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Event Management and Hype Prediction System

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Abstract - The increasing role of data-driven decision-making has transformed how events are planned and promoted. However, most traditional event management systems focus on logistical operations such as registration and scheduling, while lacking mechanisms to assess or predict audience interest prior to an event. To address this limitation, this study proposes an integrated Event Management and Hype Prediction System developed using the MERN (MongoDB, Express.js, React, Node.js) stack and a Python-based machine learning model.
The system leverages user engagement data, historical attendance patterns, and feedback metrics to compute a predictive "Hype Score" for upcoming events. The machine learning module is integrated with the MERN backend through RESTful APIs, enabling real-time data exchange and prediction. Experimental evaluation demonstrates strong predictive accuracy in estimating event popularity, supporting improved event planning, marketing strategies, and audience targeting. The proposed framework highlights the effectiveness of combining full-stack application technologies with machine learning to deliver actionable insights for intelligent event management.

Keywords: Event Management, Hype Prediction, MERN Stack, Machine Learning, Predictive Analytics, User Engagement

I. INTRODUCTION

Event management has evolved into a data-centric process where success increasingly depends on understanding audience behavior and engagement trends. With the rapid growth of digital platforms, the hype surrounding an event — reflected through interest levels, registrations, interactions, and online discussions — has become a crucial indicator of its potential success[9]. However, traditional event management platforms mainly handle logistical tasks such as scheduling, ticketing, and participant tracking. They lack intelligent mechanisms to analyze audience enthusiasm or predict event outcomes before the event occurs.

In the current digital ecosystem, predicting event hype can significantly influence marketing decisions, sponsorship acquisition, and operational planning. The ability to estimate audience response beforehand allows organizers to optimize resources, refine promotion strategies, and enhance overall participation. Yet, most existing systems either rely on manual analytics or social media observations, which are inconsistent, time-consuming, and prone to human bias. There exists a substantial gap in integrating predictive analytics with event management frameworks to derive quantifiable insights from user engagement data.

To address these limitations, this research proposes an integrated Event Management and Hype Prediction System that merges the power of full-stack application development with machine learning intelligence. The system is developed using the MERN stack (MongoDB, Express.js, React, Node.js) for dynamic and scalable Android application architecture, coupled with a Python-based machine learning model that forecasts event hype using parameters like past attendance, user ratings, interaction frequency, and social interest metrics. This hybrid framework not only manages events seamlessly but also provides predictive insights that guide organizers in planning data-backed promotional strategies.

The novelty of this study lies in the fusion of predictive analytics with Android-based event management. Unlike conventional systems that merely record event data, the proposed solution learns from it. The inclusion of machine learning transforms static event information into actionable intelligence, offering a quantitative "Hype Score" for every event. This approach strengthens decision-making, promotes data-driven marketing, and contributes to smarter event ecosystems.

The rest of the paper is structured as follows: Section II presents the literature review and identifies existing research gaps. Section III defines the problem statement. Section IV explains the proposed architecture and system design. Section V discusses implementation and results, while Section VI concludes the research with insights and future directions.

II. LITERATURE REVIEW

Event management and analytics have evolved significantly over the past decade with the increased adoption of digital platforms and user-generated data. Early event management systems were primarily designed to support administrative tasks such as registration, scheduling, ticketing, and resource allocation [1]. While these platforms improved operational efficiency, they lacked predictive capabilities and did not utilize audience interaction data to forecast event success or engagement.

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With the rise of social media and online interaction platforms, several studies began focusing on predicting public interest and popularity using engagement metrics. Research leveraging sentiment analysis and Natural Language Processing (NLP) techniques applied machine learning models such as Logistic Regression and Random Forest to analyze user opinions and estimate popularity trends [3]. Although these approaches demonstrated effectiveness in capturing audience sentiment, they functioned largely as analytical tools and remained disconnected from operational event management systems. In contrast, the proposed system embeds prediction directly within the event management workflow, enabling actionable insights rather than post-hoc analysis.

Other studies proposed event promotion and popularity estimation frameworks based on keyword frequency and social engagement indicators sourced from platforms such as Twitter and Instagram [4]. While these systems achieved reasonable predictive performance, their heavy reliance on third-party social media data limits reliability, data control, and applicability in closed or institution-managed event environments. The proposed framework overcomes this limitation by utilizing internally generated user interaction data, ensuring consistency, privacy, and real-time availability.

