Q.4. CI/CD Pipeline with GitHub Actions & Docker (No Cloud Needed)

Objective: Set up a full CI/CD pipeline that builds a Docker image, runs tests, and deploys locally.

Tools: GitHub Actions, Docker, Docker Hub (free), Minikube or local VM

Mini Guide:

Write a Dockerfile and docker-compose.yml.

Configure GitHub Actions to run tests, build the image, and push to Docker Hub.

Use Minikube or a local VM to pull and run the image.

Deliverables:

GitHub repo with workflows

Docker image link

CI/CD workflow results

Screenshots of the deployed app

CI/CD Pipeline with GitHub Actions & Docker (No Cloud Needed)

This project uses only free tools (no paid cloud) — GitHub, Docker, Docker Hub, and Minikube.
It demonstrates end-to-end CI/CD from code commit → testing → image build → push → local deployment.

Project structure (recommended)

```
ci-cd-flask-docker/
├── .github/
│   └── workflows/
│       └── ci-cd.yml
```

├─ CI-CD_FLASK-DOCKER/

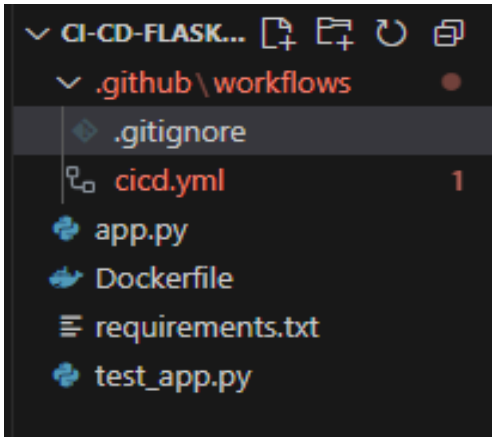
│ ├─ app.py

│ ├─ requirements.txt

│ └─ Dockerfile

├─ test_app.py

├└─ README.md



Tools Used :

Tool | Purpose :

🎯 Objective

Create a full CI/CD pipeline that:

1. **Builds a Docker image from your app**
2. **Runs tests automatically**
3. **Pushes the image to Docker Hub**
4. **Deploys locally using Minikube or Docker Compose**

🧰 Tools Used

- **GitHub → for source code & workflows**

- **GitHub Actions → CI/CD automation**
- **Docker & Docker Hub → containerization & image hosting**
- **Minikube / Docker Compose / VM → local deployment**

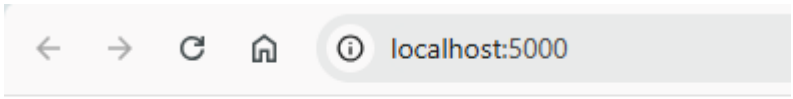
Step 6: Local Deployment (No Cloud Needed)

Option: Run with Docker Compose

docker-compose up --build

```
PS D:\Priti_Data\elevatelab\DevOps_Projects\ci-cd-flask-docker> docker-compose up --build
time="2025-11-12T22:02:25+05:30" level=warning msg="D:\\Priti_Data\\elevatelab\\DevOps_Pro
t to avoid potential confusion"
[+] Building 75.8s (13/13) FINISHED
 => [internal] load local bake definitions
 => => reading from stdin 590B
 => [internal] load build definition from Dockerfile
 => => transferring dockerfile: 306B
```

