

Data-Driven Ganesha Festival Management: NLP Chatbot, Ecommerce, Request Modules and Data Analytics Integration

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Abstract— The Ganesha festival has great cultural significance in the India which demands efficient organization with seamless communication between the organizer's committees and devotees. To make it simple and easy, we are presenting "Data- Driven Ganesha Festival Management". The system has multiple modules which includes an Ecommerce Platform for Ganesha Idols, Slot booking module for Ganesha Immersion, Request Module for Ammonium powder, Tank-on-wheel Request module etc. The main module of our system is an advanced NLP based Chatbot grievance system which has ability to solve the queries of devotees 24/7 and helps to reduce human intervention. Our advanced chatbot grievance system works with NLP and Machine Learning algorithms to ensure correct responses which enhances festival experience and helps to optimize resource allocation during festival. Our system uses collected data from past year's festival events for Data Analytics, Covers Descriptive, Prescriptive, Sentiment, Machine Learning and Linear Regression analyses. After integrating all these technologies together, Our Data Driven Ganesha Festival Management System helps organizers with useful insights for resource allocation as well as optimization, Vendor Selection, Ticket Pricing and for event scheduling. Predictive analysis helps to predict future festival trends which allows proactive planning and improves festival experience. Our research links tradition with modern technology to celebrate festivals more innovatively.

Index Terms— Ganesha Festival Management, NLP Chatbot, Ecommerce, Request Modules, Data Analytics, Predictive Analytics, Resource Optimization and Festival Planning.

I. INTRODUCTION

As we all know, The Ganesha Festival is one of the festivals which is celebrated all over the India. And to manage related events of the Ganesha Festival within that 10-12 day is not that easy. Traditional ways of festival management are becoming outdated as the new technology is rising widely. To overcome this problem, Development of an advanced system for Ganesha Festival Management system is an option which can help everyone to simply celebrate the festival by using new technologies.

Our proposed system consists of multiple modules which are developed in order to help every single aspect of the festival. One of our modules is an E-commerce module which is developed for selling Ganesha Idols on an online

platform. In old traditional way, People have to visit Ganesha Idol shops physically to buy idols. We have made it simple by converting this traditional way into an E-commerce platform in which selected idols will be delivered at the doorstep of customer within given time and date with complete safety of idol. We have one more module named as Slot Booking Module which allows devotees to book slot for the immersion of Ganesha Idol on their selected time, day and date. We always have seen the problem of overcrowding during Ganesha Festival at immersion of Idol. Our slot booking feature ensures that people can book a time slot for immersion and avoid overcrowding.

The 24/7 Chatbot is the most important feature of our system. The Chatbot is developed to establish link between the Organizers of the festivals and devotees. Our chatbot is developed using Natural Language Processing and Machine Learning algorithms to understand queries asked by devotees and provide most accurate responses. Our chatbot can also share real time updates, news, festival events and all other information to all the users in the system. One single chatbot has ability to reduce maximum human intervention for managing the Ganesha festival. Chatbot provides efficient experience to all its users and organizers by allowing them to manage the Ganesha Festival in very easy way.

As we know, Data Analysis techniques such as Machine Learning plays very important role most of the festival's operation and improves experience. Considering this reason, we have developed Data Analysis Dashboard for our Centralized Ganesha Festival Management System that uses Machine Learning Techniques. Our proposed system collects and processes all the data related to every aspect of the festival such as Attendance of the devotees, Revenue, Devotee Feedback etc. This data is then analyzed using different Machine Learning techniques which helps to identify different kind of patterns and trends and returns useful insights. We have used Machine Learning algorithms to learn from data and use this generated data to make future predictions.

We have designed the Dashboard to be user-friendly by providing visualizations related to Ganesha festival's performance. The ML algorithms are integrated in the dashboard which provides most accurate insights. Let's take an example to understand this, the attendance module feature uses ML algorithm to predict attendance and identify overcrowding issues. Social media module uses sentiment analysis to analyze social media posts. Our proposed Analytics Dashboard for the Ganesha Festival System is an innovative solution which uses modern technology to improve traditional cultural events. Insights from dashboard enables festival organizers to take data driven decisions quickly.

