DevOps Project

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad – 500 043

Certificate

This is to certify that it is a bonafied record of practical work done by Mr. / Ms. G.Reshma, T.Pujita, B.Priyanka bearing the roll no. 23951A057K,23951A0573, 24955A0526 of B.Tech CSE class Computer Science Engineering branch in the DevOps laboratory during the academic year 2024-25 under our supervision.

Head of the department **Lecturer – in charge**

Signature of External Examiner **Signature of Internal Examiner**

DevOps Project On: Dockerized Travel App using Flask

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Bachelor of Technology
in
CSE

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DECLARATION

I certify that

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b. The work has not been submitted to any other Institute for any degree or diploma.
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ABSTRACT

In today's fast-paced software development environment, ensuring quick, consistent, and reliable deployment of web applications is essential. This project showcases the complete **DevOps lifecycle** applied to a **Flask-based Travel Web Application**, with a strong focus on **Dockerization** and **CI/CD automation using GitHub Actions**.

The main objective is to **automate the process of building, testing (if applicable), and containerizing the Flask app**, making deployment faster and more reliable. The journey begins with version-controlling the codebase using **Git and GitHub**.

From there, **GitHub Actions** is integrated to implement a **Continuous Integration and Continuous Deployment (CI/CD)** pipeline. This pipeline is triggered by events such as code pushes or pull requests. The CI/CD process includes optional testing, building the application, and creating a **production-ready Docker image**. This Docker image can then be pushed to a container registry or deployed on a hosting platform.

Through this hands-on project, we explore key DevOps principles such as:

- **Automated builds**
- **Reproducible deployments using Docker**
- **Consistent environments**
- **End-to-end pipeline automation**

This project demonstrates how combining **Flask**, **Docker**, and **GitHub Actions** can simplify the delivery of modern web applications and promote a culture of automation and reliability in software engineering.

CONTENTS

CHAPTER 1
INTRODUCTION

1.1About CI/CD Pipelining

This project centers around a **Flask-based Travel Application** that helps users explore travel destinations through a simple and intuitive web interface. The application is built using **Flask (Python)** for backend logic and includes HTML/CSS for the frontend. It can display destinations, travel tips, or even mock booking options depending on your implementation.
To ensure **rapid, reliable, and consistent deployment**, the app is **containerized using Docker** and integrated with a **CI/CD pipeline via GitHub Actions**. The goal is to automate every step of the software delivery process—from code updates to final deployment.

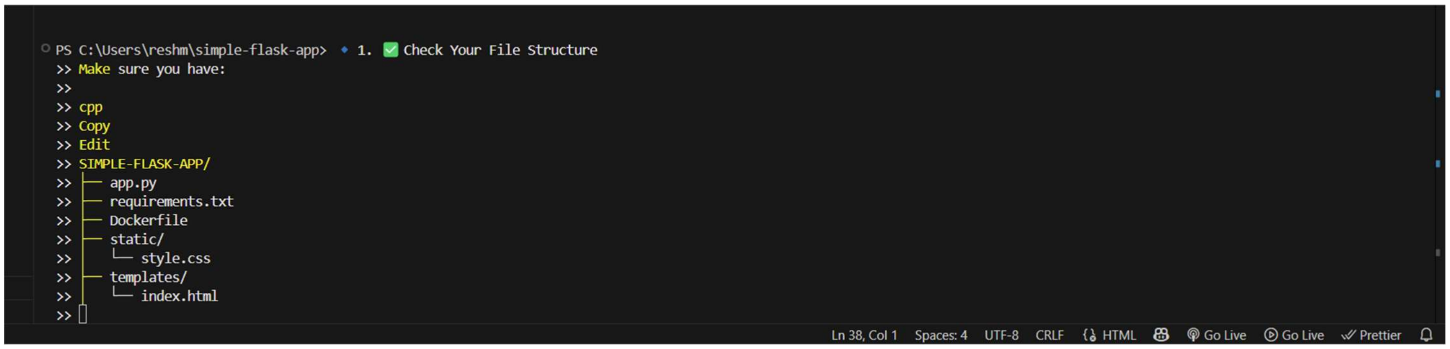
- **Continuous Integration (CI)** ensures that every code push is automatically built and optionally tested.
- **Continuous Deployment (CD)** automates the process of deploying the application as a container to a production-like environment, eliminating the need for manual intervention. This setup allows for:
- Consistent behavior across different systems using Docker containers.
- Faster iterations and feedback loops through automated builds and deployment.
- Real-world exposure to **DevOps practices** like version control with Git, automation via GitHub Actions, and containerization with Docker.
  By combining Flask with Docker and CI/CD, this project highlights the **modern DevOps approach** to software engineering—emphasizing automation, reproducibility, and developer efficiency.