Then visit → http://localhost:5000

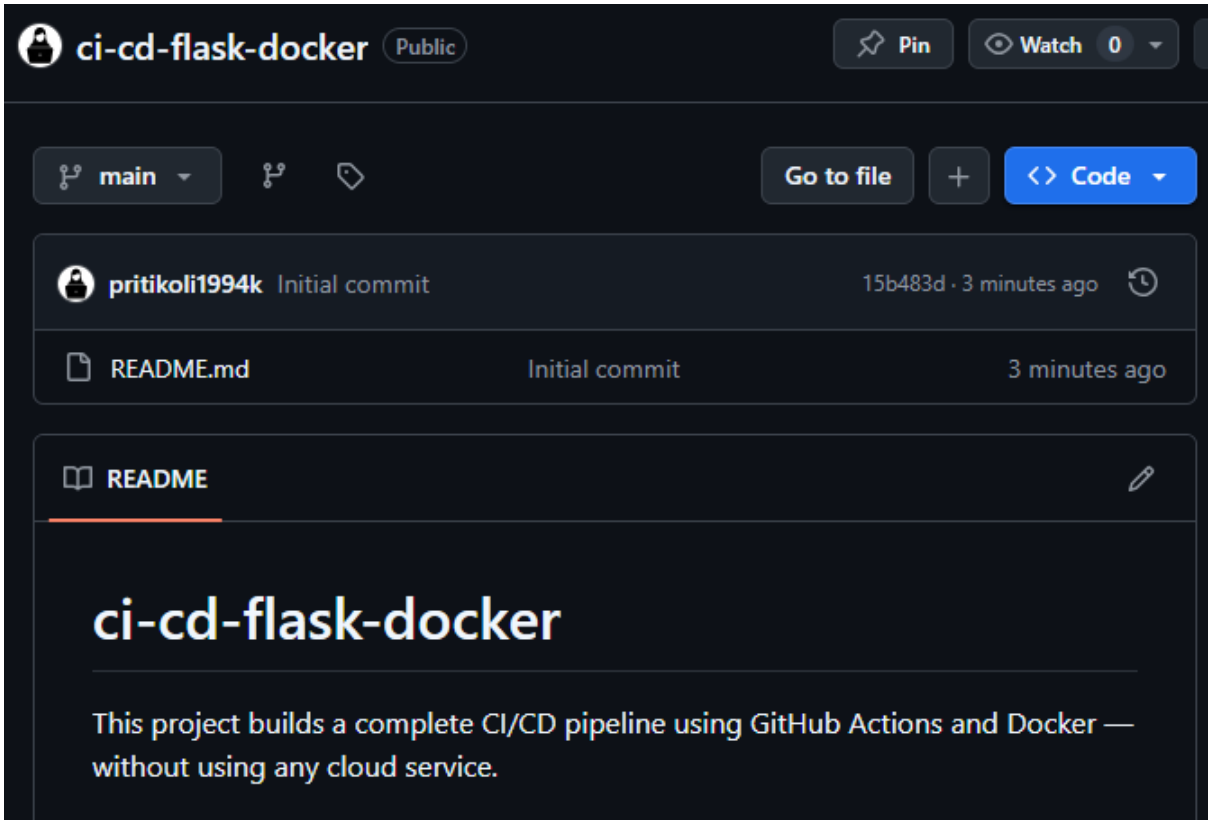



```
[+] Running 3/3
 ✔ ci-cd-flask-docker-web                Built
 ✔ Network ci-cd-flask-docker_default    Created
 ✔ Container ci-cd-flask-docker-web-1    Created
Attaching to web-1
web-1  |  * Serving Flask app 'app'
web-1  |  * Debug mode: off
web-1  | WARNING: This is a development server. Do not use it in a production deployment
web-1  |  * Running on all addresses (0.0.0.0)
web-1  |  * Running on http://127.0.0.1:5000
web-1  |  * Running on http://172.18.0.2:5000
web-1  | Press CTRL+C to quit
web-1  | 172.18.0.1 - - [12/Nov/2025 16:33:44] "GET / HTTP/1.1" 200 -
web-1  | 172.18.0.1 - - [12/Nov/2025 16:33:44] "GET /favicon.ico HTTP/1.1" 404 -
```

```
PS D:\Priti_Data\elevatelab\DevOps_Projects\ci-cd-flask-docker> docker build -t myimage:latest .
[+] Building 5.0s (11/11) FINISHED                                                    docker:desktop-linux
 => [internal] load build definition from Dockerfile                                                  0.0s
 => => transferring dockerfile: 306B                                                                  0.0s
 => [internal] load metadata for docker.io/library/python:3.10-slim                                   4.7s
 => [auth] library/python:pull token for registry-1.docker.io                                         0.0s
 => [internal] load .dockerignore                                                                     0.0s
 => => transferring context: 2B                                                                       0.0s
 => [1/5] FROM docker.io/library/python:3.10-slim@sha256:c299e10e0070171113f9a1f109dd05e7e634fa94589b  0.0s
 => => resolve docker.io/library/python:3.10-slim@sha256:c299e10e0070171113f9a1f109dd05e7e634fa94589b  0.0s
