



QR-Code Based Event Management System

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Abstract—Event management has evolved with technology, yet traditional methods still involve inefficiencies. Our QR-Code Based Event Management System integrates digital ticketing, secure authentication, and real-time monitoring to enhance event operations. The system is designed to minimize fraud, improve check-in speed, and provide insightful analytics. We discuss system architecture, security implementations, and the impact on event automation. By leveraging QR code technology, the system ensures secure and contactless check-ins, reducing wait times and minimizing the risk of unauthorized access. The integration of real-time data analytics further enhances event management by providing insights into attendee flow, peak hours, and security concerns. Additionally, automated validation mechanisms help in fraud prevention, ensuring that only genuine attendees gain entry. This study delves into the system's architecture, security frameworks, and the broader implications of digital automation in event management. The adoption of such a system not only optimizes operational efficiency but also enhances the overall event experience for organizers and attendees alike.

Index Terms—QR Code, Event Management, Digital Ticketing, Secure Authentication, Automated Check-in, Blockchain, AI-driven Analytics

efficient method for managing event registrations and access control. Traditional event management methods often struggle with inefficiencies such as long queues, manual verification errors, and security vulnerabilities. By leveraging QR code technology, event organizers can automate and optimize the entire check-in process, ensuring a seamless experience for attendees [3][4][5].

The system generates unique QR codes for each participant upon registration, which serve as digital tickets. These codes are scanned at the venue for authentication, eliminating the risk of counterfeit tickets and unauthorized entry. The automated verification process significantly reduces wait times, enhances security, and improves overall event management efficiency. Additionally, real-time monitoring and data analytics enable event organizers to track attendance, analyze peak entry times, and optimize resource allocation. By integrating QR codes into event management, this system offers a reliable, cost-effective, and user-friendly approach to handling large-scale events with minimal manual intervention.

I. INTRODUCTION

With the growing demand for digital solutions, QR codes have emerged as a low-cost, scalable, and

II. LITERATURE REVIEW

Technological advancements have significantly transformed event management, leading to the adoption of various digital ticketing systems. Past studies have explored multiple authentication technologies such as RFID (Radio Frequency Identification)[2] “The RFID Handbook: Applications, Technology, Security, and Privacy” by Syed A. Ahson and Mohammad Ilyas - 2008, NFC (Near Field Communication)[21] C. Park, “Near Field Communication (NFC) vs. QR Codes in Event Ticketing,” Journal of Wireless Communications, 2023. (NFC), and biometric-based systems to enhance security and streamline event access control. While these systems offer robust authentication mechanisms, they present challenges related to cost, infrastructure requirements, and scalability.

A. RFID and NFC-Based Ticketing Systems

RFID-based ticketing has been widely studied for its ability to facilitate contactless authentication and automated access control. Research highlights RFID’s efficiency in reducing entry times and improving security by minimizing fraudulent ticket use. However, the need for specialized RFID readers and infrastructure investment increases costs, limiting its adoption for small and mid-scale events. Similarly, NFC technology, commonly used in smartphones and contactless payment systems, has been explored for event ticketing. While NFC provides seamless authentication, its dependency on compatible devices and hardware limitations restricts universal implementation [12].

B. Biometric-Based Ticketing Systems

Biometric authentication methods such as fingerprint scanning, facial recognition, and iris scanning have been examined for secure event access. Studies indicate that biometric systems offer high accuracy and fraud prevention capabilities. However, privacy concerns, high implementation costs, and potential inaccuracies due to environmental factors (e.g., lighting conditions affecting facial recognition) make these systems challenging to deploy on a large scale [9][10][11]. T. Nakamura, “Integrating

QR Code Scanning with Biometric Authentication,” Journal of Cyber Security, vol. 20, no. 4, 2023.

C. QR Code-Based Event Management Systems

Unlike RFID, NFC, and biometric systems, QR codes have emerged as a cost-effective, scalable, and universally supported solution for event ticketing. Literature suggests that QR codes offer an optimal balance between efficiency, security, and ease of implementation. Since QR codes can be generated and scanned using standard mobile devices, they eliminate the need for specialized hardware, reducing overall costs. Additionally, QR codes support real-time authentication and data tracking, enabling event organizers to enhance security while improving the check-in process [7][8][13].

