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InfraPilotX

An Autonomous GitOps Framework for Streamlined Kubernetes
Infrastructure Management

A Dissertation by

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Abstract

This research project explores the convergence of DevOps, GitOps and MLOps paradigms by leveraging its core principles to Implement InfraPilotX: An Autonomous Framework for Streamlined Kubernetes Infrastructure Management in Business Eco-systems. While existing studies emphasize GitOps capabilities such as version control as the source of truth, declarative system states, automated synchronization, rollback mechanisms, and containerized infrastructure management, they fail to deliver a comprehensive, business-ready GitOps framework that seamlessly integrates multi-cloud applications, CI/CD, MLOps, and monitoring solutions.

To bridge this gap, this research introduces a streamlined, automation-driven GitOps framework tailored for business ecosystems, addressing high setup overheads, poor component integration, and lack of multi-cloud deployment support. The proposed InfraPilotX leverages ArgoCD Autopilot as its backbone, automates cloud infrastructure provisioning, CI/CD workflows, MLOps pipelines, and observability integrations while maintaining GitOps principles. InfraPilotX significantly reduces cognitive workload, simplifies Kubernetes infrastructure management, and enhances cross-cloud migration, rollback, and recovery mechanisms.

Each feature of the framework is validated against specified requirements, and all components were tested for seamless interaction. Performance benchmarks showed system response times under different loads, while usability tests confirmed an intuitive interface. The project achieved a 100% pass rate on core GitOps workflows and sub-5s UI response times.

Subject Descriptors:

- Computer System Organization → Architectures → Distributed architectures → Cloud computing
- Software and its engineering → Software creation and management → Software post development issues → System administration
- Applied computing → Enterprise computing → Enterprise architectures → Enterprise architecture frameworks

Keywords: DevOps, GitOps, MLOps, Kubernetes, CI/CD (Continuous Integration/Continuous Delivery), Multi-Cloud, Framework