 => [internal] load build context                                                                     0.0s
 => => transferring context: 5.26kB                                                                   0.0s
 => CACHED [2/5] WORKDIR /app                                                                         0.0s
 => CACHED [3/5] COPY requirements.txt requirements.txt                                               0.0s
 => CACHED [4/5] RUN pip install -r requirements.txt                                                  0.0s
 => CACHED [5/5] COPY . .                                                                             0.0s
 => exporting to image                                                                                0.1s
 => => exporting layers                                                                               0.0s
 => => exporting manifest sha256:9deee76fd72165656bdd36a269d24158897c3bd3fe2954ad7c66ab246a53af6e     0.0s
 => => exporting config sha256:2dbf379cde4c0539a06128d5df64cb264fee4656cc239244d7a7729c904b7b28       0.0s
 => => exporting attestation manifest sha256:92a81b66e89c8bd9144709c323d725ee0452f5ee2b93ce8c68f5ebb  0.0s
 => => exporting manifest list sha256:7bd5eec7faac17e719eec36f596aa6daadb0e06de5e19159f68a41d9c64b896  0.0s
 => => naming to docker.io/library/myimage:latest                                                     0.0s
 => => unpacking to docker.io/library/myimage:latest                                                  0.0s
```

```
PS D:\Priti_Data\elevatelab\DevOps_Projects\ci-cd-flask-docker> docker images
REPOSITORY                 TAG       IMAGE ID       CREATED          SIZE
ci-cd-flask-docker-web     latest    f745edad0c74   4 minutes ago    224MB
myimage                    latest    7bd5eec7faac   4 minutes ago    224MB
```