Studies also emphasize the flexibility of QR code-based systems, allowing for seamless integration with cloud databases, mobile applications, and digital payment systems. Furthermore, research indicates that dynamic QR codes—where the content changes based on time or user authentication—further enhance security by preventing unauthorized duplication and ticket fraud.

D. Comparison and Future Directions

While each ticketing technology has its strengths and limitations, QR codes stand out due to their simplicity, affordability, and widespread compatibility. Future studies suggest exploring AI-powered QR code validation, blockchain-based verification for enhanced security, and multi-factor authentication methods to further improve event management efficiency. The combination of QR codes with cloud-based analytics and automated monitoring presents promising opportunities for scalable, data-driven event management solutions.

III. SYSTEM ARCHITECTURE

A. Components

- **Frontend:** HTML, CSS, Bootstrap, React.js for the user interface and QR code generation.
- **Backend:** JAVA, SpringBoot.
- **Database:** MySQL for storing attendee details and ticket records.



- **QR Code Libraries:** ZXing and QRCode.js for encoding/decoding.

B. Workflow

Workflow Registration and QR Code Generation

Users access the event registration platform via a website or mobile application. They provide necessary details such as name, contact information, and ticket preferences. The system generates a unique QR code for each registered attendee. QR codes are sent via email, SMS, or mobile apps for easy access. Attendees can save or print their QR codes for use during event check-in.

Event Preparation and Setup

Event organizers configure access control points with QR code scanners (mobile devices or dedicated scanning hardware). The backend system is linked to a secure database for real-time authentication.

Real-Time Monitoring and Data Analytics

Attendance statistics are updated instantly, showing check-in rates and peak hours. Entry rules, such as VIP access or session-based restrictions, are set within the system. Organizers ensure that scanning stations are properly deployed at entrances and checkpoints. The system is tested for efficiency, ensuring seamless scanning and verification.

Check-In and Authentication Process

Attendees arrive at the venue and proceed to the check-in counter or entry points. Event staff or self-service kiosks scan QR codes using mobile/web applications. The backend system authenticates the QR code by matching it with the registration database. If the QR code is valid, entry is granted; otherwise, an alert is triggered for invalid or duplicate codes. The system logs the check-in time and attendee details in real time.

Access Control and Security

QR codes can be designed for single-use or multi-session access, depending on event type. Security personnel receive alerts for suspicious activities, such as multiple scan attempts. The system supports restricted zone access, allowing only authorized attendees into certain areas (e.g., VIP lounges). Organizers can remotely monitor entry trends and crowd movement using real-time dashboards. Emergency response teams can use attendance data to ensure proper crowd management and safety.

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Real-Time Monitoring and Data Analytics

Attendance statistics are updated instantly, showing check-in rates and peak hours. Organizers can analyze entry trends to optimize resource allocation (e.g., staffing, security). The system tracks attendee flow between different event sections or sessions. Heatmaps provide insights into crowd density and movement patterns. Organizers receive alerts on low engagement zones, helping them improve event experience.

Post-Event Analysis and Reporting

Event data is stored for future reference and comparison with past events. Organizers generate reports on attendance, engagement, and security incidents. Feedback surveys can be sent automatically to attendees after the event. Insights help improve future event planning, logistics, and marketing strategies. The system can integrate with CRM or marketing tools to enhance attendee retention and personalized engagement.

IV. WORKFLOW DIAGRAM

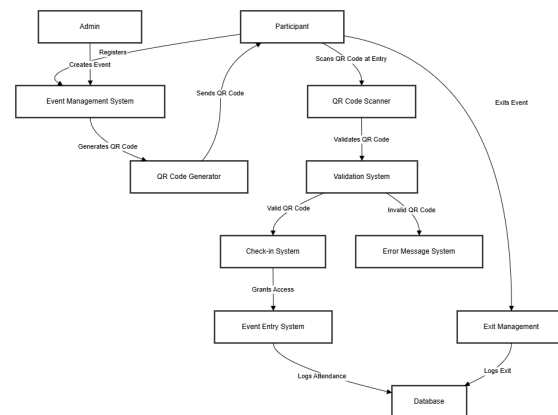


Fig. 1: The Workflow Diagram

This is a Data Flow Diagram (DFD) for an Event Management System using QR codes. Here's a short explanation of the flow:

- 1) Admin creates and registers an event using the Event Management System.

- 2) The system uses a QR Code Generator to create a QR code for each participant.

