

CROWD MANAGEMENT SYSTEM FOR TIRUCHENDUR TEMPLE

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Abstract

Managing large crowds during temple festivals is a major challenge due to sudden crowd increase, limited space, and safety concerns. In many cases, crowd control is handled manually, which may not be effective for large-scale events. This paper presents a predictive crowd management system developed to assist in planning and coordination during temple festivals. The system uses past festival data to predict expected crowd size and crowd hike percentage. Based on these predictions, alerts are generated in advance, and coordination is supported through separate modules for the temple committee and police. The system also includes a volunteer assignment module and a bilingual interface to improve usability. The proposed system helps authorities prepare in advance and manage crowds more efficiently during temple events.

Keywords: Crowd Management, Temple Festivals, Machine Learning, Random Forest, Volunteer Assignment, Bilingual Interface

I. Introduction

Temple festivals attract a large number of devotees, especially during

special occasions and annual celebrations. Managing such large gatherings is difficult and requires proper planning, coordination, and timely decision-making. Traditional crowd management methods mainly depend on experience and manual estimation, which may not always be accurate.

With the availability of historical data and advances in machine learning, it is possible to predict crowd behaviour before an event takes place. Predictive systems can help authorities take preventive measures instead of reacting after problems occur. However, prediction alone is not sufficient; proper communication between stakeholders and efficient use of resources are also important.

This paper focuses on the development of a predictive crowd management system for temple festivals. The system provides crowd predictions, role-based access for police and temple

committee members, volunteer assignment features, and a bilingual interface. The main aim is to improve safety and efficiency during large temple gatherings.

II. Literature Review

Crowd management has become an important research area due to the increasing number of large public gatherings. Previous studies have focused on crowd monitoring, detection, and density estimation using traditional and intelligent techniques. However, limited attention has been given to advance crowd prediction, volunteer coordination, and role-based communication systems. This section reviews existing works and identifies the research gap addressed by the proposed system.

[1] Khan, A., Shah, J., Kadir, K., Albattah, W., and Khan, F.

The authors presented a detailed review of crowd monitoring and localization techniques using deep convolutional neural networks. The paper discusses how deep learning models can analyze dense crowd scenes effectively. Different challenges such as occlusion and varying crowd density were highlighted.

[2] Zhang, C., Li, H., Wang, X., and Yang, X.

The authors introduced a deep learning framework for cross-scene crowd counting using convolutional neural networks. The model was trained to handle different environments without retraining for each scene. Results showed

that deep CNNs can generalize well across locations. This study supports scalable crowd prediction systems.

[3] Vaniya, J.H.K., Gamit, N.C., Trivedi, N.S.B., Chand, C.G., and Varia, D.

The authors used a machine learning method to study and predict how crowds behave from videos. They added information about crowd emotions to help the model understand actions better. They trained the system using a big set of labeled crowd videos. The results showed that using emotions made the predictions of crowd movement more accurate and useful for managing crowds.

[4] Kulkarni, S., Adsul, A.P., Ayare, S., Pandit, S.V., Hundekari, S.N., and Pattanaik, O.

The authors looked at how CNNs can be used to count people and measure crowd density from images. They showed that CNNs can learn important features on their own, which helps make predictions more accurate. They also explained ideas like multi-column networks and attention layers to deal with different crowd sizes. Overall, CNNs make crowd counting and density estimation easier and more reliable.

[5] IoT-based crowd management systems (2025)

Introduced frameworks combining sensors and historical data for crowd capacity estimation. These systems generate alerts when safety limits are exceeded. The approach supports real-time monitoring and automation.

However, implementation complexity and offline usability remain challenges.

III. Methodology

The proposed system is designed using a modular approach to simplify development and usage. Each module performs a specific function and works together to support effective crowd management.

1. Temple Committee Module

The Temple Committee Module is designed to assist committee members in planning and managing festival-related activities efficiently. This module provides detailed information about upcoming festivals, including predicted crowd size and expected crowd hike percentage. It also generates alerts well in advance of major festivals, allowing the committee to prepare necessary arrangements such as facilities, queue management, and coordination with authorities. In addition, the module enables direct communication with police officials, ensuring timely information exchange and smooth coordination for effective crowd control.

2. Police Module

The Police Module is intended for law enforcement authorities responsible for maintaining safety and order during temple festivals. Through this module, police officials can access predicted crowd data, festival alerts, and crowd hike percentages. Based on these predictions, appropriate security measures such as barricade placement, traffic control, and deployment of

personnel can be planned in advance. The module also supports communication with the temple committee, enabling coordinated decision-making and rapid response during high-crowd situations.

3. Volunteer Assignment Module

The Volunteer Assignment Module helps police authorities efficiently manage and deploy volunteers during festival events. Volunteers are assigned to different zones based on predicted crowd intensity, ensuring that high-risk areas receive adequate support. The module visually represents zone-wise crowd conditions, making it easier to allocate manpower effectively. This systematic assignment improves crowd flow management, reduces congestion, and enhances overall safety during large gatherings.