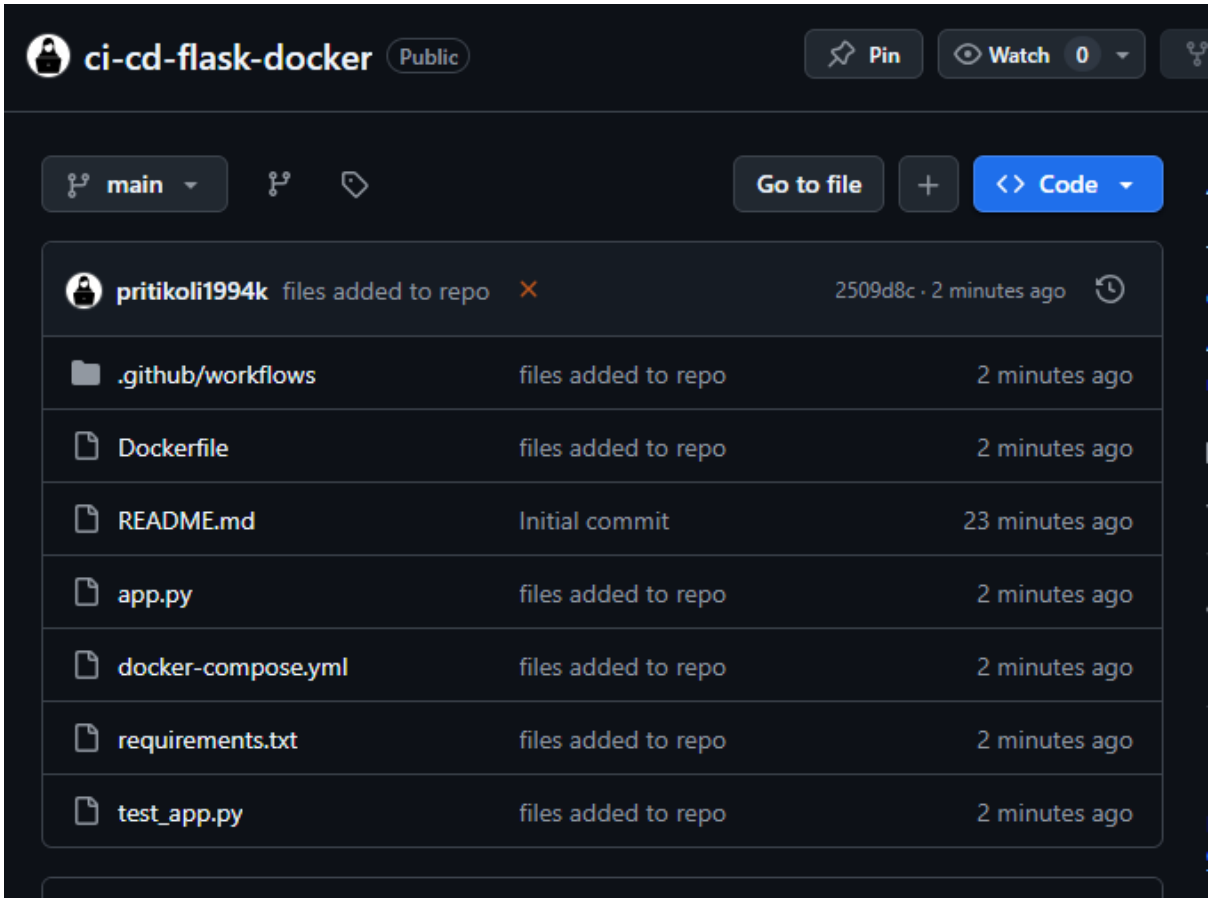
Create repo on git :



```
tanuj@Tanuj MINGW64 /d/Priti_Data/elevatelab/DevOps_Projects/ci-cd-flask-docker (main)
$ git add .
```

```
tanuj@Tanuj MINGW64 /d/Priti_Data/elevatelab/DevOps_Projects/ci-cd-flask-docker (main)
$ git commit -m "files added to repo"
[main 2509d8c] files added to repo
 7 files changed, 81 insertions(+)
 create mode 100644 .github/workflows/.gitignore
 create mode 100644 .github/workflows/ci-cd.yml
 create mode 100644 Dockerfile
 create mode 100644 app.py
 create mode 100644 docker-compose.yml
 create mode 100644 requirements.txt
 create mode 100644 test_app.py
```

```
tanuj@Tanuj MINGW64 /d/Priti_Data/elevatelab/DevOps_Projects/ci-cd-flask-docker (main)
$ git push
Enumerating objects: 12, done.
Counting objects: 100% (12/12), done.
Delta compression using up to 8 threads
Compressing objects: 100% (8/8), done.
Writing objects: 100% (11/11), 1.55 KiB | 794.00 KiB/s, done.
Total 11 (delta 0), reused 0 (delta 0), pack-reused 0 (from 0)
To https://github.com/pritikoli1994k/ci-cd-flask-docker.git
   15b483d..2509d8c  main -> main
```