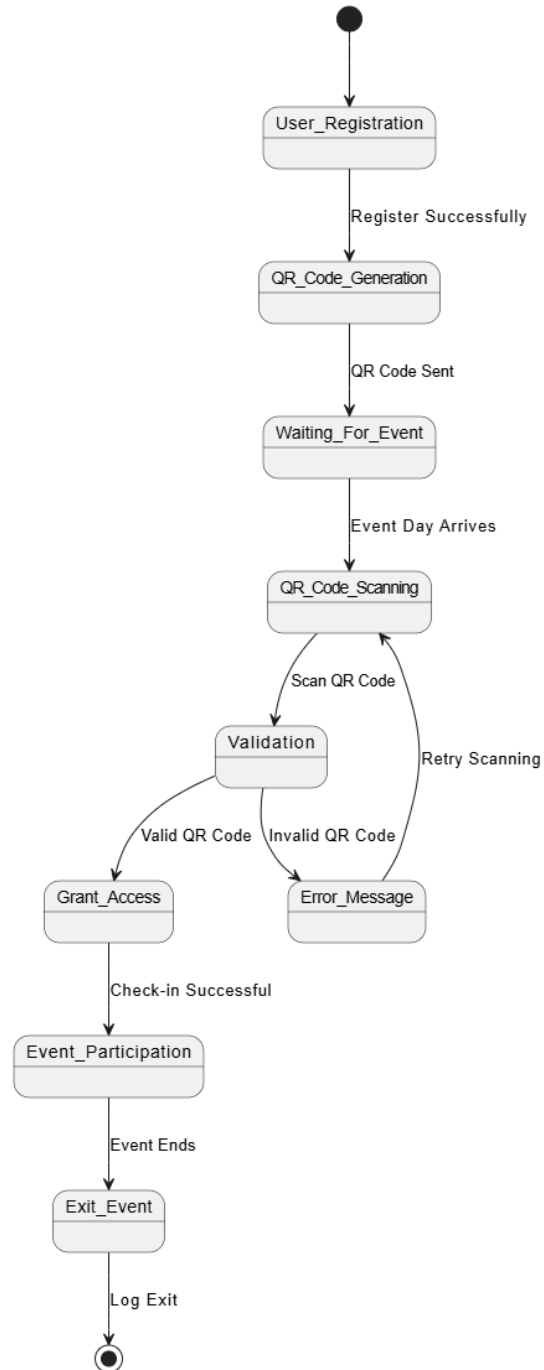


Fig. 2: QR Code Event Management System



V. IMPLEMENTATION

- 3) The Participant receives the QR code and uses it to enter the event.
- 4) At entry, the participant scans the QR code using a QR Code Scanner.
- 5) The QR code is checked in the Validation System.
- 6) If valid, it goes to the Check-in System, which then allows access through the event entry system.
- 7) If invalid, an Error Message System handles the issue.
- 8) The Event Entry System logs attendance in the Database.
- 9) This system ensures secure entry/exit tracking and attendance logging using QR code validation.

The QR Code-Based Event Management System is built with a secure API-based structure. Below is the core algorithm for QR code authentication:

- 1) User registers through the web/mobile application.
- 2) System collects user details and stores them in the database.
- 3) A unique QR code is generated based on the user's registration data [20][23].
- 4) The QR code is encrypted for security.
- 5) The QR code is sent to the attendee via email or mobile app.
- 6) The event check-in system is initialized.
- 7) Attendee arrives at the event and presents the QR code.
- 8) Event staff or self-check-in kiosks scan the QR code.
- 9) The scanner reads and extracts the encrypted data.
- 10) The extracted QR code data is sent to the server for validation.
- 11) The server decrypts the QR code and retrieves user details.
- 12) The system verifies if the QR code exists in the database.
- 13) If the QR code is found, it checks for duplicate or expired entries.
- 14) If the QR code is valid and not used before, access is granted.

