack the ability to manage sudden walk-in surges or external variations such as weather conditions and special religious events. As a result, queue distribution becomes uneven, leading to delays, congestion, and a compromised experience for devotees.

DarshanEase is motivated by the need to modernize this process through the application of intelligent technologies. By utilizing predictive analytics and real-time data inputs, the system dynamically regulates time-slot allocation and ensures smoother crowd movement. The main aim is to blend traditional temple practices with advanced digital solutions, providing a more organized, accessible, and stress-free darshan experience for all categories of visitors.

V. SYSTEM DESIGN

The system design of DarshanEase focuses on defining how different components of the application interact, process information, and support smooth queue management. It outlines the internal workflow, major modules, data flow behavior, and functional organization of the system. The goal of this design is to ensure that every part of the system works together efficiently to predict crowds, assign slots, monitor queues, and provide real-time updates.

A. System Architecture

The architecture of DarshanEase, shown in Fig.1, follows a client-server model to enable real-time and smart queue management. The system primarily consists of the following components:

1. **User Layer (Frontend):** This layer includes the Mobile Application and Kiosk Entry System through which devotees can register, pre-book darshan slots, or check queue status. Users can access the system either remotely via the mobile app or on-site through kiosks installed at the temple premises.
2. **Backend Server:** The backend handles all logic and communication between the user interface and the database. It consists of two main modules: **AI Crowd Prediction Module:** This component uses XGBoost and LSTM algorithms along with external inputs such as Weather API and Festival Calendar to predict expected crowd density. These predictions help dynamically manage time slots and queue length. **Queue and Slot Management Module:** This component handles both online and offline queue systems, maintaining records for paid and unpaid slots. It continuously updates slot availability based on user bookings and predicted crowd levels.
3. **Notification Service:** This service is responsible for sending real-time notifications and alerts to devotees and administrators. It can send messages regarding slot confirmations, changes in schedule, or crowd updates through SMS, app notifications, or display kiosks.
4. **Database Layer:** The database stores and retrieves information related to devotees, bookings, attendance, and queue status. It also keeps logs for analytics and future prediction improvements.
5. **Devotee Entry and Exit System:** At the temple premises, devotees validate their booking using QR codes or tokens at the entry point. The system logs their attendance and updates the database accordingly. This ensures smooth tracking and prevents duplicate entries.
6. **Data Flow and Integration:** The mobile app and kiosk system send API requests to the backend for booking, validation, and queue updates. The backend processes the data, predicts crowd patterns, and updates queue/slot information in real-time. The notification service then communicates relevant updates to users. The database continuously syncs all records for consistent and reliable operation. This modular and scalable architecture ensures that the system remains efficient, flexible, and responsive even during peak crowd conditions such as festivals or special temple events.

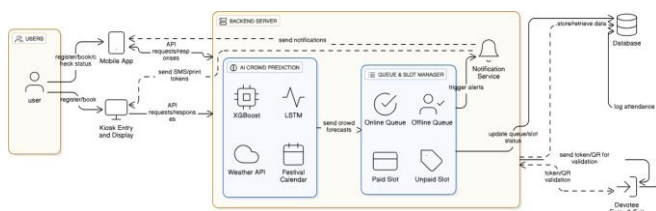


Fig. 1: System Architecture

VI. CONCLUSION

The DarshanEase: Smart Temple Queue Management System marks the foundation of an innovative approach toward intelligent temple management using Artificial Intelligence (AI), Machine Learning (ML), and real-time analytics. During this stage, the focus was primarily on understanding the problem domain, analyzing user and administrative needs, designing the system architecture, and developing preliminary modules for queue prediction and slot allocation.

Major achievements of Stage 1 include: - Conceptualization of an AI-driven system aimed at optimizing temple queue scheduling and crowd flow. - Design of the system architecture integrating AI prediction, dynamic slot allocation, and administrative dashboard modules. - Development of basic prototypes and initial dataset exploration for crowd trend prediction. - Feasibility analysis and evaluation of key technologies suitable for scalable and secure deployment. - This phase successfully establishes the groundwork for the next stages of implementation and testing. It demonstrates the potential of DarshanEase to transform traditional temple management into a smarter, data-driven, and user-friendly system.

A. Future Work

In the upcoming stages, the focus will shift toward: - Building a functional prototype integrating AI-based queue prediction and real-time slot scheduling. - Implementing the administrative dashboard for live data visualization. - Integrating IoT-based crowd monitoring and feedback mechanisms. - Testing system efficiency with simulated or pilot temple data to refine algorithms. - By completing Stage 1, the DarshanEase project has laid a strong conceptual and technical foundation. The forthcoming stages will translate these designs and models into a fully functional, intelligent, and scalable temple queue management solution, bringing the vision of seamless crowd and queue management closer to reality.

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