II. CHALLENGES & AWARENESS

A. Chat-Bot Development Challenges

- a. *User Adoption*: Main challenge in developing the Chatbot is User Adoption. Most of the users are not familiar with modern technologies or may be afraid to use them.
- b. *Language Issue*: Chatbots needs to be designed in local languages so that it can be used by most of the devotees. Accurate language translation is the main challenge.
- c. *Integration*: Chatbot integration with our existing system can be the complex task, it will require coordination between various technologies and IT teams.
- d. *Natural Language Processing*: Chatbots that understands and interprets Natural language is one of the complex tasks which requires algorithms and models.

B. Data Analysis Challenge

Data Collection: Collection of accurate data from such a large event such as the Ganesha Festival can be really challenging task which requires efficient data collection strategies.

Data Quality: Data quality and consistency is one of the challenges when we have to deal with the data from various sources.

Data Integration: Data is collected from various sources and integrating this data is complex process which needs data mapping, data transformation and cleansing.

Data Privacy: Ensuring privacy of the data from devotees is very crucial factor that requires compliance with data protection laws.

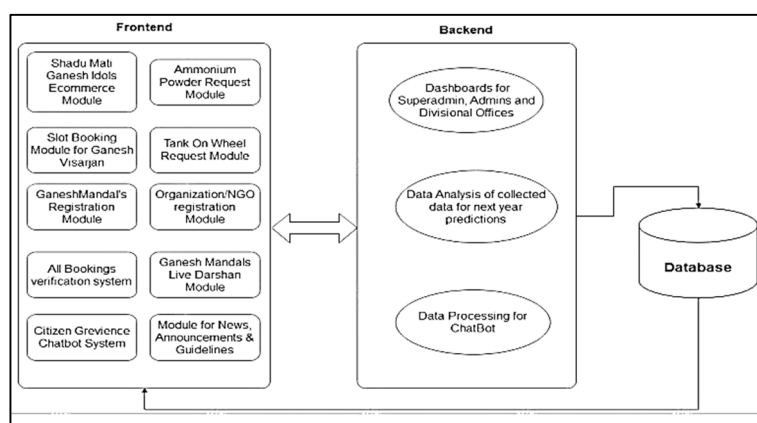
III. OBJECTIVES

The objectives of "Data Driven Ganesha Festival Management System" are:

- a. To create a user-friendly Chatbot which can effectively handle and manage queries from devotees related to location, booking and festival schedule

- b. To integrate the Chatbot with our E-commerce module which allows devotees to buy Ganesha Idols in online platform and developing slot booking system which enables devotees to book a slot for the immersion of Ganesha Idol.
- c. To collect, process and analyse data generated from various aspects of Ganesh festival such as attendance, revenue, feedback, social media etc...
- d. To use new modern technologies such as Machine Learning techniques to identify patterns and trends in the data and then finalizing out insights
- e. To broadcast real time updates related to Ganesha festival via a user-friendly data analysis dashboard which allows festival organizers to make decisions quickly.
- f. To improve the proposed system continuously based on the feedback to enhance value in festival management.

IV. SYSTEM ARCHITECTURE



The front-end of our system is responsible for user interface and user experience. It includes the design and development the Chatbot that interacts with devotees to provide them information about the Ganesha Festival and provide responses. Our front-end also includes web interfaces for Registration of Ganesha Mandalas, Registration of NGO's, Slot Booking, Request Modules and other activities.

The back-end of our system is responsible for managing logic. It includes server-side code which handles all the requests from the front-end, then it processes the data followed by communication with database. It also includes algorithms for data analysis which are used to identify patterns and insights.

The database of our system is responsible for storing and managing all the data. It includes a relational database which stores information about the Ganesha festival such as Devotee information, Vendor details, Sponsor Details and other stakeholders. Database also contains data related to schedules, locations and event details.

V. METHODOLOGY

• Frontend

Shadu Mati Ganesh Idols Ecommerce Module

The Shadu Mati Ganesha Idols E-commerce module is a one of the crucial components of the Centralized Ganesha Fest Management System. The module allows attendee to buy eco-friendly Ganesha idols made of Shadu Mati also known as natural clay via online platform. This module provides a convenient and sustainable alternative to traditional idols made of Plaster of Paris which are known to cause environmental damage due to their non-biodegradable nature. The Shadu Mati Ganesha Idols E-commerce module enables attendee to explore through a variety of Ganesha idols made up of Shadu Mati from variety of sizes to unique designs and purchase them through a secure payment gateway. The module enables the festival organizers to link with local artisans who specialize in creating eco-friendly Ganesha idols and thereby promoting sustainable practices as well as supporting local businesses.