1.2 Requirements

To implement **Dockerization** and **CI/CD** for the Flask-based Travel App, the following tools and configurations were used:

1.2.1 GitHub Repository

- The Travel App's source code is hosted in a **GitHub repository**.
- The repository contains:
    - app.py – the Flask backend logic
    - templates/ – folder containing HTML files (e.g., index.html)
    - static/ – folder containing CSS files (e.g., style.css)
    - Dockerfile – instructions for containerizing the app
    - requirements.txt – Python dependencies
    - .github/workflows/ci.yml – GitHub Actions workflow file for CI/CD automation



```
PS C:\Users\reshm\simple-flask-app> ◆ 1. ✅ Check Your File Structure
>> Make sure you have:
>>
>> cpp
>> Copy
>> Edit
>> SIMPLE-FLASK-APP/
>> ├── app.py
>> ├── requirements.txt
>> ├── Dockerfile
>> ├── static/
>> │   └── style.css
>> ├── templates/
>> │   └── index.html
>>
```

1.2.2 GitHub Actions

- A **YAML workflow file** is used to automate stages like install, build, and deployment.
- The pipeline is **triggered** by events like push or pull_request.
- Common GitHub Actions used:
    - actions/checkout@v2 – Checks out the repository
    - actions/setup-python@v4 – Sets up a Python environment
    - Custom shell commands to:
        - Install dependencies using pip
        - Run Flask app
        - Build Docker image and optionally push it to a registry

1.2.3 Flask Travel App Codebase

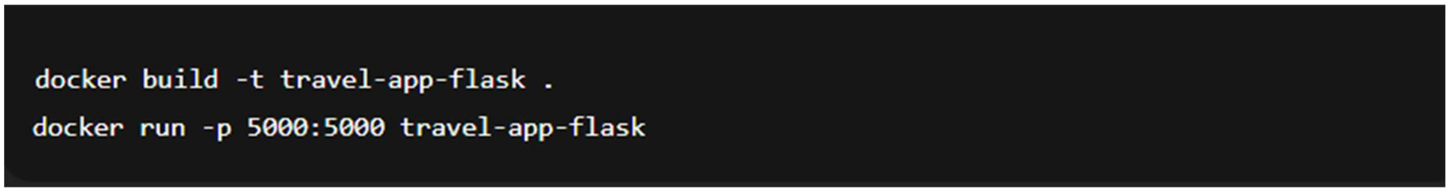
- The application is built using **Flask (Python)** with a simple web interface.
- Uses **Jinja templates** for HTML rendering.
- Folder structure includes:

  - app.py – main Flask app
  - templates/index.html – for user interface
  - static/style.css – for styling
  - requirements.txt – includes Flask, etc.
- Lightweight and easy to extend for adding features like bookings or destination search.