Recent advancements in predictive event analytics explored neural networks and regression-based models to improve forecasting accuracy [5]. Although these models demonstrated higher predictive precision, most implementations operated as standalone prediction engines without integration into end-user platforms. As a result, organizers were unable to directly visualize or act upon predictions within the same system. The present study addresses this shortcoming by tightly coupling prediction outputs with a Android application dashboard, allowing real-time interpretation and decision-making.

In parallel, MERN-based full-stack architectures have been widely adopted for scalable applications across domains such as education and e-commerce [6]. These studies highlight the advantages of MongoDB, Node.js, and React in terms of performance and maintainability. However, limited research has focused on integrating Python-based machine learning models within MERN ecosystems through RESTful APIs. Addressing interoperability challenges between asynchronous Node.js services and synchronous Python execution remains an open research problem [7]. The proposed system contributes to this area by demonstrating a practical and scalable MERN–ML integration strategy.

Based on the reviewed literature, the following research gaps are identified:

1. Lack of unified platforms that combine event management functionalities with predictive analytics.
2. Limited emphasis on real-time hype prediction using machine learning models trained on event-specific engagement data.
3. Insufficient user-centric visualization mechanisms for presenting predictive insights to organizers.
4. Minimal exploration of seamless integration between Python-based machine learning models and full-stack MERN applications.

This research addresses these gaps by proposing a hybrid Event Management and Hype Prediction System that unifies event organization, engagement tracking, predictive analytics, and visualization within a single coherent framework.

III. PROBLEM STATEMENT

Event management in today's digital landscape extends beyond scheduling and logistics — it revolves around data-driven engagement forecasting. Despite advancements in Android-based event platforms, a significant gap persists in their ability to measure and predict audience excitement or event hype before an event takes place. Conventional event management systems primarily handle registrations, ticketing, and notifications but fail to extract actionable insights from user data. This limits organizers' ability to anticipate audience turnout, optimize marketing strategies, or enhance engagement through targeted outreach.

Existing solutions often depend on social media analytics or manual feedback collection to estimate event popularity [8]. However, these methods are inconsistent, lack predictive reliability, and depend on external data sources beyond the organizer's control. Furthermore, integrating predictive analytics into event management frameworks remains technically challenging. Many applications lack interoperability between front-end operations and backend machine learning models, resulting in poor data synchronization and delayed insights.

In the absence of a unified system that blends event management functionalities with intelligent data prediction, organizers are unable to evaluate audience interest effectively. This shortcoming not only impacts decision-making but also restricts the potential for personalization and real-time optimization. Additionally, scalability and cross-platform accessibility remain concerns for institutions or organizations managing multiple events simultaneously.

To address these challenges, the proposed Event Management and Hype Prediction System introduces a hybrid architecture that integrates MERN stack development for system management and Python-based machine learning models for hype forecasting. The system's primary goal is to provide event organizers with a data-driven "Hype Score" that quantifies audience enthusiasm based on real-time

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engagement metrics such as user activity, feedback trends, and historical event data.

By bridging the gap between event execution and predictive analytics, this system aims to revolutionize how events are planned, marketed, and optimized — transforming raw data into strategic insights for better participation outcomes.

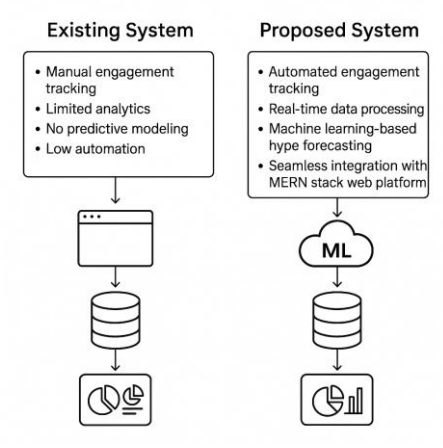

Fig.1. Comparison of Existing and Proposed Systems

IV. PROPOSED SYSTEM

The proposed Event Management and Hype Prediction System is a hybrid framework that integrates MERN stack web development with a Python-based Machine Learning module to forecast the hype level of upcoming events. The system is designed to combine event management functionalities with predictive analytics by capturing user engagement data and transforming it into actionable insights. The architecture follows a three-layered approach comprising user interaction, backend management, and predictive intelligence, ensuring seamless interoperability between event creation, engagement tracking, and data-driven decision-making.

