

Towards Cognitive Olympic Event Management Systems: AI, Kubernetes, and Intelligent Automation in Mega Sporting Events

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ABSTRACT

The rapid digital transformation of global sporting events has significantly increased the demand for intelligent, scalable, and resilient software infrastructures capable of managing complex operational environments. Modern Olympic event management platforms must process massive volumes of real-time data, coordinate distributed services, maintain cybersecurity, and ensure uninterrupted user experiences for athletes, organizers, spectators, and stakeholders. Traditional software management approaches often struggle to meet these dynamic requirements due to limitations in scalability, deployment speed, predictive monitoring, and system adaptability. This study proposes a scalable AI-integrated DevOps architecture designed specifically for smart Olympic event management platforms to address these challenges. The proposed framework combines Artificial Intelligence (AI), DevOps practices, cloud-native technologies, and intelligent automation to enhance operational efficiency, software reliability, and system responsiveness within Olympic digital ecosystems. The architecture incorporates continuous integration and continuous deployment (CI/CD) pipelines, AI-driven predictive analytics, automated infrastructure monitoring, container orchestration, and real-time fault detection mechanisms. Furthermore, the framework utilizes machine learning models to analyse system behaviour, predict potential service disruptions, optimize resource allocation, and support proactive decision-making during large-scale sporting events.

This research adopts a design science and system architecture methodology to develop and evaluate the proposed framework through simulated Olympic event management scenarios. Key performance indicators such as deployment frequency, system scalability, incident response time, fault tolerance, and operational efficiency are used to assess the effectiveness of the architecture. The study demonstrates that integrating AI capabilities into DevOps environments can significantly improve software delivery performance, reduce downtime, enhance cybersecurity readiness, and support intelligent event coordination under high-demand operational conditions. The findings contribute to the growing intersection of Software Engineering, intelligent systems, and sports event technologies by providing a novel architectural model for mega-event digital management. The proposed framework offers practical implications for Olympic organizers, smart stadium developers, software engineers, and policymakers seeking to modernize large-scale sporting event infrastructures through advanced automation and intelligent computing technologies. Additionally, the study establishes a foundation for future research in AI-enabled DevOps ecosystems for global event management and smart city applications.

Keywords: Artificial Intelligence, DevOps Architecture, Smart Olympic Event Management, Cloud Computing, Software Engineering

INTRODUCTION

The increasing digitalization of global sporting events has transformed the operational structure of modern Olympic management systems. Contemporary Olympic platforms are no longer limited to scheduling competitions and managing athlete participation; instead, they now encompass complex digital ecosystems involving real-time communication, intelligent crowd management, cybersecurity monitoring, cloud-based services, ticketing systems, transportation coordination, media broadcasting, and data-driven decision-making processes. As one of the world's largest and most Technologically demanding mega-events, the Olympic Games require highly scalable, reliable, and adaptive software infrastructures capable of supporting millions of simultaneous interactions across geographically distributed environments. Consequently, the integration of advanced technologies within Software Engineering has become essential for ensuring efficient Olympic event management. Traditional software development and deployment models often face substantial limitations when applied to large-scale event management systems. Conventional infrastructures are frequently characterized by slow deployment cycles, limited scalability, delayed fault detection, and inadequate responsiveness to rapidly changing operational conditions (Bass et al., 2021). During Olympic events, software failures or service disruptions can severely affect security operations, transportation systems, digital ticketing, athlete coordination, and spectator experiences. The dynamic and time-sensitive nature of Olympic operations therefore demands intelligent software architectures capable of continuous monitoring, automated deployment, predictive maintenance, and rapid recovery from system failures. In recent years, DevOps has emerged as a transformative approach in software engineering by integrating software development and IT operations into a unified framework that emphasizes collaboration, automation, continuous integration, and continuous deployment (CI/CD) practices (Kim et al., 2021). DevOps methodologies enable organizations to accelerate software delivery while improving system reliability and operational efficiency. Through automated workflows, infrastructure as code, container orchestration, and real-time monitoring, DevOps supports the development of scalable and resilient digital ecosystems suitable for large-scale operational environments. However, while DevOps improves software lifecycle management, many existing DevOps frameworks still rely heavily on reactive monitoring mechanisms rather than proactive and intelligent system optimization. Artificial Intelligence (AI) has increasingly been incorporated into modern software infrastructures to address these limitations. AI technologies such as machine learning, predictive analytics, intelligent automation, and anomaly detection provide organizations with the ability to analyze complex datasets, identify operational risks, predict failures, and automate decision-making processes in real time (Russell &

Norvig, 2021). The integration of AI into DevOps environments, commonly referred to as AIOps or AI-driven DevOps, has demonstrated significant potential in improving software performance, reducing downtime, optimizing resource allocation, and strengthening cybersecurity resilience. Within Olympic event management systems, AI can support intelligent crowd flow prediction, automated incident detection, resource optimization, and predictive infrastructure management under high-demand operational conditions.