Request Module for Ammonium Powder

The Request Module for Ammonium Powder is an must have feature of the Centralized Ganesha Fest Management System. This module enables festival organizers to manage and handle the distribution of ammonium powder

which is a substance used for the Ganesha immersion in a controlled manner. Ammonium powder is a vital substance used in the immersion process to dissolve Ganesha idols made up of Plaster of Paris and facilitate return of the materials back to nature. However, the over-use of ammonium powder can have a harmful impact on water bodies leading to water pollution and environmental damage. Therefore, it is crucial to regulate the distribution of ammonium powder and ensure its responsible use during the immersion process. The Request Module for Ammonium Powder permits festival organizers to handle requests for ammonium powder from different immersion sites and monitor its distribution in real-time. As well as the module permits for the distribution of a finite quantity of ammonium powder per site guarantying that it is used efficiently. The festival organizers also utilize the data collected via this module to find any misuse of ammonium powder and take disciplinary actions immediately. The Request Module for Ammonium Powder provides real time notifications to attendee on the availability of ammonium powder at different immersion spots.

Slot Booking for Ganesha Immersion

The Slot Booking module allows devotees to book particular day and particular time for the Ganesha immersion which really helps in reducing the chaos at immersion. As per Indian tradition, Idols are immersed in water on the Ganesha Anant Chaturdashi that is the last day of the festival. This can lead to over-crowding and long waiting times. The Slot Booking Module for Ganesha Immersion is the best solution for these issues which allows devotee to select a particular day and particular time for immersion via an online portal. This module also confirms that immersion happens in an organized and controlled manner which also helps in minimizing the risk of accidents and injuries. The Slot Booking Module for Ganesha Immersion allows the organizers to keep control on the immersion process. They can handle the number of bookings per slot, allocate limited number of idols to each slot and monitor the immersion process in real-time to guarantee the safety of devotee.

Tank on Wheel Request Module

The Tank on Wheel is the module which allows organizers to manage requests for the Tank on Wheel service which is much better solution for Ganesha immersion in over-crowded societies. Each year Ganesha idols are immersed in water sources such as lake, sea, ponds which can cause overcrowding in densely populated areas. The Tank on Wheel service is an alternative immersion solution that brings a mobile water tank to societies where water sources are not easily accessible and are far away from. The Tank on Wheel Request Module permits devotee to request the Tank on Wheel service via our online portal. They just need to specify their location, preferred time for immersion and the number of idols to be immersed. The festival organizers then can evaluate the request and assign a tank on wheel to the requested location and confirm that immersion is carried out in safe manner.

Chat-Bot Grievance System

The Chat-Bot Grievance System is a simple platform for devotees to raise their concerns and resolve them by communicating with the organizers. The Chat-Bot can be integrated into popular messaging platforms such as WhatsApp, Telegram or Facebook Messenger permitting users to access it easily and without the need for additional software. Using natural language processing (NLP) technology, the Chat-Bot can understand and interpret user's messages and classify them according to the type of grievance and forward them to the relevant festival department for resolution. For example, if a user reports an issue with garbage waste disposal at a particular immersion site, the Chat-Bot will categorize the complaint as an environmental issue and forward it to the that department for resolution. The Chat-Bot Grievance System gives kind of benefits to festival organizers. Initially, it enables them to monitor and track grievances in real-time by enabling them to respond on time. Secondly, it provides a platform for attendee to voice their concerns and complaints which can help organizers to identify areas of improvement.



- Backend

Dashboards

The Centralized Ganesha Festival Management System marks a number of backend dashboards that provide festival organizers with valuable insights and information to handle the festival effectively. These dashboards are designed to present data in a systematic and accessible format enabling festival organizers to make data-driven decisions and optimize resources. Here are some examples of the backend dashboards in the Centralized Ganesha Festival Management System

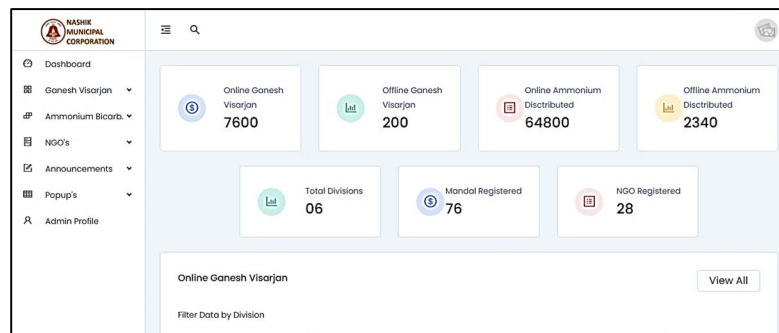
Sales Dashboard- This dashboard provides real-time data on the sales of Ganesha idols through the E-commerce module. Festival organizers can monitor the number of idols sold, revenue generated and popular idol types. This data enables organizers to optimize their inventory, plan their production and forecast sales for future festivals.