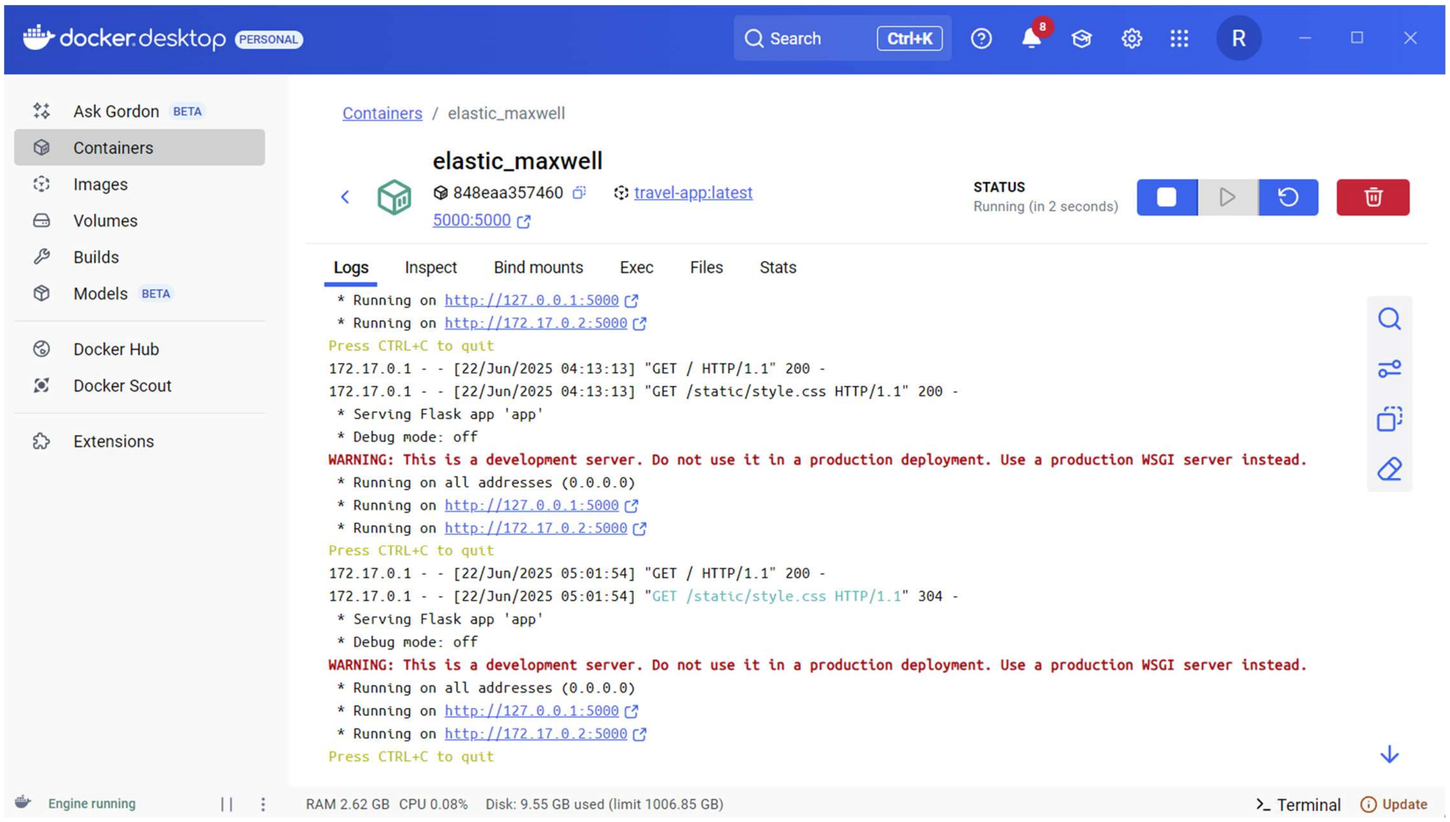
1.2.4 Docker

- **Docker** is used to ensure consistent deployment across different environments.
- Key Docker components include:
  - Dockerfile – defines how to build the container image
  - Optional .dockerignore – to exclude files from Docker context (e.g., .git, __pycache__)

Docker commands used in the pipeline:



```
docker build -t travel-app-flask .
docker run -p 5000:5000 travel-app-flask
```



```
 * Running on http://127.0.0.1:5000
 * Running on http://172.17.0.2:5000
Press CTRL+C to quit
172.17.0.1 - - [22/Jun/2025 04:13:13] "GET / HTTP/1.1" 200 -
172.17.0.1 - - [22/Jun/2025 04:13:13] "GET /static/style.css HTTP/1.1" 200 -
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on all addresses (0.0.0.0)
 * Running on http://127.0.0.1:5000
 * Running on http://172.17.0.2:5000
Press CTRL+C to quit
172.17.0.1 - - [22/Jun/2025 05:01:54] "GET / HTTP/1.1" 200 -
172.17.0.1 - - [22/Jun/2025 05:01:54] "GET /static/style.css HTTP/1.1" 304 -
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on all addresses (0.0.0.0)
 * Running on http://127.0.0.1:5000
 * Running on http://172.17.0.2:5000
Press CTRL+C to quit
```

1.3 Prerequisites

1.3.1 Technical Knowledge

- **Git & GitHub:**
  For version control, pushing code to GitHub, and enabling collaboration.
- **Flask (Python):**
  Understanding of basic Python and how Flask handles routing, templating, and HTTP requests.
- **YAML:**
  To configure CI/CD workflows using GitHub Actions.
- **Docker:**
  Basic knowledge of Docker concepts like containers, images, and how to write a Dockerfile.

1.3.2 Tooling Setup

- Git installed on your local machine

- Visual Studio Code (VS Code) or any other code editor
- Docker Desktop for building and testing Docker containers locally
- GitHub Account to host your project and use GitHub Actions for CI/CD
- Fully functional React frontend

CHAPTER 2
METHODOLGY

This project follows a structured DevOps methodology to automate the build, testing, containerization, and deployment of a Flask-based Travel App. The aim is to ensure consistent delivery, improved developer productivity, and reliable deployment using Docker and GitHub Actions.

1. Application Development

- The Flask web framework is used to develop the Travel App backend.
- Static files (HTML, CSS) and templates are organized within Flask's directory structure (templates/, static/).
- The main application logic is handled in app.py.

2. Version Control with Git & GitHub

- The entire project is tracked using Git.
- A GitHub repository is created to host the source code and manage collaborative development.
- All changes are committed with meaningful messages and pushed to the remote repository.

3. CI/CD Pipeline with GitHub Actions

- A CI/CD pipeline is configured using GitHub Actions to automate testing and deployment tasks.
- A YAML workflow file (.github/workflows/ci.yml) is created to define the CI/CD process.
- The pipeline runs automatically on code pushes or pull requests and performs:
- o Python environment setup
- o Dependency installation (pip install)

- Code linting (optional)
- Docker image build
- Optional deployment steps (e.g., push to Docker Hub or run container)