Despite the growing adoption of AI and DevOps across various industries, limited scholarly attention has been devoted to the development of integrated AI-driven DevOps architectures specifically designed for smart Olympic event management platforms. Existing research primarily focuses on isolated domains such as cloud computing, cybersecurity, smart stadium technologies, or event analytics without providing a comprehensive architectural framework capable of integrating scalability, intelligent automation, operational reliability, and continuous deployment within a unified Olympic management ecosystem (Zhang et al., 2022). Moreover, the increasing complexity of digital sporting infrastructures has created new challenges related to interoperability, real-time scalability, fault tolerance, and cybersecurity management that conventional software engineering approaches are often unable to address effectively. This study seeks to bridge this research gap by proposing a scalable AI-integrated DevOps architecture specifically designed for smart Olympic event management platforms. The proposed framework combines AI-driven predictive analytics, cloud-native infrastructures, automated monitoring systems, CI/CD pipelines, and intelligent orchestration mechanisms to improve operational performance and system adaptability during mega sporting events. The architecture aims to enhance deployment efficiency, minimize service interruptions, strengthen cybersecurity readiness, and enable proactive infrastructure management through intelligent automation and data-driven decision-making processes. The significance of this research extends beyond Olympic event management and contributes to broader advancements in intelligent software engineering and smart infrastructure development. As global cities increasingly adopt smart technologies for transportation, security, communication, and public service management, scalable AI-integrated DevOps frameworks may serve as foundational models for future smart city ecosystems and other large-scale international events. Furthermore, this research contributes to the theoretical and practical development of AI-enabled DevOps by demonstrating how intelligent automation can improve system reliability and operational sustainability within highly dynamic and mission-critical environments. The remainder of this paper is organized into several sections. The literature review examines existing studies on DevOps, AI-driven software systems, cloud computing, and smart event management technologies. The methodology section presents the proposed architectural framework and research design. Subsequently, the study evaluates the effectiveness of the proposed system using simulated Olympic operational scenarios and discusses the implications of integrating AI with DevOps practices in large-scale event infrastructures. Finally, the paper concludes with recommendations for future research and practical implementation strategies for intelligent Olympic event management systems.

LITERATURE REVIEW

The rapid advancement of digital technologies has significantly transformed the management of mega sporting events, particularly the Olympic Games. Modern Olympic event management systems rely heavily on intelligent digital infrastructures to coordinate logistics, security, transportation, communication, and spectator services. As a result, researchers in Software Engineering have increasingly explored scalable software architectures, cloud-native platforms, and intelligent automation techniques to support large-scale sporting operations.

DevOps has emerged as one of the most influential approaches in modern software engineering due to its ability to improve collaboration between development and operations teams while accelerating software

delivery processes. According to Bass et al. (2021), DevOps enhances software reliability through continuous integration, automated deployment, and infrastructure monitoring. Similarly, Kim et al. (2021) argued that DevOps practices improve operational efficiency and reduce deployment failures in large-scale digital ecosystems. These capabilities are particularly relevant for Olympic event management systems, where uninterrupted digital services and rapid scalability are critical during high-demand operational periods. Recent studies have also highlighted the growing role of Artificial Intelligence (AI) in optimizing complex software infrastructures. AI-driven systems utilize machine learning algorithms, predictive analytics, and intelligent automation to improve decision-making and system performance (Russell & Norvig, 2021). In cloud computing environments, AI-based monitoring systems can identify anomalies, predict failures, and optimize resource allocation in real time. Chen et al. (2022) emphasized that AI-integrated operational frameworks significantly improve fault tolerance and infrastructure resilience in distributed computing systems. These technologies are increasingly being adopted in smart stadiums and intelligent event management platforms to support real-time operational coordination and predictive system management. Cloud-native architectures and microservices have also gained substantial attention in smart event management research. Zhang et al. (2022) noted that scalable cloud infrastructures enable Olympic platforms to handle massive user traffic, distributed data processing, and real-time analytics more efficiently than traditional monolithic systems. Containerization technologies such as Docker and orchestration platforms such as Kubernetes further enhance scalability, portability, and automated deployment capabilities within complex digital environments. However, despite these advancements, many existing event management systems still face challenges related to interoperability, cybersecurity vulnerabilities, and delayed incident response mechanisms. Several scholars have examined cybersecurity risks associated with mega sporting events due to the increasing dependence on digital infrastructures. According to Ahmad and Li (2023), large-scale international events remain vulnerable to cyberattacks targeting ticketing systems, communication networks, and operational databases. AI-driven security monitoring and DevOps-based automated patch management have therefore become essential components of secure event management architectures. Although previous studies provide valuable insights into DevOps, AI, and smart infrastructure technologies, limited research has focused on integrating these components into a unified scalable architecture specifically designed for Olympic event management systems. Existing literature primarily examines these technologies independently rather than addressing their combined potential for intelligent automation, predictive monitoring, and operational scalability. Therefore, this study aims to bridge this gap by proposing a scalable AI-integrated DevOps architecture capable of supporting secure, adaptive, and intelligent Olympic event management platforms.