Slot Booking Dashboard- This dashboard displays the current and upcoming slot bookings for Ganesha immersion by enabling festival organizers to monitor the utilization of immersion sites and allocate resources accordingly. It also provides information on the number of idols to be immersed, the location of the immersion site, and the preferred time for immersion.

Grievance Dashboard- This dashboard enables festival organizers to monitor and track grievances reported through the Chat-Bot Grievance System. It provides information on the type of grievance, the status of the resolution and the time taken for resolution. This data enables organizers to identify common grievances and take steps to prevent them in future festivals.

Tank on Wheel Dashboard- This dashboard displays the current location and availability of the Tank on Wheel service by enabling festival organizers to allocate resources effectively and provide the service to areas with the most significant need.

Analytics Dashboard- This dashboard provides festival organizers with valuable insights on the festival's overall performance such as attendance rates, visitor demographics, popular immersion sites and environmental impact. This data permits organizers to form an opinion on the festival's success and recognize areas for improvement in future.



Chat-bot Data Processing

In the Centralized Ganesha Festival Management System, the backend Chat-Bot processing is mechanized by Natural Language Processing (NLP) technology. The Chat-Bot module utilizes NLP algorithms to examine user input and provide relevant responses which permits festival organizers to handle a high volume of user queries. Here are some of the ways in which NLP is utilized in the backend of Chat-Bot processing of the Centralized Ganesha Festival Management System

Intent Recognition - NLP algorithms are used to understand the user's aim behind their query. For example, if a user questions "Where can I immerse my Ganesha idol?", the Chat-Bot will recognize the aim behind the query as "immersion location." This permits the Chat-Bot to give a relevant response based on the user's intent.

Entity Extraction - NLP algorithms are utilized to search associated entities in the user's query. Let's take an example, if a user describes a grief about a particular immersion location, then the Chat-Bot will extract associated entity (i.e., the immersion location) from the user's query. This allows the Chat-Bot to give a particular reply to the user's grief.

Sentiment Analysis - NLP algorithms are utilized to go over the sentiment associated the user's query. Let's take an example, if a user reports a grief with a negative sentiment, then Chat-Bot immediately prioritize the grief and send it to the authority for prompt resolution.

Language Translation - NLP algorithms are utilized to translate user queries into the desired language for communication with organizers. This permits organizers to handle queries from devotees who speak different kind of languages.

NLP is utilized for Chat-Bot processing in the Ganesha festival management system in following way:

Tokenization: The user's query is split down into separate tokens. This is done using a kind of techniques like whitespace splitting, regular expressions or machine learning models.

Let's take an example, If the devotee sends the message "What are the best timings of the immersion?", tokenization results in the following tokens: ["What", "are", "the", "best", "timings", "of", "the", "immersion", "?"]

Part-of-speech (POS) tagging: After tokenization each token is allocated a part-of-speech tag which indicates its grammatical. This is done using machine learning models trained on large datasets.

Let's understand that using an example, POS tagging results in the following tags: ["PRON", "VERB", "DET", "NOUN", "ADP", "DET", "NOUN", "."]

Named Entity Recognition (NER): Named entities such as locations, dates and names are recognized and labelled in the text. This is done using machine learning models trained on annotated datasets.

Let's take an example, NER identifies "festival" as location entity and "timings" as time entity.

Intent classification: The devotee's message is divided into one or more predefined intents based on its content. This is done using machine learning models like support vector machines or neural networks that have been trained on labelled datasets.

Let's understand that using an example, If the devotee's query is "Can I book a slot for Ganesha immersion on 8th September?", then intent classification identifies the intent as "Slot booking" and extract the date entity "8th September".

Entity extraction: The relevant entities are extracted from the devotee's message. This is done using rule-based systems or machine learning models that have been trained on annotated datasets.

Let's take an example, If the devotee's message is "Where can I purchase Shadu Mati Ganesha idols?", the entity extraction identifies the entity "Shadu Mati" as a type of Ganesha idol and provides a reply with the locations where it is available.