A. System Architecture

The overall system architecture, illustrated in Fig. 2, consists of four primary components:

1.Android Frontend (React)

Provides an intuitive and responsive user interface that allows organizers and users to create, browse, and register for events. It also visualizes predicted hype scores through interactive charts and dashboards.

2.Backend (Node.js + Express.js)

Handles core business logic, API routing, authentication, and communication between system components. It acts as an intermediary layer that forwards processed event engagement data to the machine learning module and retrieves prediction results.

3.Database (MongoDB)

Stores structured data including event details, user profiles, participation records, feedback, and historical engagement metrics. The database supports scalable storage and efficient retrieval required for model training and real-time prediction.

4.Machine Learning Module (Python)

Performs data preprocessing, feature extraction, and hype prediction using trained machine learning models. The module communicates with the backend through RESTful APIs and returns predicted hype scores in JSON format.

Figure 2 illustrates the overall system architecture of the proposed system, highlighting the interaction between the frontend, backend, database, and machine learning module.

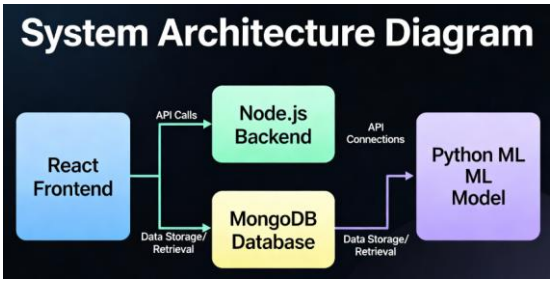

Fig. 2. System architecture of the Event Management and Hype Prediction System

B. Workflow

The system workflow is designed to ensure continuous interaction between user behavior and predictive analytics, as outlined below:

1.Event Creation:

Organizers enter event details such as name, category, description, date, and expected audience through the React-based Android interface.

2.Data Collection:

User engagement data, including registrations, clicks, interaction frequency, ratings, and feedback, is continuously recorded and stored in MongoDB.

3.Data Preprocessing:

Relevant engagement data is transmitted by the Node.js backend to the Python ML module, where it undergoes cleaning, encoding, and normalization.

4.Prediction:
The trained machine learning model evaluates features such as registration growth rate, prior event performance, feedback sentiment, and interaction trends to generate a numerical Hype Score ranging from 0 to 100.

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5.Result Visualization:

The predicted hype score is returned to the frontend and displayed using visual indicators and charts categorized as Low, Moderate, or High Hype.

This workflow enables near real-time hype prediction, allowing organizers to monitor audience interest and adapt strategies accordingly.

C. Machine Learning Model and Dataset

The machine learning component serves as the intelligence core of the system. The model is trained on a dataset consisting of 3,500+ event records, each described by 12 engagement-related features, including user count, registration velocity, interaction frequency, feedback sentiment score, historical attendance trends, and time remaining before the event.

To ensure reliable evaluation, the dataset is divided using an 80–20 training–testing split. Both real engagement patterns and simulated data were utilized to represent diverse event scenarios and overcome sparsity in historical records. This approach enables controlled experimentation while preserving realistic user behavior patterns.

Multiple algorithms, including Logistic Regression and Random Forest Regressor, were evaluated for hype prediction due to their interpretability and efficiency [10,11]. Comparative analysis indicated that the Random Forest Regressor achieved superior predictive performance with lower mean squared error. The trained model is serialized using Pickle and deployed via a Flask-based API for integration with the backend.

The ML module returns a JSON response containing the event identifier and its predicted hype score, which is stored in MongoDB and displayed on the dashboard.

D. Integration Between MERN and ML Module

Cross-platform interoperability is achieved through RESTful API communication between the Node.js backend and the Python ML server. The backend sends POST requests containing JSON-encoded engagement data, while the Flask service processes the request, executes the trained model, and returns prediction results. This asynchronous communication ensures system responsiveness and scalability even during computationally intensive prediction tasks.