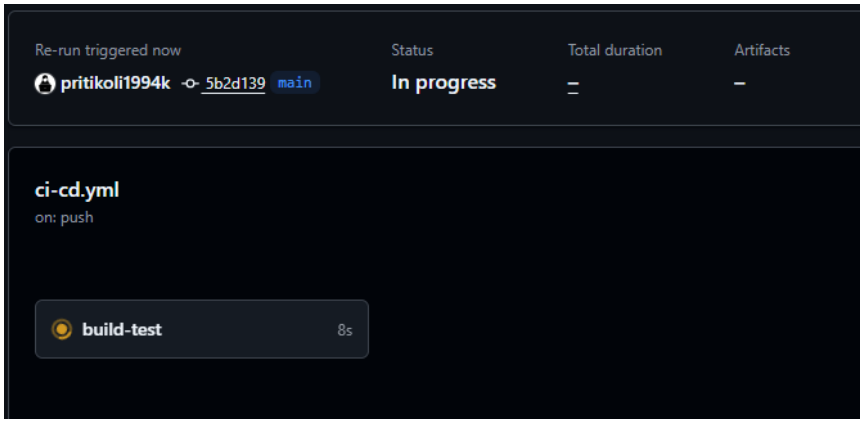
Add the ci-cd.yml file to workflows

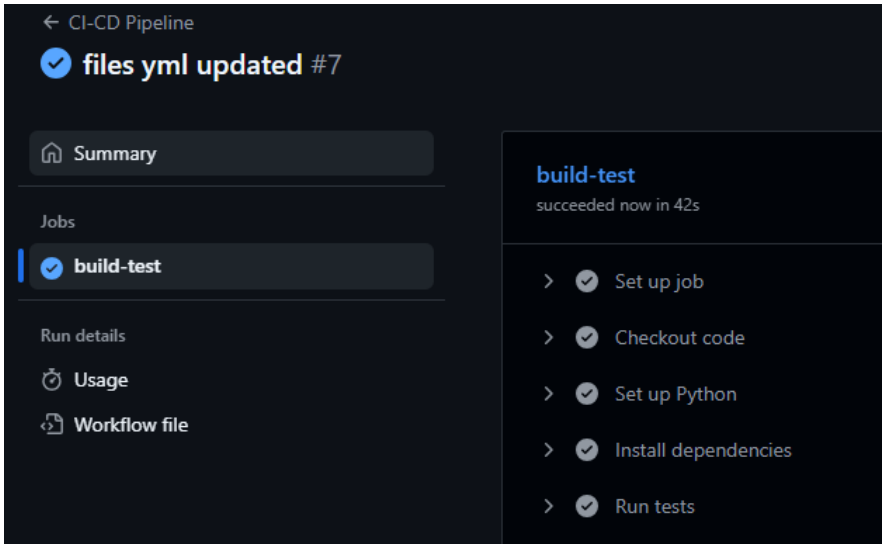
Verify Workflow in GitHub

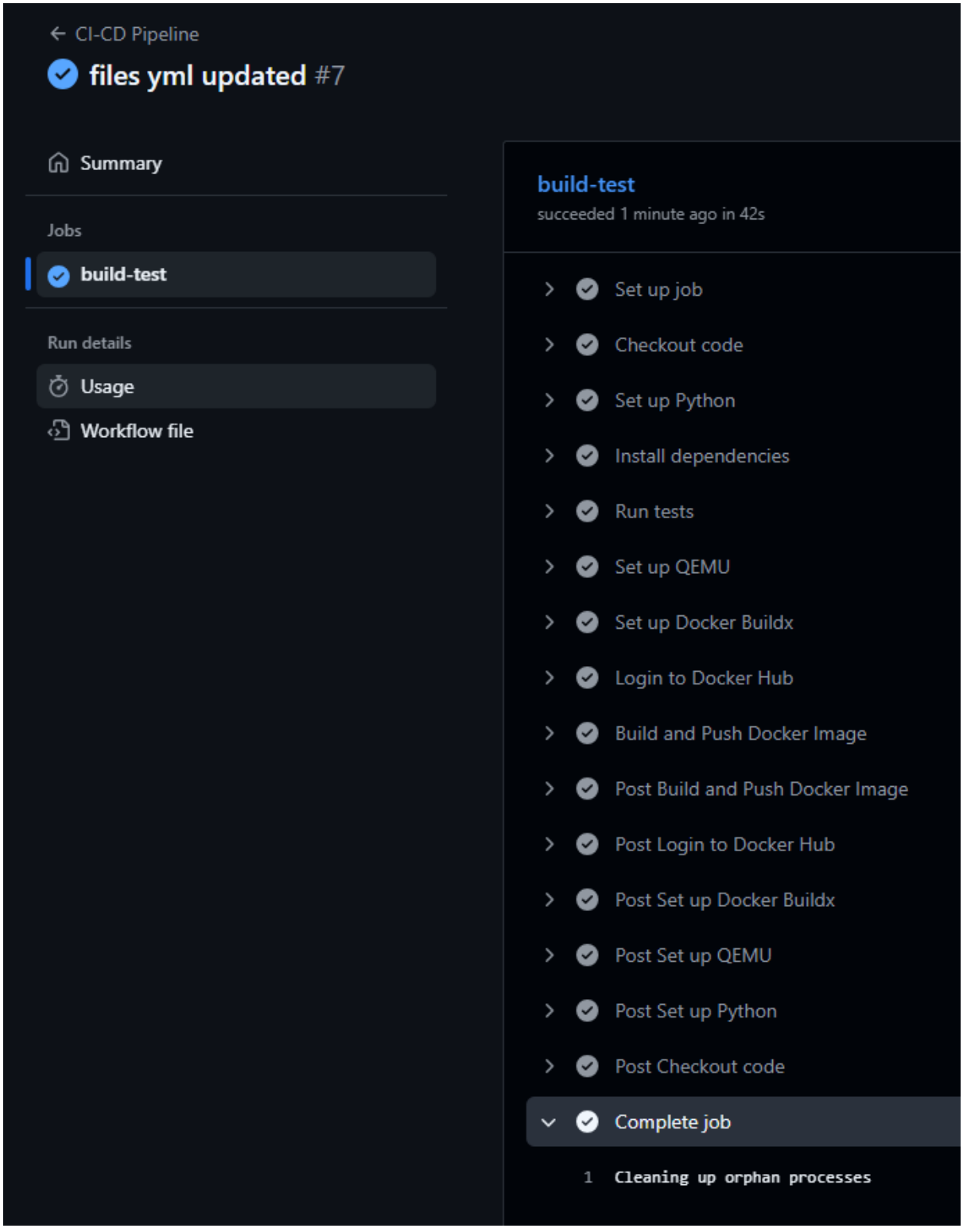
After pushing code:

```
tanuj@Tanuj MINGW64 /d/Priti_Data/elevatel
$ git add .

tanuj@Tanuj MINGW64 /d/Priti_Data/elevatel
$ git commit -m "Added workflow"
On branch main
Your branch is up to date with 'origin/mai

nothing to commit, working tree clean

tanuj@Tanuj MINGW64 /d/Priti_Data/elevatel
$ git push
Everything up-to-date
```

```
PS D:\Priti_Data\elevatelab\DevOps_Projects\ci-cd-flask-docker> docker build -t pritikoli123/cicd-flask:test .
[+] Building 4.1s (11/11) FINISHED                                                                  docker:desktop-linux
 => [internal] load build definition from Dockerfile                                                                0.0s
 => => transferring dockerfile: 306B                                                                                0.0s
 => [internal] load metadata for docker.io/library/python:3.10-slim                                                 3.4s
 => [auth] library/python:pull token for registry-1.docker.io                                                       0.0s
 => [internal] load .dockerignore                                                                                   0.0s
 => => transferring context: 2B                                                                                     0.0s
 => [1/5] FROM docker.io/library/python:3.10-slim@sha256:c299e10e0070171113f9a1f109dd05e7e634fa94589b056e0e87bb22   0.1s
 => => resolve docker.io/library/python:3.10-slim@sha256:c299e10e0070171113f9a1f109dd05e7e634fa94589b056e0e87bb22   0.0s
 => [internal] load build context                                                                                   0.1s