4. Dockerization

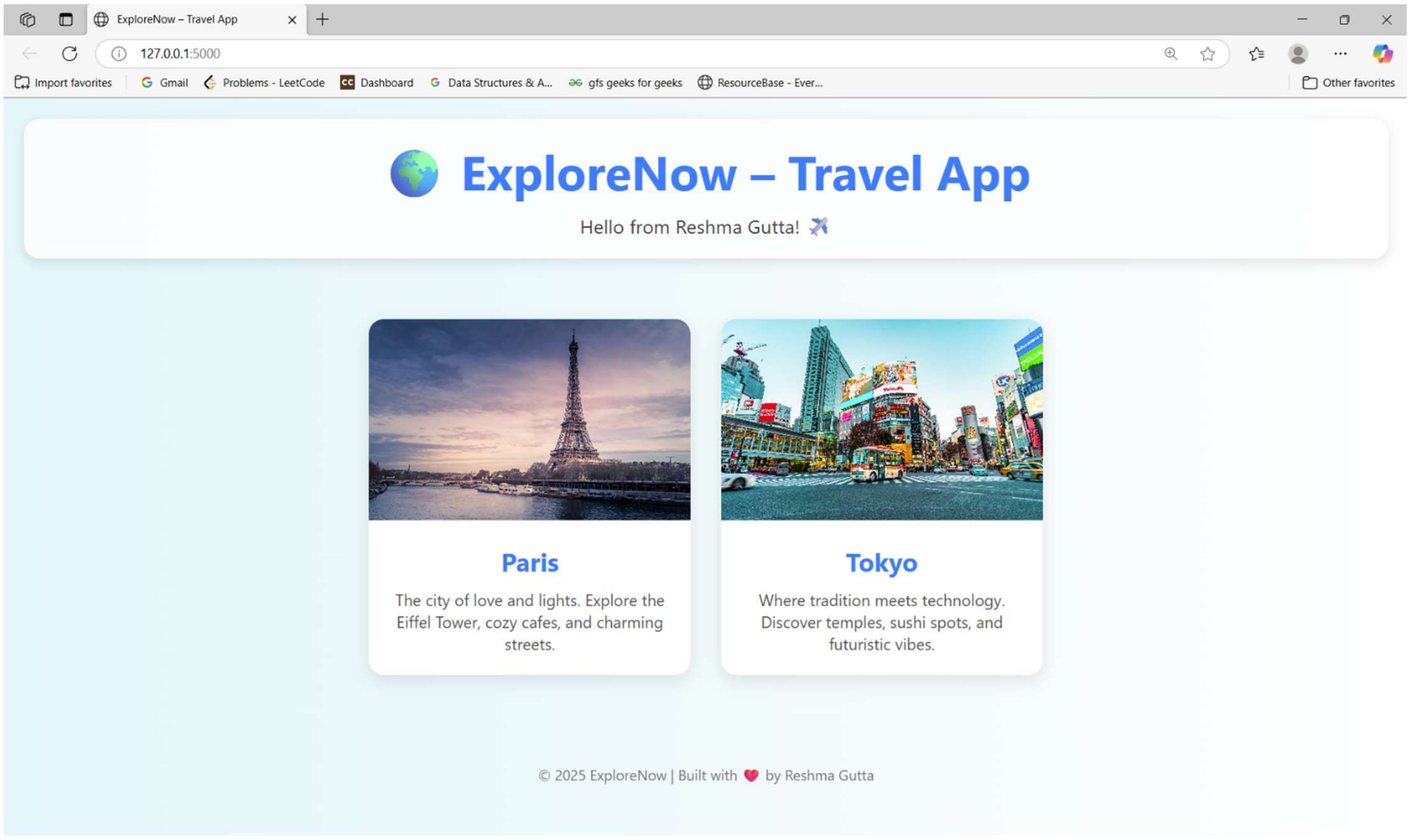
- A Dockerfile is written to containerize the Flask app, ensuring consistent environments across local and production setups.
- The Docker image includes:
- Python base image
- Copied source code
- Installed dependencies
- CMD to start the Flask server

5. Deployment

- The final Docker image is tested locally using docker run.
- (Optional) The image can be:
- Pushed to Docker Hub
- Deployed to cloud servers like AWS EC2, Heroku, or Render
- Automated for deployment through GitHub Actions

CHAPTER 3
RESULTS AND DISCUSSION

Execution:



ExploreNow – Travel App

Hello from Reshma Gutta! ✈️

Paris

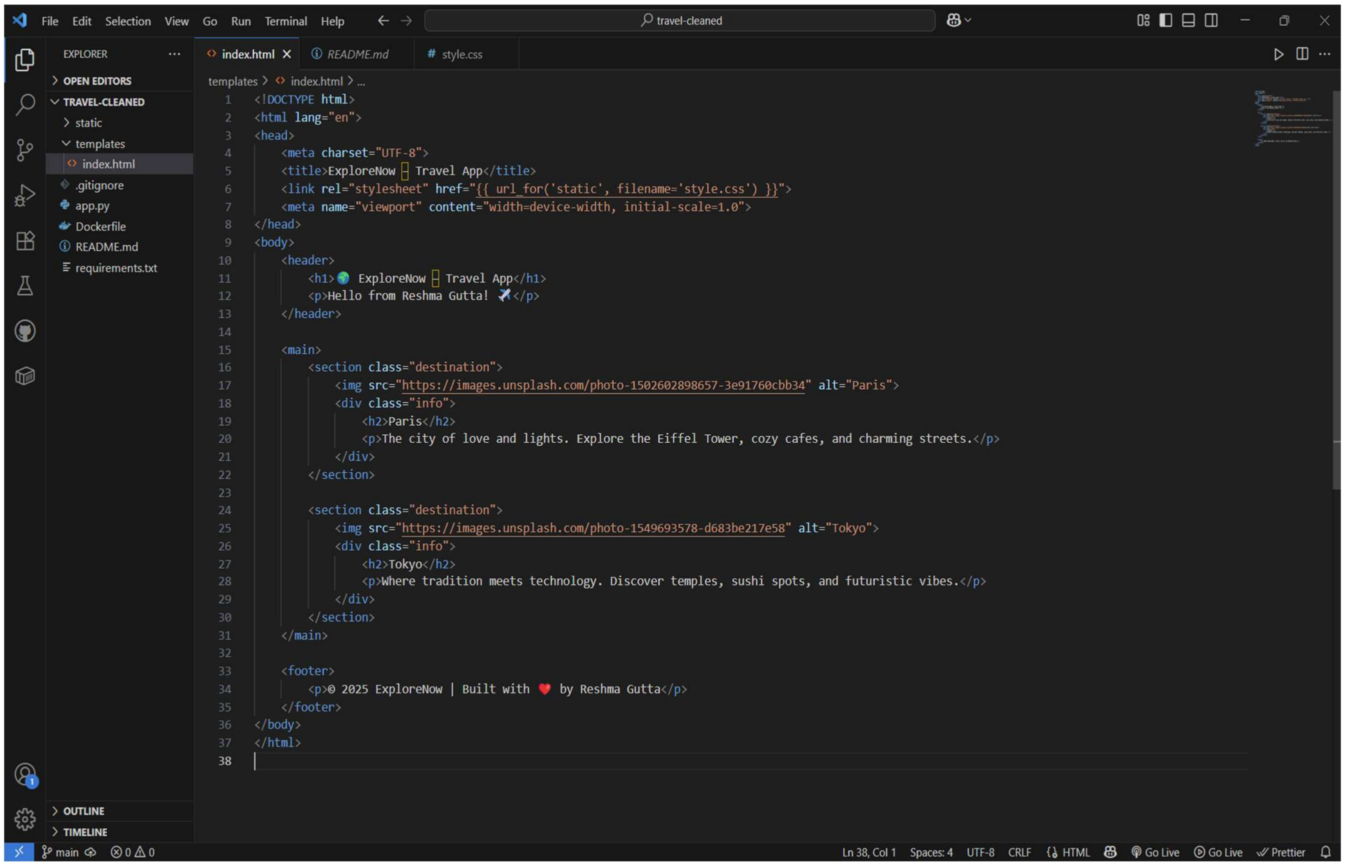
The city of love and lights. Explore the Eiffel Tower, cozy cafes, and charming streets.

Tokyo

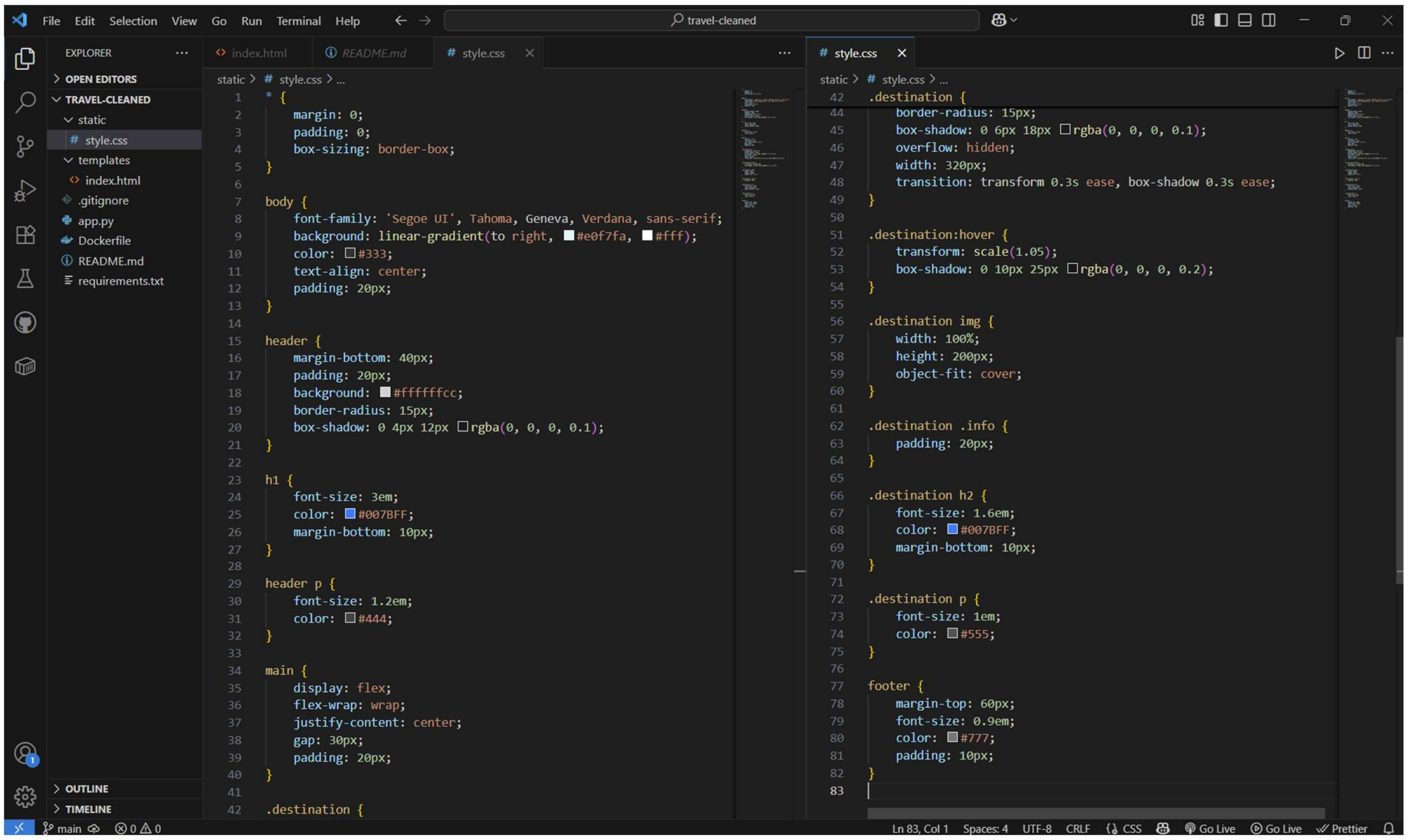
Where tradition meets technology. Discover temples, sushi spots, and futuristic vibes.