Research Gap

Despite significant advancements in Software Engineering, cloud computing, Artificial Intelligence (AI), and DevOps practices, several limitations still exist in the development of smart Olympic event management platforms. Existing research has primarily focused on isolated technological domains such as cloud-based infrastructures, cybersecurity systems, AI-driven analytics, or DevOps automation independently rather than integrating these technologies into a unified and scalable operational architecture. Most current Olympic management systems rely on conventional monitoring and deployment approaches that are reactive in nature and incapable of addressing real-time operational complexities during mega sporting events. Previous studies have explored the role of DevOps in improving software deployment and operational efficiency; however, limited attention has been given to the integration of AI-driven predictive analytics within DevOps ecosystems for large-scale event management environments. Similarly, research related to AI applications in smart stadiums and sports analytics mainly concentrates on audience behaviour analysis, athlete performance monitoring, and surveillance systems rather than intelligent software infrastructure management. Consequently, there remains a lack of comprehensive frameworks capable of

supporting automated deployment, predictive fault detection, intelligent scalability, cybersecurity resilience, and real-time decision-making within Olympic event platforms.

Another important research gap exists in the area of scalability and operational reliability. Modern Olympic systems generate massive volumes of real-time data from ticketing systems, crowd management applications, transportation services, security networks, and digital communication platforms. Traditional monolithic software architectures often struggle to maintain operational efficiency under such high-demand environments. Although cloud-native and microservices architectures have improved scalability in many industries, their integration with AI-enhanced DevOps models for Olympic event operations remains insufficiently explored in current literature.

Furthermore, existing studies rarely address the combined implementation of AI, DevOps, container orchestration, and intelligent monitoring mechanisms within a single smart Olympic management ecosystem. This lack of integrated research limits the development of adaptive, resilient, and automated digital infrastructures capable of supporting future Olympic events and smart stadium environments. Therefore, this study seeks to bridge this gap by proposing a scalable AI-integrated DevOps architecture specifically designed for smart Olympic event management platforms.

Research Objectives

To develop a scalable AI-integrated DevOps architecture for smart Olympic Games event management platforms that enhances operational efficiency, system scalability, intelligent automation, and real-time infrastructure management.

Specific Objectives

1. To design a cloud-native DevOps architecture capable of supporting large-scale Olympic event management operations.
2. To integrate Artificial Intelligence-based predictive analytics and intelligent monitoring mechanisms within the proposed DevOps framework.
3. To improve real-time deployment, scalability, and operational reliability through automated CI/CD pipelines and container orchestration technologies.
4. To evaluate the effectiveness of AI-driven fault detection and predictive maintenance in reducing system downtime during Olympic event operations.
5. To analyze the role of intelligent automation in enhancing cybersecurity readiness and operational resilience in smart Olympic infrastructures.
6. To assess the performance of the proposed architecture using scalability, deployment efficiency, response time, and fault tolerance metrics under simulated Olympic operational scenarios.

Proposed Framework/Architecture

The proposed framework introduces a scalable AI-integrated DevOps architecture specifically designed for smart Olympic Games event management platforms. The architecture combines Artificial Intelligence (AI), cloud-native computing, DevOps automation, microservices, and intelligent monitoring systems to support

real-time Olympic operations efficiently and securely. The framework is designed to improve deployment speed, operational scalability, cybersecurity resilience, and predictive infrastructure management within highly dynamic sporting environments.

The proposed architecture consists of six major layers that operate collaboratively to ensure continuous service delivery and intelligent system management.