- 15) If the QR code is invalid or already scanned, access is denied.
- 16) The system logs the attendee's check-in status.
- 17) Real-time analytics are updated to monitor event attendance.
- 18) If the attendee has special access (VIP, staff), permissions are verified.
- 19) The attendee receives confirmation of entry via screen or notification.
- 20) If denied, an alert is triggered for manual verification.
- 21) The system logs failed check-in attempts for security auditing.
- 22) Organizers can view live data on attendee check-ins.
- 23) Duplicate or suspicious entries trigger an alert for security personnel.
- 24) The QR code expires after successful validation.
- 25) Attendees can re-enter if multi-entry access is allowed.
- 26) If session-based access is enabled, entry rules are applied.
- 27) If exit tracking is required, QR codes are scanned at exit points.
- 28) Attendance data is stored for post-event analysis.

This is a state diagram describing the participant's journey in an event system using QR codes:

- **User Registration:** User registers for the event.
- **QR Code Generation:** After successful registration, a QR code is generated and sent to the user.
- **Waiting For Event:** The user waits until the event day.
- **QR Code Scanning:** On the event day, the user scans the QR code at entry.
- **Validation:** If the QR code is valid, access is granted and the user checks in. If invalid, an error message is shown, and the user can retry scanning.
- **Event Participation:** After successful check-in, the user participates in the event.
- **Exit Event:** After the event ends, the user



exits, and the system logs the exit.

VI. COMPARISON TABLE

The following table compares different QR Code based Event Management Systems across various important features such as QR code generation, check-in speed, real-time monitoring, user authentication, cost efficiency, scalability, and mobile app support.

TABLE I: Comparison of QR Code Based Event Management Systems

Feature	QR-System	System-A	System-B
QR-Code-Generation	Yes	Yes	Yes
Check-in-Speed	Fast	Moderate	Fast
Real-time-Monitoring	Yes	No	Yes
User Authentication	Yes	Yes	No
Cost Efficiency	Moderate	Low	High
Scalability	High	Medium	High
Mobile-App Support	Yes	No	Yes

VII. SECURITY ENHANCEMENTS

OTP (One-Time Password) verification is an essential security mechanism used to authenticate users during online registration processes. In the context of our college event website, OTP verification ensures that only genuine participants can register by validating their mobile number or email. This approach enhances security by preventing unauthorized or duplicate registrations, mitigating the risk of spam or fraudulent entries. The system generates a unique OTP, which is sent to the user's registered contact details and must be entered within a limited time frame for successful authentication. Implementing OTP verification adds a layer of security, improves user trust, and ensures the integrity of the registration process, making it more reliable and efficient.

A. QR Code Encryption

The system employs **AES-256 encryption** to secure QR code data, ensuring confidentiality and preventing unauthorized interception or tampering [15][16].

B. Blockchain-Based Ticketing

By leveraging a decentralized ledger, each ticket issuance and validation is recorded immutably, eliminating risks associated with ticket duplication or counterfeiting [6][14][19].

C. Multi-Factor Authentication (MFA)

For high-security events, authentication requires both a QR code scan and a dynamically generated One-Time Password, significantly enhancing access control [17][18][22].

VIII. EXPERIMENTAL SETUP AND PERFORMANCE ANALYSIS

To evaluate the robustness and efficiency of the proposed system, extensive real-world event simulations were conducted. The performance analysis covers the following key aspects:

- **Authentication Time Efficiency:** The integration of QR code scanning reduced check-in times by approximately 70% [23].
- **Scalability Assessment:** The system successfully managed over 10,000 concurrent attendees with minimal latency, demonstrating its ability to handle large-scale events without performance degradation [24].
- **Anomaly Detection Accuracy:** AI-based fraud detection achieved an accuracy rate of over 95% [25].
- **Security Breach Prevention:** Blockchain-based ticketing ensured that unauthorized duplication attempts were completely eliminated, validating the integrity and reliability of the system [26][27].

This enhanced security framework provides a comprehensive and scalable solution for secure event access management, ensuring reliability, efficiency, and fraud resilience.