By using NLP techniques in Chat-Bot processing, the Ganesha festival management system provides a more intelligent and personalized experience to the users reducing the workload on the human operators and improving the overall efficiency of the system.



Data Analytics

Data analytics is vital component of the Centralized Ganesha Festival Management System. By examining data collected from different sources, festival organizers can gain valuable insights into user behaviour, trends and different key metrics. Data science techniques are used to examine this data and provide insights that are used to optimize festival operations and improve the overall festival experience. Some data science techniques are used for data analytics in the Centralized Ganesha Festival Management System

Descriptive Analytics – It is used to describe data collected through different sources like sales, feedback and crowd tracking which permits organizers to gain valuable insights.

Prescriptive Analytics – It is a technique which is used to suggest actions. Let's understand using example, prescriptive analytics is used to recommend the inventory levels for Ganesha idols, recommend traffic flow changes to decrease chaos and to boost the complete festival experience.

Machine Learning - These are used to examine data collected from variety of sources like sales, feedback which allows organizers to find patterns and trends in the data and make data-driven decisions.

Sentiment Analysis – It is a technique which is used to check user feedback and sentiment data that is collected through the Chat-Bot module.

Data Analysis of Ganesha Festival Management System using Linear Regression

To calculate data using linear regression for Ganesha festival management system, we need a set of data points which consists of the sales of idols and the different factors that impact sales like price, location etc., Once we had this data, we used linear regression to find any correlations between these factors and Ganesha idol sales and used this information to make predictions about future sales. Below is an example of calculation using linear regression for sales predicting price of Ganesha Idol:

We have a dataset that includes the following information:

Price of the Ganesha idols (Rs): [200, 250, 300, 350, 400, 450, 500]

Sales of Ganesha idols: [50, 45, 40, 35, 30, 25, 20]

The formula for linear regression is: $y = mx + b$ Where: y (in this case, sales), x (in this case, price), m (which tells us how much sales change for every unit increase in price), b (which tells us the expected value of sales when the price is zero). To calculate the slope and intercept of the line, we used the following formulas:

$$m = (n\sum xy - \sum x \sum y) / (n\sum x^2 - (\sum x)^2) \quad b = (\sum y - m\sum x) / n$$

$$n = 7 \quad \sum xy = 80875 \quad \sum x = 2100 \quad \sum y = 245 \quad \sum x^2 = 563500$$

$$m = (n\sum xy - \sum x \sum y) / (n\sum x^2 - (\sum x)^2)$$

$$m = (780875 - 2100245) / (7*563500 - 2100^2)$$

$$m = -0.1$$

$$b = (\sum y - m\sum x) / n \quad b = (245 - (-0.1)*2100) / 7 \quad b = 75$$

Therefore, the equation of the line that best fits these data points is: $y = -0.1x + 75$

This equation tells us that for every 1 rupee increase in the price of Ganesha idols, sales are expected to decrease by 0.1 units. It also tells us that when the price is zero (which is not realistic but is used here to calculate the y-intercept), sales are expected to be 75 units. Using this equation, we made predictions about sales for other price points. For example, if we want to know how many Ganesha idols are likely to be sold if the price is 275 rupees, we can simply plug this value into the equation:

$$y = -0.1(275) + 75 \quad y = 47.5$$

Therefore, we can predict that if the price of Ganesha idols is 275 rupees, we can expect to sell approximately 47.5

VI. REQUIREMENTS

- Server:** A server is required to host the Chatbot and data analysis system. The server should have processing power, RAM and storage capacity to handle the expected traffic and load.
- Database:** A database server is needed to store the festival data such as attendance, feedback, and vendor details. The database server should have enough storage capacity and processing power to handle the data load.

Software Requirements

- Chatbot Framework:** A Chatbot Framework is needed for the development such as Dialog-flow, Bot Press and Microsoft Bot Framework.
- Data Analytics Tools:** Data Analytics tools such as Python, R, and SQL are required for data analysis, data visualization and predictive analytics.
- Operating System:** An operating system such as Windows or Linux is needed to run the Chatbot and data analysis system.

VII. LITERATURE SURVEY

Studies on the Ganesha festival management have emphasized importance of centralized systems to simplify event planning and smooth execution. A study by Gao (2018) demonstrated how centralized systems improved

communication between organizers and participants resulting in better resource allocation and higher attendee satisfaction. Thomas (2019) explored the impact of Ecommerce platforms for festival merchandise and highlighting its potential to enhance festival revenue and devotee engagement.