1. User Interaction Layer

The User Interaction Layer serves as the entry point for all stakeholders, including athletes, spectators, organizers, media personnel, and security teams. This layer supports:

- Smart ticketing systems
- Mobile Olympic applications
- Real-time event dashboards
- Crowd management interfaces
- Emergency response communication systems

The layer enables users to interact with Olympic services through secure web and mobile platforms integrated with cloud-based APIs.

2. Application and Microservices Layer

This layer contains modular microservices responsible for handling various Olympic operations independently. The architecture adopts microservices to improve scalability, fault isolation, and deployment flexibility.

Key services include:

- Athlete management systems
- Event scheduling systems
- Smart transportation coordination
- Crowd analytics services
- Broadcasting and media services
- Security monitoring modules

Containerization technologies such as Docker are utilized to package each service independently, while Kubernetes manages orchestration, scalability, and automated resource allocation.

3. DevOps Automation Layer

The DevOps layer automates software development, testing, integration, deployment, and infrastructure management processes.

Major DevOps components include:

- Continuous Integration (CI)
- Continuous Deployment (CD)
- Infrastructure as Code (IaC)
- Automated testing pipelines
- Configuration management systems
- Real-time performance monitoring

Tools such as Jenkins, GitHub Actions, and Terraform can be integrated to support automated software delivery and infrastructure provisioning.

4. AI and Predictive Analytics Layer

This layer represents the core intelligent component of the proposed framework. AI-driven systems continuously analyze operational data generated from Olympic platforms to support predictive decision-making.

The AI module performs:

- Predictive fault detection
- Traffic load forecasting
- Intelligent resource optimization
- Crowd behavior prediction
- Security anomaly detection
- Predictive maintenance analytics

Machine learning algorithms analyze historical and real-time operational data to identify abnormal patterns and optimize infrastructure performance proactively.

5. Cloud Infrastructure Layer

The framework utilizes cloud-native infrastructure to support scalability, distributed computing, and high availability.

Cloud services provide:

- Elastic resource scaling
- Distributed data storage
- Edge computing support
- High-speed processing capabilities
- Disaster recovery mechanisms

The architecture supports hybrid cloud environments to improve operational continuity during large-scale Olympic events.

6. Security and Monitoring Layer

Security remains a critical requirement for Olympic management systems due to high cybersecurity risks. This layer integrates AI-driven security monitoring and DevSecOps practices.

Security features include:

- Intrusion detection systems
- Automated vulnerability scanning
- Access control management
- Real-time threat monitoring
- Encrypted communication protocols
- AI-based anomaly detection

The monitoring subsystem continuously evaluates system health, server utilization, and network traffic to ensure operational stability.

Operational Workflow of the Proposed Framework

The framework operates through an automated intelligent lifecycle:

1. User requests are processed through cloud-based Olympic applications.
2. Microservices execute event-related operations independently.
3. DevOps pipelines automatically deploy updates and monitor infrastructure performance.
4. AI engines analyze system behavior and predict operational anomalies.
5. Kubernetes dynamically scales infrastructure resources based on workload demands.

6. Security systems continuously monitor threats and implement automated responses.

This integrated workflow enhances scalability, reliability, automation, and operational efficiency within smart Olympic event management platforms.

METHODOLOGY

This study adopts a design science research methodology combined with experimental system evaluation to develop and validate the proposed AI-integrated DevOps architecture for smart Olympic event management systems.

Research Design

The research follows a quantitative and system-oriented design approach focused on architectural development, simulation, and performance evaluation. The study aims to propose and assess a scalable framework capable of improving operational efficiency and intelligent automation within Olympic digital infrastructures.

Data Collection

The study utilizes simulated operational datasets representing Olympic event environments. The datasets include:

- User traffic patterns
- Ticketing transactions
- Crowd management data
- Infrastructure monitoring logs
- Network performance metrics
- Security incident records

Both historical and real-time simulation data are used to evaluate system behavior under high-demand operational conditions.

Development Environment and Tools

The proposed framework is developed using cloud-native and DevOps technologies.

Software and Technologies

- Docker for containerization
- Kubernetes for orchestration
- Jenkins for CI/CD automation

- TensorFlow for AI model development
- Prometheus and Grafana for monitoring
- AWS or Microsoft Azure cloud services
- Python and Java-based microservices

These technologies support scalability, automated deployment, and intelligent monitoring.

AI Model Implementation

Machine learning algorithms are integrated into the framework to support predictive analytics and intelligent decision-making.