 => => transferring context: 15.64kB                                                                                0.1s
 => CACHED [2/5] WORKDIR /app                                                                                       0.0s
 => CACHED [3/5] COPY requirements.txt requirements.txt                                                             0.0s
 => CACHED [4/5] RUN pip install -r requirements.txt                                                                0.0s
 => [5/5] COPY . .                                                                                                  0.1s
 => exporting to image                                                                                              0.4s
 => => exporting layers                                                                                             0.1s
 => => exporting manifest sha256:12eb0fb9923d1f8d8881fdd90c805d46a4380080a148f4f9282536729cc0c20e                    0.0s
 => => exporting config sha256:d0472c5a7b18eccef29ba07f13fa8a700cadcf878bfb564ae78029e4279d1c73                     0.0s
 => => exporting attestation manifest sha256:fb3e3b9a29c71e750e9638ac37de9716fabae2375d1774477a372fa8f89b1074       0.0s
 => => exporting manifest list sha256:6da4d60eff13f5c6d1a31ea1017cb54661a435af696c6641848571c307ed8a9e              0.0s
 => => naming to docker.io/pritikoli123/cicd-flask:test                                                             0.0s
 => => unpacking to docker.io/pritikoli123/cicd-flask:test                                                          0.1s
PS D:\Priti_Data\elevatelab\DevOps_Projects\ci-cd-flask-docker> docker push pritikoli123/cicd-flask:test
The push refers to repository [docker.io/pritikoli123/cicd-flask]
f04c332e0405: Waiting
```