4. Bilingual Interface Module

The Bilingual Interface Module allows users to interact with the system in both English and Tamil. This feature improves accessibility for local temple staff, volunteers, and police personnel who may be more comfortable using their regional language. All alerts, predictions, and system messages are dynamically translated without affecting system functionality. By supporting bilingual interaction, the system ensures clear communication and wider usability across different user groups.

5. Chat Communication Module

The Chat Communication Module enables real-time message exchange between the temple committee and police

authorities. This module is used to share important updates, alerts, and instructions during festival preparations and live events. It helps reduce delays caused by manual communication methods such as phone calls or paper notices. By providing a direct and reliable communication channel within the system, the module improves coordination, supports quick decision-making, and enhances overall crowd management efficiency.

IV. Results and Discussion

The system was tested using historical festival data. Crowd predictions were generated successfully and displayed through the user interface.



Fig. 1: Login and Role Selection Page

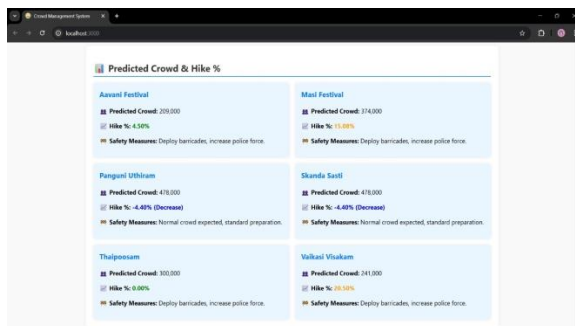


Fig. 2: Crowd Prediction Dashboard

Alerts were generated prior to festival dates, allowing early preparation. The volunteer assignment module helped in

distributing volunteers based on predicted crowd levels.

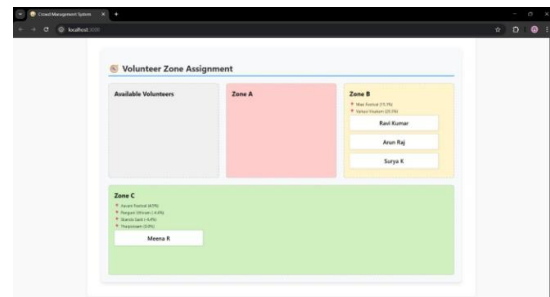


Fig. 3: Volunteer Zone Assignment

The two-way chat system allows real-time communication between the temple committee and police officials. Messages sent from one side are received instantly by the other, enabling quick sharing of updates and instructions. This reduces reliance on phone calls and manual coordination. The feature improves communication efficiency during high-crowd festival situations.

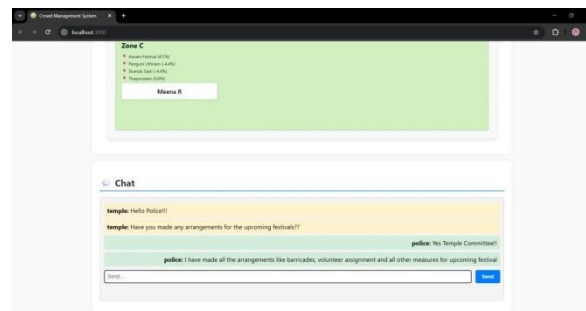


Fig. 4: Two-Way Chat Communication Interface

The bilingual interface improved usability and reduced communication difficulties.

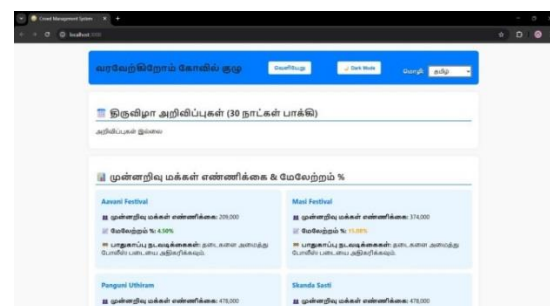


Fig. 5: Bilingual Interface (Tamil View)

Overall, the system supported better planning and coordination compared to manual methods.

V. Future Work

In the future, the proposed crowd management system can be further enhanced by integrating real-time data sources such as CCTV surveillance, IoT-based sensors, and mobile crowd feedback to improve the accuracy of crowd prediction. Real-time inputs will help the system respond dynamically to sudden changes in crowd movement and density. The development of a dedicated mobile application can provide instant access to alerts, notifications, and live updates for temple authorities, police personnel, and volunteers, enabling quicker response during critical situations. Additionally, support for more regional languages can be incorporated to improve usability and accessibility for a wider range of users. The system can also be extended and adapted to manage crowds at other large-scale public events such as fairs, concerts, political gatherings, and sports events, making it a scalable and versatile solution.

VI. Conclusion

This paper presented a predictive crowd management system developed specifically for temple festivals, with an emphasis on safety, advance planning, and effective coordination. The system integrates crowd prediction, role-based access for temple committee and police

authorities, volunteer zone assignment, and a bilingual interface to support smooth operations during large gatherings. By providing early alerts and clear communication between stakeholders, the system helps authorities make timely and informed decisions. The results demonstrate that the proposed approach can reduce congestion risks and improve overall crowd control efficiency. Overall, the system serves as a practical, scalable, and reliable solution for enhancing public safety during large religious events.

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