The AI module performs:

- anomaly detection,
- workload prediction,
- automated incident response,
- and predictive maintenance analysis.

Supervised and unsupervised learning techniques are applied to operational datasets to identify abnormal system behaviors and optimize infrastructure performance.

Experimental Evaluation

The proposed framework is evaluated using simulated Olympic operational scenarios.

Evaluation Metrics

- System scalability
- Deployment frequency
- Response time
- Infrastructure utilization
- Fault recovery time
- Downtime reduction
- Prediction accuracy
- Cybersecurity threat detection rate

The performance of the proposed AI-integrated DevOps architecture is compared with traditional DevOps-based Olympic management systems.

Data Analysis

Collected performance data are analyzed using statistical and comparative analysis techniques. Graphs, tables, and performance indicators are used to evaluate the effectiveness of the proposed framework in improving scalability, reliability, and intelligent automation.

Ethical Considerations

The study utilizes simulated and non-personal operational datasets to ensure compliance with ethical research standards. No sensitive personal information or confidential Olympic organizational data are used during the research process.

Experimental Setup

The experimental setup was designed to evaluate the scalability, reliability, automation efficiency, and intelligent monitoring capabilities of the proposed AI-integrated DevOps architecture for smart Olympic Games event management platforms. A cloud-based simulated Olympic environment was developed to replicate real-world operational conditions involving high user traffic, real-time data processing, and distributed infrastructure management.

The experimental environment was deployed using a hybrid cloud infrastructure integrating Amazon Web Services (AWS) and Kubernetes-based container orchestration. Docker containers were used to manage individual microservices, while Jenkins supported continuous integration and continuous deployment (CI/CD) pipelines. Prometheus and Grafana were integrated for infrastructure monitoring and performance visualization. Additionally, TensorFlow-based machine learning models were implemented to perform predictive analytics and anomaly detection.

The simulation environment consisted of multiple operational modules, including:

- Smart ticketing systems
- Crowd management services
- Athlete management systems
- Transportation coordination platforms
- Security monitoring systems
- Real-time broadcasting services

To simulate Olympic-scale operational conditions, approximately one million concurrent user requests were generated using automated workload simulation tools. The AI engine continuously analyzed infrastructure logs, server utilization patterns, and network traffic to predict workload spikes and identify abnormal system behavior.

The proposed framework was evaluated against a traditional DevOps-based architecture without AI integration. The comparison focused on several performance indicators, including:

- System response time
- Deployment speed
- Scalability efficiency
- Fault recovery time
- Downtime reduction
- Resource utilization
- Security threat detection accuracy

The experiments were conducted under varying workload conditions to assess system adaptability and operational resilience during peak Olympic operational periods.

RESULTS AND DISCUSSION

The experimental findings demonstrated that the proposed AI-integrated DevOps architecture significantly improved the operational performance of smart Olympic event management platforms compared to conventional DevOps systems. The integration of Artificial Intelligence within the DevOps lifecycle enabled predictive monitoring, intelligent automation, and proactive infrastructure management, resulting in enhanced system scalability and reliability.

The proposed framework achieved substantially lower response times under high-demand operational conditions. During peak workload simulations involving one million concurrent requests, the AI-integrated system maintained stable performance levels and dynamically allocated cloud resources through Kubernetes orchestration. In contrast, the traditional DevOps environment experienced delayed response times and increased infrastructure strain during traffic spikes.

The implementation of AI-driven predictive analytics also improved fault detection and incident response capabilities. Machine learning algorithms successfully identified abnormal system behaviours before critical failures occurred, enabling automated corrective actions through DevOps pipelines. Consequently, system downtime was significantly reduced compared to the baseline architecture. Predictive maintenance models further enhanced operational continuity by identifying potential infrastructure bottlenecks and server overload conditions in advance.

Another significant finding was the improvement in deployment efficiency. Automated CI/CD pipelines accelerated software release cycles and minimized manual intervention. The proposed framework supported continuous deployment with improved reliability and lower deployment failure rates, which is particularly important during rapidly changing Olympic operational scenarios.

The study also demonstrated improved resource optimization through intelligent workload forecasting. AI models accurately predicted traffic fluctuations and dynamically adjusted infrastructure resources, resulting

in reduced cloud resource wastage and improved computational efficiency. These findings indicate that AI-enhanced DevOps frameworks can support cost-effective and scalable Olympic infrastructure management.

Overall, the results confirm that integrating AI with DevOps significantly enhances operational resilience, intelligent automation, scalability, and system reliability within large-scale sporting event environments. The proposed framework therefore provides a practical and innovative solution for future smart Olympic management systems.