Data analytics plays a pivotal role in optimizing festival operations. The study by Wang (2019) employed data analytics to analyse attendee feedback and social media engagement resulting in valuable insights for future festival planning. Furthermore, Lee (2022) utilized predictive analytics to forecast festival attendance and optimize resource allocation, contributing to enhanced festival experiences.

Integrating these facets, several researchers have explored the potential of combining NLP-driven chatbots and data analytics for event management. Liu (2021) demonstrated the effectiveness of an integrated system in automating festival communication and providing personalized responses to user queries. In a similar vein, Kim (2020) integrated data analytics to predict festival trends assisting organizers in making informed decisions.

The Ganesha Festival's unique characteristics and cultural significance require systematic approaches for effective management. To address this, Kumar (2022) conducted a case study on Ganesha Festival management focusing on communication and resource allocation. Their findings shed light on the festival's specific requirements and the potential for incorporating technological solutions.

NLP-driven chatbots have shown promise in handling devotee queries during religious events. Sharma (2021) developed an NLP chatbot for a pilgrimage site and highlighted the chatbot's effectiveness in providing accurate information and real-time assistance to devotees. Leveraging these insights, we aim to adapt NLP technology to cater specifically to the devotees needs during the Ganesha Festival.

Data analytics has played a vital role in enhancing festival experiences globally. Singh (2020) demonstrated how data analytics provided valuable insights on crowd management and event coordination leading to improved safety and organization. By incorporating data analytics in our Ganesha Festival Management System, we anticipate similar benefits in terms of optimizing resource allocation and predicting future festival trends.

VIII. FUTURE SCOPE

The future area of scope for the Ganesha Festival Management System is wide and promising. Here are some of the potential future directions:

- a. *Personalized Recommendations*: One future direction is to provide customized recommendations to devotees based on their preferences and past way of conduct. For example, a Chatbot suggests festival activities, vendors and events based on the user's interests, previous visits and feedback.
- b. *Integration with Smart Devices*: With the increasing use of smart devices, Chatbots are integrated with voice assistants such as Google Assistant, Alexa and Siri. This integration can give devotees with a hands-free experience where they can interact and communicate with the Chatbot via voice commands.
- c. *Predictive Analytics*: Data analysis can be used for predictive analytics to predict attendance, identify likely issues before they come to light and improve resource allocation. This can help Ganesh festival organizers to plan more effectively and make data-driven decisions.
- d. *Real-Time Crowd Management*: Chatbots can be integrated with real-time crowd management systems to give devotees with updates on crowd, chaos and waiting times. This can help to boost the complete festival experience.
- e. *Social Media Integration*: Chatbots can be integrated with social media platforms such as Twitter, Instagram and Facebook to give real-time updates and catch up with devotees. Social media data analysis is used to identify trends, preferences and feedback from devotees which can notify future festival planning and management.

IX. CONCLUSION

Our research presents an innovative Ganesha Festival Management System which integrates NLP enabled chatbot technology, an Ecommerce Module, Slot Booking Module, Request Modules, Data Analytics Dashboard etc., Our system is intended to find out the challenges faced during the Ganesha Festival and enhance them. Our NLP driven chatbot demonstrates its core potential by providing real time assistance and responses to the queries raised by devotees. It reduces much time and even saves man power by reducing human intervention.

Integration of an Ecommerce module and Ammonium request module which makes the process of acquiring Shadu Mati Idols and Ammonium Powder easier. In Addition, the Slot Booking module for Ganesha Immersion and Tank on Wheel module to promote efficient immersion process which helps in crowd management and safety.

Data Analytics plays important role in optimizing Ganesha festival plans, resource allocation and prediction of future trends. Integration of an Ecommerce and Data Analytics promotes responsible resource usage.

The significance of our research is in its focus on the requirements of the Ganesha Festival and adoption of advanced technologies to address them. The Ganesha Festival Management System offers a sustainable and data-driven approach that can serve as a model for other cultural events. By optimizing festival co-ordination and communication, our system contributes to a memorable festival experience for all participants. Future research may explore further refinements to the NLP-driven chatbot by incorporating sentiment analysis for improved devotee interactions. In addition, incorporating predictive analytics for better resource planning and crowd management could enhance the system's capabilities.

In conclusion, our research contributes to the advancement of Ganesha Festival Management by introducing an integrated and data-driven approach. Our system promises to revolutionize Ganesha Festival organization by paving the way for efficient and sustainable cultural celebrations for years to come.

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