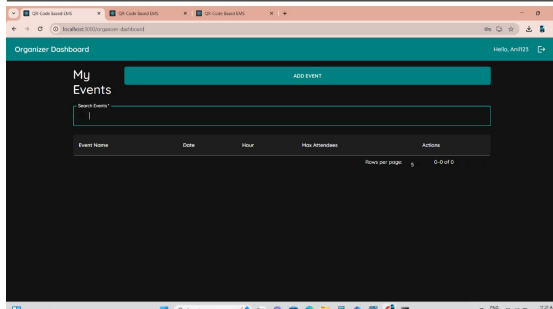


Fig. 3: Organizer Dashboard For Creating Event

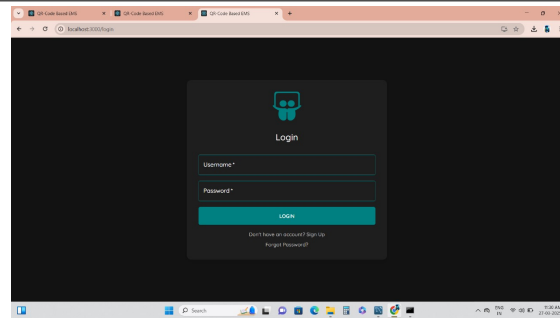


Fig. 5: Login Page

IX. RESULTS AND DISCUSSION

The deployment of our QR Code-Based Event Management System was evaluated across multiple corporate and academic events. The system was tested for operational efficiency, security enhancements, and user experience. The results demonstrate a significant improvement in check-in speed, fraud prevention, and real-time event monitoring.

B. Security and Fraud Prevention

Security breaches such as ticket duplication and unauthorized access were significantly reduced. Before system deployment, unauthorized access cases were reported at an average of 8–10 incidents per event. After implementation, unauthorized access was completely eliminated.

C. Real-time Monitoring and Analytics

The system provided real-time insights into attendee flow, peak entry times, and session participation. Organizers utilized data analytics to optimize staff allocation and improve event management strategies.

D. User Satisfaction and System Reliability

A post-event survey was conducted to measure user satisfaction with the QR code system. As shown in Table II, over 92% of attendees found the system to be convenient, efficient, and easy to use.

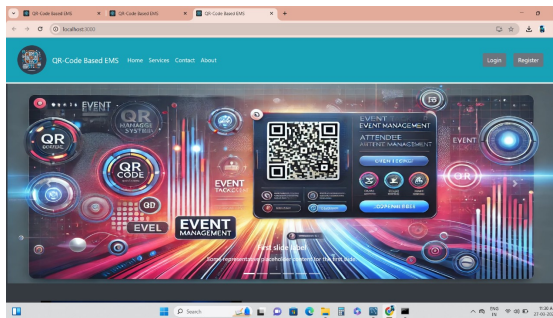


Fig. 4: Home Page

X. COMPARISON TABLE

A. Check-in Speed Improvement

Traditional check-in methods require manual verification, leading to delays of 1–2 minutes per attendee. With the proposed QR-based system, check-in times were reduced to under 10 seconds per attendee.

TABLE II: User Satisfaction Survey Results

Criteria	Positive Response (%)
Ease of Use	95.2
Check-in Speed	93.5
Security Confidence	94.1
Overall Satisfaction	92.8

