

# Project Report: Advanced DevOps Automation & GitOps Implementation

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## 1. Introduction

This report summarizes three hands-on DevOps projects demonstrating automated recovery, multi-cloud IaC, and GitOps workflows. Additionally, a **custom Advanced QR Code Scanner web application** was developed to showcase full-stack development skills. These projects highlight capabilities in automation, monitoring, cloud provisioning, and modern software delivery practices.

## 2. Abstract

- **Self-Healing Infrastructure:** Prometheus + Ansible auto-detect and recover failed services.
- **Multi-Cloud Deployment:** Terraform provisions AWS & GCP resources simultaneously.
- **GitOps Workflow:** ArgoCD on Kubernetes ensures declarative, auditable deployments.
- **Full-Stack Application:** Flask-based QR scanner integrates Python backend with HTML/JS frontend.

Focus: Monitoring, automation, cloud provisioning, containerization, and CI/CD.

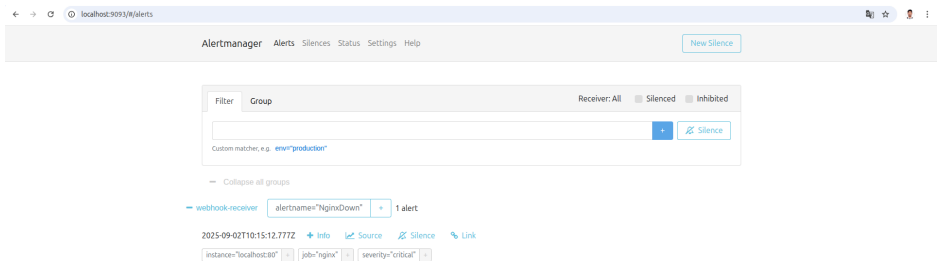
## 3. Tools Used

- **Monitoring & Alerting:** Prometheus, Alertmanager
- **Automation & Config Management:** Ansible, Shell Scripting
- **IaC:** Terraform
- **Cloud Platforms:** AWS EC2, GCP Compute Engine
- **GitOps & Orchestration:** K3s/Minikube, ArgoCD, Kubernetes
- **Version Control:** GitHub
- **Containerization:** Docker
- **Full-Stack Development:** Python, Flask, OpenCV, PyZbar, Gunicorn; HTML, CSS, JavaScript
- **OS:** Ubuntu VM

## 4. Steps Involved

### Project 1: Self-Healing Infrastructure

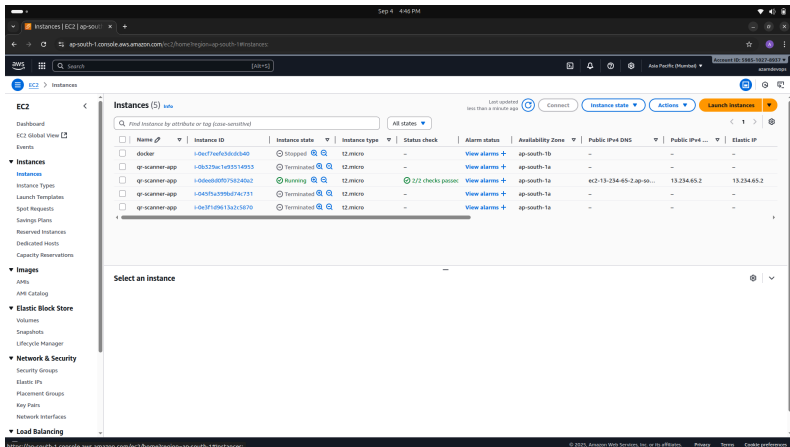
- Deployed NGINX + Node Exporter; Prometheus scrapes metrics.
- Alerts trigger for downtime or high CPU; Alertmanager sends webhooks to a shell script.
- Ansible playbook restarts failed services automatically.



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## Project 2: Multi-Cloud Deployment (Terraform)

- Configured AWS & GCP providers; defined identical compute instances with firewall rules and NGINX startup scripts.
- **terraform apply -auto-approve** provisions both clouds in parallel.
- Verified connectivity via public IPs and NGINX default page.



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## Project 3: GitOps Workflow (ArgoCD + Kubernetes)

- Deployed ArgoCD on K3s cluster; created GitHub repo with app manifests.
- ArgoCD Auto-Sync deploys changes from Git automatically.
- Demonstrated automated deployment by updating Docker image tag in Git.

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## Additional Project: Advanced QR Scanner

- Backend: Flask, OpenCV, PyZbar; processes images and decodes QR codes.
- Frontend: HTML/JS UI supports file upload or webcam scanning.
- Integration: Real-time results displayed via API.

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## 5. Conclusion

- **Self-Healing Infra:** Reactive automation improves reliability.
- **Multi-Cloud IaC:** Consistent, reproducible cloud environments.
- **GitOps:** Git as single source of truth ensures declarative deployments.
- **QR Scanner:** Full-stack project demonstrating backend/frontend integration.

This portfolio demonstrates practical skills for **modern, automated, and resilient DevOps workflows**.

Completed as part of the **Elevate Labs Internship**, this portfolio reflects skills in **building automated, resilient, and modern DevOps workflows**.