This report will cover the **objective, tools, architecture, workflow, implementation steps, and conclusion**

Project Report: CI/CD Pipeline

1. Introduction

In modern software development, **Continuous Integration (CI)** and **Continuous Deployment (CD)** play a crucial role in delivering high-quality applications at speed. This project, *CI/CD Pipeline*, demonstrates how to automate the build, test, and deployment process of a sample application using industry-standard DevOps tools.

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2. Objective

- Automate software builds and testing.
- Minimize manual intervention in deployments.
- Enable rapid feedback to developers.
- Ensure consistent and reliable application delivery.

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3. Tools & Technologies

- **GitHub** – Version control & repository hosting.
- **Jenkins / GitHub Actions** – CI/CD automation.
- **Docker** – Containerization of applications.
- **Kubernetes / Local VM** – Deployment environment (if applicable).

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4. Architecture

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Developer → GitHub Repo → CI Tool (Jenkins/GitHub Actions) → Build & Test → Docker Image → Deployment Server (VM/K8s) → Monitoring & Alerts
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5. Workflow

1. **Code Commit** – Developers push code to GitHub.
2. **Trigger Pipeline** – CI tool detects changes and starts build.
3. **Build & Test** – Application is compiled and tested automatically.
4. **Containerization** – Application packaged as a Docker image.
5. **Deployment** – Image deployed to staging/production.
6. **Monitoring** – Alerts triggered if service failure occurs.

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6. Implementation Steps

1. **Set up GitHub Repository** – Store application code & pipeline files.
2. **Configure CI/CD Tool** – Jenkins pipeline or GitHub Actions workflow.
3. **Write Pipeline Script**
    - Build stage
    - Test stage
    - Deploy stage
4. **Integrate Docker** – Build images & push to DockerHub.
5. **Deploy Application** – On a VM or Kubernetes cluster.
6. **Add Monitoring** – Prometheus + Alertmanager for health checks.
7. **Automated Recovery (Optional)** – Use Ansible to restart failed services.

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7. Results

- Fully automated build and deployment process.
- Reduced manual errors during releases.
- Faster delivery of new features.
- Reliable rollback mechanism in case of failures.

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8. Challenges Faced

- Configuring webhooks between GitHub and CI tool.
- Managing secrets securely (API keys, DockerHub credentials).
- Debugging failed builds in Jenkins/GitHub Actions.
- Resource limitations when running on local VM.

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9. Future Improvements

- Implement blue-green or canary deployments.
- Integrate automated security scanning (Snyk, Trivy).
- Use Infrastructure as Code (Terraform) for scalable deployment.
- Enhance monitoring dashboards with Grafana.

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10. Conclusion

This project demonstrates the power of **CI/CD pipelines** in automating the software delivery process. By combining tools such as GitHub, Jenkins/GitHub Actions, Docker, and Ansible, development teams can achieve **faster, reliable, and scalable deployments** while maintaining high quality.