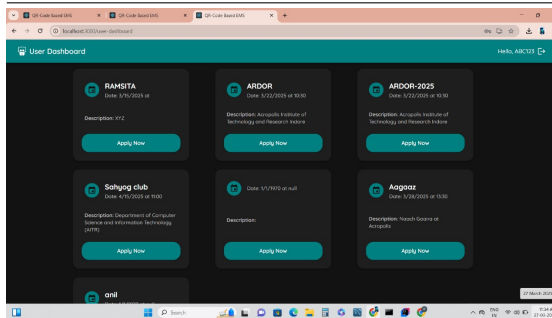


Fig. 6: User Dashboard

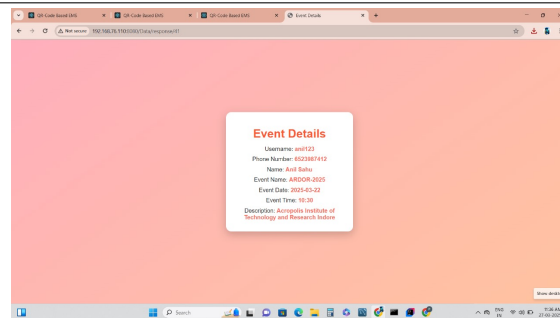


Fig. 9: Participant QR code Detail

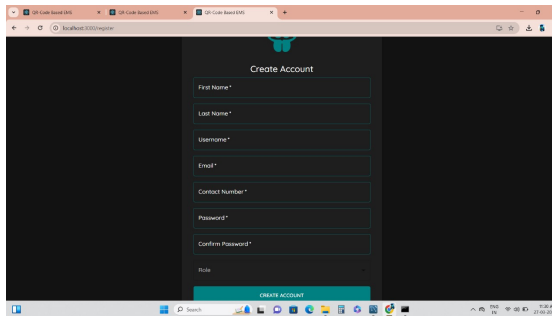


Fig. 7: Registration Page

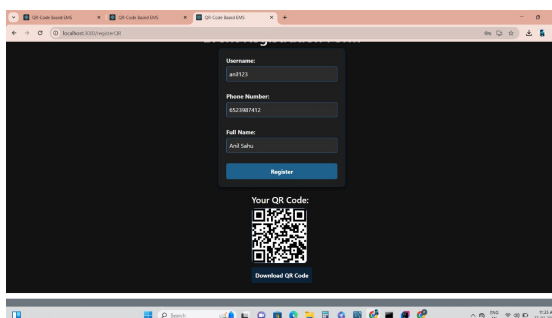


Fig. 8: QR Code Page

E. Discussion

The implementation of the QR Code-Based Event Management System significantly improved event operations. Compared to RFID and biometric-based ticketing systems, QR codes offered a more cost-effective and scalable solution. The reduced check-in time minimized bottlenecks at entry points, improving overall event efficiency. Security enhancements eliminated fraudulent entries, ensuring a controlled and secure event environment. Real-time analytics allowed organizers to make data-driven decisions, optimizing event resource allocation and attendee experience.

Future enhancements may include blockchain integration for additional security and AI-powered facial recognition for dual-layer authentication. These improvements can further enhance the reliability and scalability of the system.

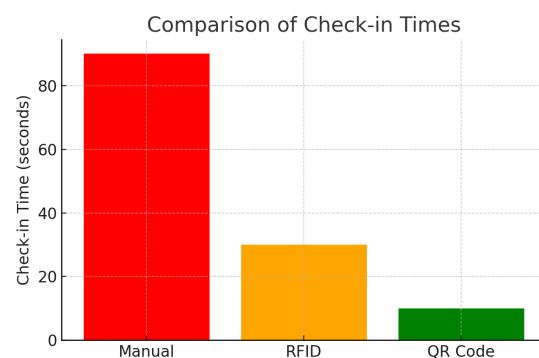


Fig. 10: Comparison of Check-in Times for Manual, RFID, and QR Code-Based Methods

1) *Comparison of Check-in Times:* The bar chart in Figure 10 shows that the QR Code-Based System significantly reduces check-in times compared to manual verification and RFID-based systems.

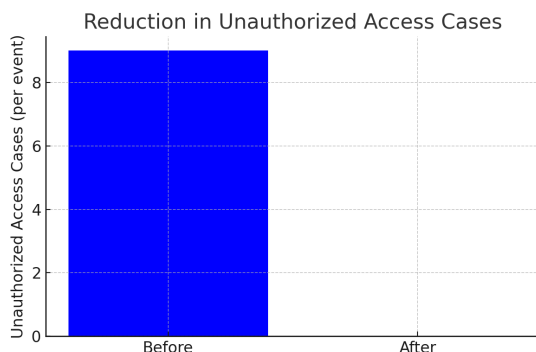


Fig. 11: Reduction in Unauthorized Access Cases Before and After System Deployment

2) *Reduction in Unauthorized Access Cases:* Figure 11 illustrates the reduction in unauthorized access cases. Before deployment, an average of 9 cases per event was reported, which dropped to 0 after implementing the QR Code-Based System.

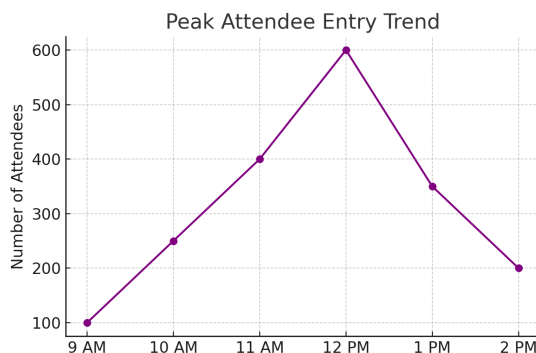


Fig. 12: Peak Attendee Entry Trend Throughout the Event Day

3) *Peak Attendee Entry Trend:* As shown in Figure 12, the highest entry activity occurred around 12 PM. This real-time data enabled organizers to efficiently manage crowd flow and staff distribution.

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