International Journal of General Engineering and Technology (IJGET)
ISSN (P): 2278–9928; ISSN (E): 2278–9936
Vol. 14, Issue 1, Jan – Jun 2025; 225–254

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

PODMON CONTAINERIZATION: REAL-TIME KUBERNETES MONITORING AND ANOMALY DETECTION FOR ENHANCED APPLICATION RELIABILITY

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ABSTRACT

As the deployment of containerized applications controlled by Kubernetes keeps on increasing, maintaining their reliability and performance in production environments is now an urgent matter. While containerization and Kubernetes orchestration have been studied in isolation in prior research, there remains a gap in efficiently merging real-time monitoring with anomaly detection to actively ensure application reliability. Most existing systems are focused on monitoring metrics like resource usage; however, they do not tend to consider the complexities of detecting and resolving low-level anomalies that can lead to system failure or reduced performance. This research seeks to bridge the gap in research mentioned above by presenting Podmon, a new framework that is particularly tailored to detect and monitor anomalies in real-time in Kubernetes systems. Podmon integrates advanced anomaly detection algorithms with the intrinsic metrics of Kubernetes to enable the detection of anomalies in normal operational patterns. By using machine learning approaches, supervised and unsupervised learning, Podmon is capable of detecting anomalous patterns instantaneously and thus sending timely warnings to prevent potential system malfunction. The proposed approach extends traditional monitoring tools by offering proactive management instead of reactive management, thus making applications running within containerized Kubernetes more stable. The paper further outlines the technical design of Podmon, its deployment into Kubernetes clusters, and a test suite for performance. The outcome indicates that real-time monitoring and advanced anomaly detection can significantly improve application uptime, reduce operational expenditure, and improve resource utilization, resulting in more stable ecosystems for containerized applications.

KEYWORDS: *Podmon, Containerization, Kubernetes, Real-Time Monitoring, Anomaly Detection, Application Reliability, Machine Learning, Performance Optimization, System Failures, Operational Behavior, Proactive Management, Resource Utilization, Containerized Environments.*

Article History

***Received:* 18 Apr 2025 | *Revised:* 20 Apr 2025 | *Accepted:* 24 Apr 2025**