© 2025 ExploreNow | Built with ❤️ by Reshma Gutta

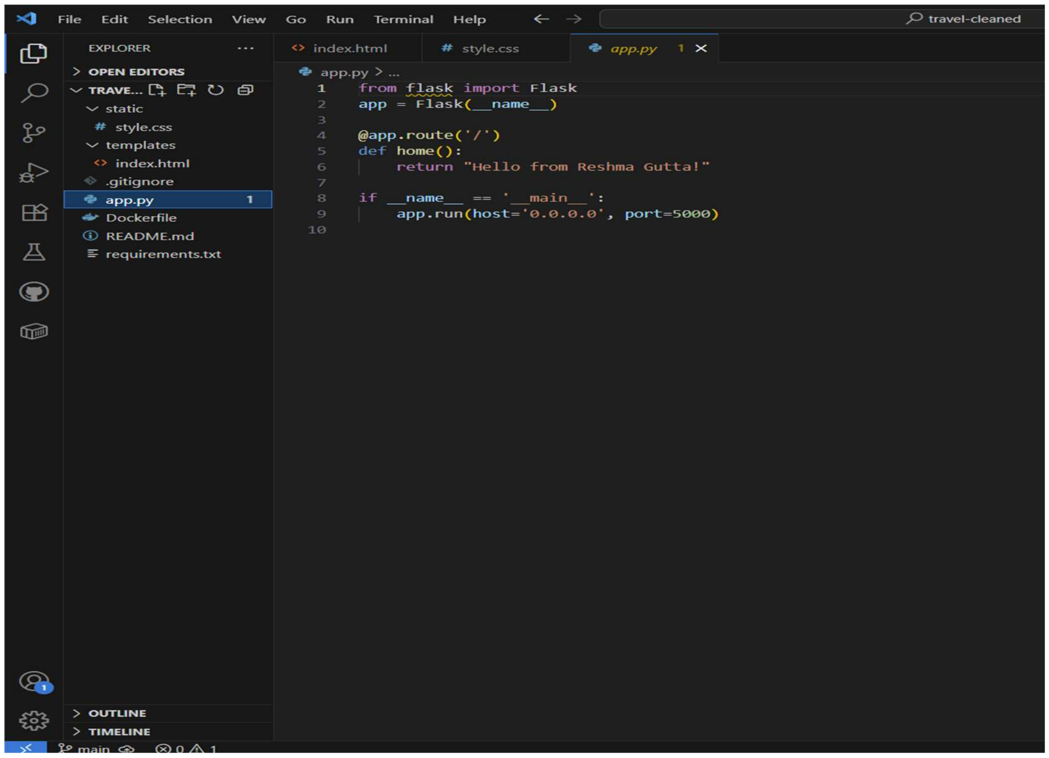
Source Code:



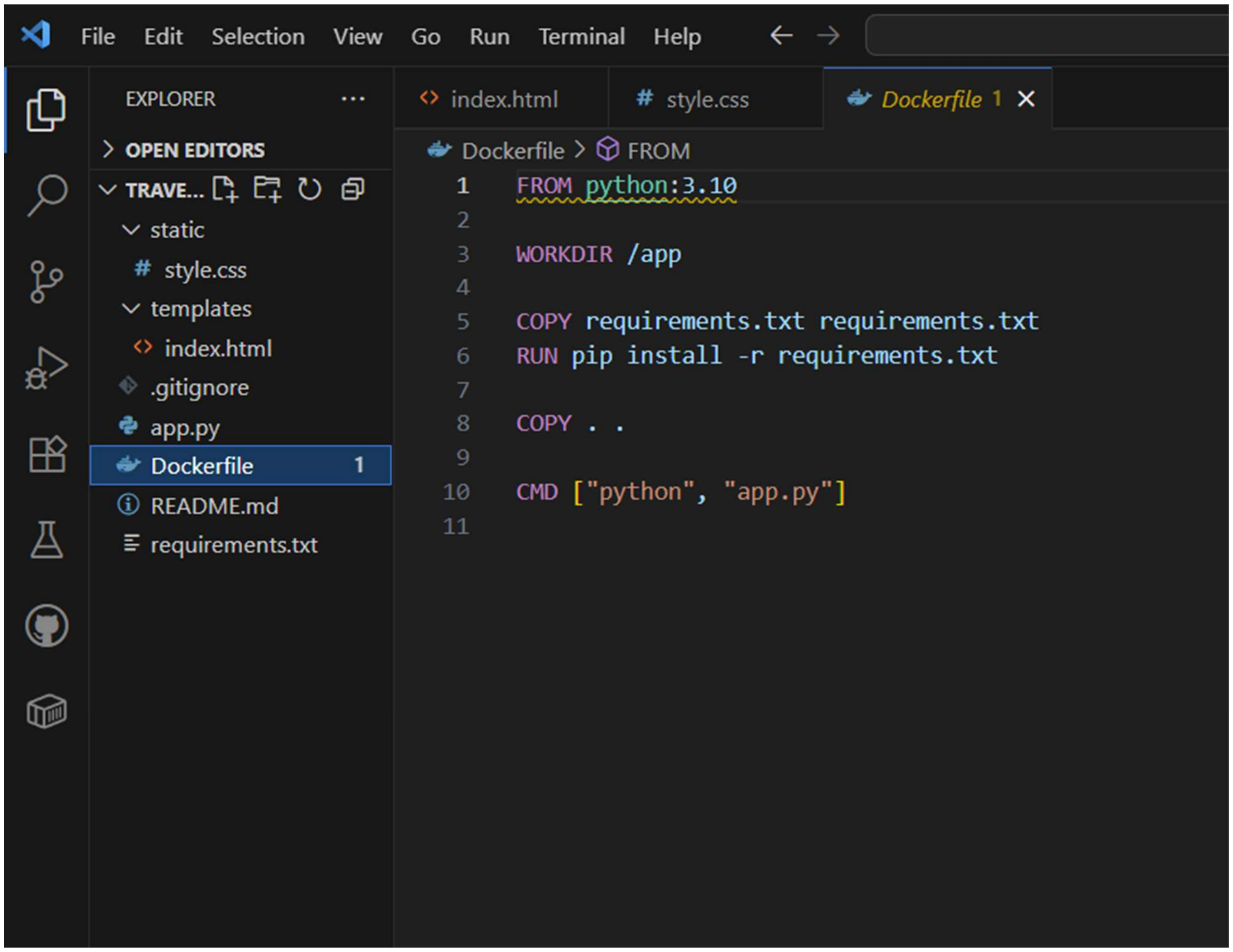
```html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>ExploreNow ▯ Travel App</title>
    <link rel="stylesheet" href="{{ url_for('static', filename='style.css') }}">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
</head>
<body>
    <header>
        <h1>🌍 ExploreNow ▯ Travel App</h1>
        <p>Hello from Reshma Gutta! ✈️</p>
    </header>

    <main>
        <section class="destination">
            <img src="https://images.unsplash.com/photo-1502602898657-3e91760cbb34" alt="Paris">
            <div class="info">
                <h2>Paris</h2>
                <p>The city of love and lights. Explore the Eiffel Tower, cozy cafes, and charming streets.</p>
            </div>
        </section>

        <section class="destination">
            <img src="https://images.unsplash.com/photo-1549693578-d683be217e58" alt="Tokyo">
            <div class="info">
                <h2>Tokyo</h2>
                <p>Where tradition meets technology. Discover temples, sushi spots, and futuristic vibes.</p>
            </div>
        </section>
    </main>

    <footer>
        <p>© 2025 ExploreNow | Built with ❤️ by Reshma Gutta</p>
    </footer>
</body>
</html>