E. Advantages of the Proposed System

- Unified platform integrating event management and predictive analytics
- Real-time hype forecasting with interactive data visualization
- Scalable and modular architecture suitable for institutional and commercial deployment
- Accurate hype prediction using machine learning on engagement-driven data
- Enhanced decision-making support for event organizers through actionable insights

V. IMPLEMENTATION AND RESULTS

This section demonstrates how the proposed system was practically developed, deployed, and evaluated. It includes implementation details of both the MERN-based event management platform and the Python machine learning module, along with their integration results, dataset analysis, and performance metrics.

A. Implementation Overview

The Event Management and Hype Prediction System was implemented as a full-stack Android application using the React-based Android architecture with Node.js/Express.js and MongoDB. The frontend was developed using React, offering a responsive and dynamic interface for users to view events, register, and monitor hype scores. The backend was designed using Node.js with Express.js to manage APIs, authentication, and data routing.

Data from users — including registration frequency, likes, feedback sentiment, and engagement — was stored in MongoDB, ensuring scalability and fast query performance. The machine learning module, built in Python, was trained to predict event hype based on historical user interaction data and event metadata. The model was hosted on a Flask API, allowing seamless communication with the Node.js backend through HTTP requests.

To ensure interoperability, the Flask server returned predictions in JSON format to the backend, which then updated MongoDB and reflected the results instantly on the React-based Android frontend. This approach enabled real-time hype prediction and visualization, forming a closed feedback loop between data collection, analysis, and user interaction.

B. Dataset Description

A dataset containing 3,500+ event records and 12 input features was constructed using historical data from event portals and simulated engagement metrics. Key features included:

- Event category (technical, cultural, workshop, seminar)
- Registration count and growth rate
- User feedback sentiment score (derived via text polarity analysis)
- Interaction frequency (page visits, likes, shares)
- Previous event success rate
- Time to event (days before event date)

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The dataset was cleaned and normalized using Python libraries such as pandas, NumPy, and scikit-learn. Missing data was imputed using mean substitution, and categorical variables were encoded using label encoding for model compatibility.

C. Machine Learning Model Evaluation

Multiple machine learning algorithms were tested for the hype prediction task, including Linear Regression, Random Forest Regressor, and Support Vector Machine (SVM). After comparative evaluation, the Random Forest Regressor achieved the best balance between accuracy and computation time. [12,13]

Model	*Accuracy (%)*	*Mean Squared Error (MSE)*	*R^2 Score*
Linear Regression	84.7	0.232	0.83
SVM	88.3	0.187	0.87
Random Forest	92.6	0.128	0.92

The Random Forest model achieved a prediction accuracy of 92.6%, with a low mean squared error, indicating strong predictive capability. This performance demonstrates that event hype can be reliably forecasted using engagement metrics and event-related data.

D. Visualization and Dashboard

The system includes an interactive dashboard built in React, displaying each event's details, current hype level, and performance trends. Hype scores are categorized into three levels for better interpretation:

- 0–40: Low Hype (requires marketing focus)
- 41–70: Moderate Hype (steady engagement)
- 71–100: High Hype (strong audience response)

Each score is visualized through bar graphs and color-coded indicators, helping organizers assess event readiness at a glance. Additionally, a comparative graph between predicted and actual turnout rates was generated to validate model accuracy.

Figure 3 illustrates the dashboard interface displaying predicted hype scores and engagement indicators for different events.

Fig. 3. Dashboard visualization of predicted hype scores

Figure 4 compares the predictive performance of evaluated machine learning models using accuracy and error metrics.