Re-run triggered now
pritikoli1994k 5b2d139 main
Status
In progress
Total duration
–
Artifacts
–
ci-cd.yml
on: push
build-test
8s


CI-CD Pipeline
files yml updated #7
Summary
Jobs
build-test
Run details
Usage
Workflow file
build-test
succeeded now in 42s
Set up job
Checkout code
Set up Python
Install dependencies
Run tests


CI-CD Pipeline
files yml updated #7
Summary
Jobs
build-test
Run details
Usage
Workflow file
build-test
succeeded 1 minute ago in 42s
Set up job
Checkout code
Set up Python
Install dependencies
Run tests
Set up QEMU
Set up Docker Buildx
Login to Docker Hub
Build and Push Docker Image
Post Build and Push Docker Image
Post Login to Docker Hub
Post Set up Docker Buildx
Post Set up QEMU
Post Set up Python
Post Checkout code
Complete job
1 Cleaning up orphan processes

Workflow file for this run

.github/workflows/ci-cd.yml at 5b2d139

```yaml
name: CI-CD Pipeline

on:
  push:
    branches: ["main"]
  pull_request:
    branches: ["main"]

jobs:
  build-test:
    runs-on: ubuntu-latest

    steps:
      # 1. Checkout code
      - name: Checkout code
        uses: actions/checkout@v3

      # 2. Setup Python
      - name: Set up Python
        uses: actions/setup-python@v4
        with:
          python-version: "3.10"

      # 3. Install dependencies
      - name: Install dependencies
        run: pip install -r requirements.txt

      # 4. Run tests
      - name: Run tests
        run: echo "No tests yet. Passed!"

      # 5. Setup QEMU (required for Buildx)
      - name: Set up QEMU
        uses: docker/setup-qemu-action@v3

      # 6. Setup Buildx
      - name: Set up Docker Buildx
        uses: docker/setup-buildx-action@v3

      # 7. Login to Docker Hub
      - name: Login to Docker Hub
        uses: docker/login-action@v3
        with:
          username: ${{ secrets.DOCKER_USERNAME }}
          password: ${{ secrets.DOCKER_PASSWORD }}

      # 8. Build and Push Docker Image
      - name: Build and Push Docker Image
        uses: docker/build-push-action@v5
        with:
          context: .
          push: true
          tags: ${{ secrets.DOCKER_USERNAME }}/cicd-flask:latest
```