```



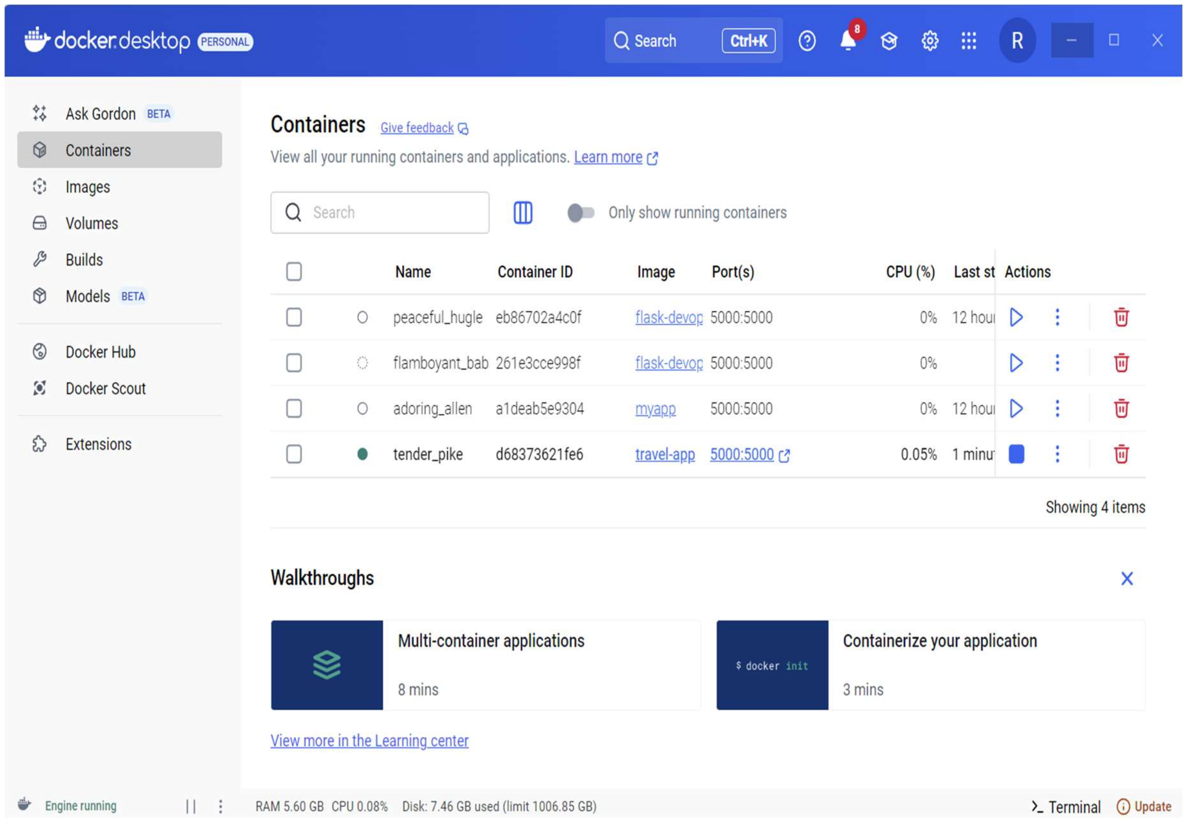
```css
* {
    margin: 0;
    padding: 0;
    box-sizing: border-box;
}

body {
    font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;
    background: linear-gradient(to right, #e0f7fa, #fff);
    color: #333;
    text-align: center;
    padding: 20px;
}

header {
    margin-bottom: 40px;
    padding: 20px;
    background: #ffffffcc;
    border-radius: 15px;
    box-shadow: 0 4px 12px rgba(0, 0, 0, 0.1);
}

h1 {
    font-size: 3em;
    color: #007BFF;
    margin-bottom: 10px;
}

header p {
    font-size: 1.2em;
    color: #444;
}

main {
    display: flex;
    flex-wrap: wrap;
    justify-content: center;
    gap: 30px;
    padding: 20px;
}

.destination {
    border-radius: 15px;
    box-shadow: 0 6px 18px rgba(0, 0, 0, 0.1);
    overflow: hidden;
    width: 320px;
    transition: transform 0.3s ease, box-shadow 0.3s ease;
}

.destination:hover {
    transform: scale(1.05);
    box-shadow: 0 10px 25px rgba(0, 0, 0, 0.2);
}

.destination img {
    width: 100%;
    height: 200px;
    object-fit: cover;
}

.destination .info {
    padding: 20px;
}

.destination h2 {
    font-size: 1.6em;
    color: #007BFF;
    margin-bottom: 10px;
}

.destination p {
    font-size: 1em;
    color: #555;
}

footer {
    margin-top: 60px;
    font-size: 0.9em;
    color: #777;
    padding: 10px;
}
```



```python
from flask import Flask
app = Flask(__name__)

@app.route('/')
def home():
    return "Hello from Reshma Gutta!"

if __name__ == '__main__':
    app.run(host='0.0.0.0', port=5000)
```



```dockerfile
FROM python:3.10

WORKDIR /app

COPY requirements.txt requirements.txt
RUN pip install -r requirements.txt

COPY . .

CMD ["python", "app.py"]

```



Containers Give feedback

View all your running containers and applications. Learn more

Only show running containers

	Name	Container ID	Image	Port(s)	CPU (%)	Last st	Actions
○	peaceful_hugle	eb86702a4c0f	flask-devop	5000:5000	0%	12 hou	
○	flamboyant_bab	261e3cce998f	flask-devop	5000:5000	0%		
○	adoring_allen	a1deab5e9304	myapp	5000:5000	0%	12 hou	
●	tender_pike	d68373621fe6	travel-app	5000:5000	0.05%	1 minu	

Showing 4 items

Walkthroughs

Multi-container applications 8 mins

Containerize your application 3 mins

View more in the Learning center

RAM 5.60 GB CPU 0.08% Disk: 7.46 GB used (limit 1006.85 GB)

CHAPTER 4
CONCLUSION

This project demonstrates how DevOps principles can be effectively applied to a real-world **Flask-based Travel Application** using **Dockerization** and **CI/CD automation**. By leveraging **GitHub Actions**, we automated the entire software delivery pipeline—from pushing code to building and deploying the application—reducing manual effort and improving the speed of releases. Docker played a key role in providing **environmental consistency**, ensuring that the app runs reliably across development, testing, and production environments.

The combination of **containerization** and **CI/CD** not only simplified deployment but also made the application more **scalable**, **portable**, and **maintainable**. This approach follows the core DevOps principles of **automation**, **continuous delivery**, and **operational efficiency**.

This project serves as a solid foundation for future enhancements such as integrating cloud platforms, expanding to microservices, or adopting Infrastructure as Code (IaC) tools. It reflects a complete and modern DevOps workflow for Flask applications.