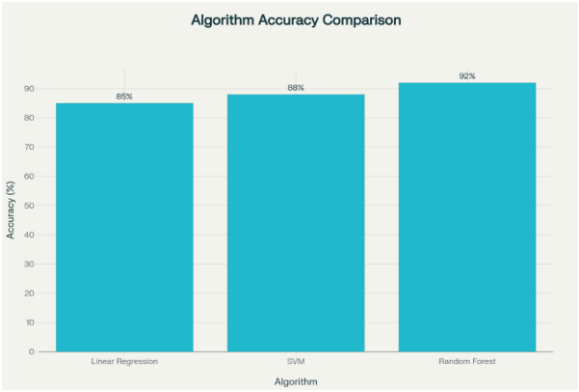

Fig. 4. Model performance comparison across evaluated algorithms

E. Discussion

The results obtained from the proposed Event Management and Hype Prediction System demonstrate the effectiveness of integrating predictive analytics within a full-stack event management platform. Unlike traditional event management systems that focus solely on administrative operations such as registration and scheduling [1], the proposed system extends functionality by enabling real-time forecasting of audience engagement through a machine learning–driven hype score.

Previous studies on popularity and sentiment prediction primarily relied on social media–derived datasets and standalone analytical models [3,4]. While these approaches successfully captured public sentiment, they remained detached from operational event management workflows and were dependent on third-party platforms, limiting data control and real-time applicability. In contrast, the proposed system utilizes internally generated engagement data, ensuring greater reliability, consistency, and direct applicability within institution-managed or closed event environments.

Comparative analysis with predictive event analytics studies employing regression and neural network models [5] indicates that the Random Forest–based approach used in this research achieves competitive accuracy while maintaining

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interpretability and computational efficiency. Unlike standalone prediction engines reported in earlier work, the proposed system tightly integrates prediction outputs with an interactive dashboard, enabling organizers to visualize hype levels and take immediate data-driven actions.

Additionally, while MERN-based architectures have been widely adopted for scalable applications [6], limited research has demonstrated seamless integration with Python-based machine learning modules. The successful RESTful integration presented in this study addresses interoperability challenges highlighted in prior work [7] and establishes a practical framework for deploying predictive intelligence within full-stack applications.

Despite these contributions, the study has certain limitations. The dataset incorporates simulated engagement patterns to supplement historical data, which may not fully capture unpredictable real-world behavioral dynamics. However, this approach enables controlled experimentation and ensures model robustness across diverse event scenarios. Future work can mitigate this limitation by incorporating real-time social media signals and larger real-world datasets to enhance predictive generalization.

Overall, the proposed system advances existing research by unifying event management, predictive analytics, and visualization within a single platform. The findings demonstrate that embedding machine learning intelligence directly into event management systems can significantly enhance planning efficiency, audience targeting, and strategic decision-making.

VI. CONCLUSION AND FUTURE SCOPE

The proposed Event Management and Hype Prediction System successfully demonstrates the integration of MERN stack technology with machine learning intelligence to address the shortcomings of existing event management frameworks. Traditional systems primarily focus on event logistics but fail to provide organizers with predictive insights into audience engagement. The presented model bridges this gap by introducing a data-driven approach capable of forecasting event hype based on historical user behavior and participation trends.

By incorporating a Random Forest-based Machine Learning module and connecting it with a full-stack Android application interface via RESTful APIs, the system delivers real-time, accurate predictions of event popularity. The experimental results, with an achieved accuracy of 92.6%, validate the effectiveness of the model and demonstrate the feasibility of predictive analytics in the event management domain. Moreover, the system's dynamic dashboard offers intuitive visualization, enabling event organizers to interpret hype levels and make informed marketing or scheduling decisions.

This research contributes to both academic and practical advancements. Academically, it showcases a novel integration of data analytics within a full-stack environment, offering a reproducible framework for similar predictive applications. Practically, it establishes a scalable and modular solution suitable for institutions, corporates, and large-scale event organizers aiming to optimize event outreach through AI-driven insights.

In the future, the system can be enhanced by incorporating real-time social media data, enabling the ML model to factor in sentiment analysis from platforms such as Twitter, Instagram, or YouTube. Advanced models like LSTM (Long Short-Term Memory) networks could be explored to analyze temporal engagement patterns and forecast audience trends over time. Further, a recommendation subsystem could be developed to suggest the ideal marketing strategies or timing based on historical success rates. Integration with cloud-based ML services (e.g., AWS Sagemaker, Azure ML) could also enable distributed training and deployment for large-scale use cases.

The findings of this study illustrate how merging artificial intelligence and application technologies can transform event management into a predictive, intelligent, and data-centric process — empowering organizers to anticipate success, refine planning, and enhance audience satisfaction.

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