Cybersecurity Implications

Cybersecurity represents one of the most critical challenges in modern Olympic event management due to the extensive dependence on digital infrastructures, cloud services, IoT devices, and real-time communication systems. Olympic platforms frequently process sensitive operational data, financial transactions, athlete records, transportation information, and security communications, making them attractive targets for cyberattacks.

The proposed AI-integrated DevOps architecture incorporates DevSecOps principles and AI-driven threat monitoring mechanisms to strengthen cybersecurity resilience within Olympic ecosystems. Automated vulnerability scanning and continuous security testing are integrated directly into the CI/CD pipelines to identify software vulnerabilities before deployment. This proactive security approach minimizes the risks associated with insecure software releases and delayed patch management.

Artificial Intelligence further enhances cybersecurity capabilities through real-time anomaly detection and predictive threat analysis. Machine learning algorithms continuously monitor network traffic, system logs, and user activities to identify abnormal behaviors that may indicate intrusion attempts, distributed denial-of-service (DDoS) attacks, unauthorized access, or malware activity. Automated response mechanisms can isolate compromised services and initiate recovery procedures without significant operational disruption.

Containerization and Kubernetes orchestration also improve infrastructure security through workload isolation and automated policy enforcement. Role-based access control, encrypted communication channels, and multi-factor authentication mechanisms provide additional protection for Olympic operational systems.

The integration of cybersecurity within the DevOps lifecycle ensures continuous security monitoring and rapid incident response capabilities, which are essential for protecting critical Olympic infrastructures during large-scale international events.

FUTURE SCOPE

The proposed AI-integrated DevOps architecture provides a strong foundation for future advancements in intelligent Olympic event management systems and smart infrastructure development. However, several emerging technologies and research directions may further enhance the capabilities of future Olympic digital ecosystems.

One important future direction involves the integration of digital twin technologies for real-time simulation and predictive management of Olympic venues. Digital twins can create virtual replicas of stadiums, transportation systems, and operational infrastructures to support intelligent decision-making and infrastructure optimization.

The adoption of edge computing and 6G communication technologies may also improve real-time processing capabilities and reduce latency within highly distributed Olympic environments. These technologies can enhance crowd management systems, autonomous security operations, and smart transportation coordination during large-scale sporting events.

Future research may further explore the integration of blockchain technology for secure ticketing systems, athlete credential verification, and decentralized operational management. Blockchain-based infrastructures can improve transparency, data integrity, and cybersecurity resilience within Olympic digital platforms.

Another promising area is the application of advanced generative AI and autonomous agents for intelligent event coordination, automated decision-making, and conversational support systems. AI-driven assistants could support spectators, organizers, and security personnel through intelligent real-time communication and operational analytics.

Additionally, future studies may focus on integrating sustainability-oriented computing models to reduce the environmental impact of large-scale Olympic infrastructures through energy-efficient cloud management and intelligent resource optimization.

Overall, the evolution of AI, cloud computing, cybersecurity, and intelligent automation technologies will continue transforming future Olympic management systems into highly adaptive, autonomous, and resilient smart ecosystems.

CONCLUSION

The increasing complexity of modern Olympic Games operations demands highly scalable, intelligent, and resilient digital infrastructures capable of supporting real-time event coordination and uninterrupted service delivery. This study proposed a scalable AI-integrated DevOps architecture specifically designed for smart Olympic event management platforms by combining Artificial Intelligence, cloud-native computing, DevOps automation, microservices, and predictive analytics within a unified operational framework. The proposed architecture addressed major challenges associated with scalability, deployment efficiency, infrastructure monitoring, cybersecurity resilience, and intelligent automation in large-scale sporting environments. The experimental evaluation demonstrated that integrating AI-driven predictive analytics with DevOps significantly improves operational performance, fault detection, automated deployment, resource optimization, and system reliability compared to traditional DevOps-based infrastructures. Furthermore, the implementation of intelligent monitoring and DevOps practices enhanced cybersecurity readiness and reduced operational risks during high-demand Olympic scenarios. The study also highlighted the practical value of cloud-native and microservices architectures in supporting flexible and adaptive event management ecosystems.

Overall, this research contributes to the advancement of Software Engineering and smart event management by presenting a modern framework capable of supporting future Olympic digital ecosystems. The proposed model provides a strong foundation for future research in intelligent automation, smart stadium technologies, and AI-driven large-scale event infrastructures.

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