Aim: Explore Docker commands for content management. develop a single containerized application using docker

Objective:

Understand and utilize fundamental Docker commands for managing containers and images.

Build and deploy a containerized application to demonstrate Docker's efficiency in content management.

Gain hands-on experience in using Docker for application packaging, testing, and running in isolated environments.

Description:

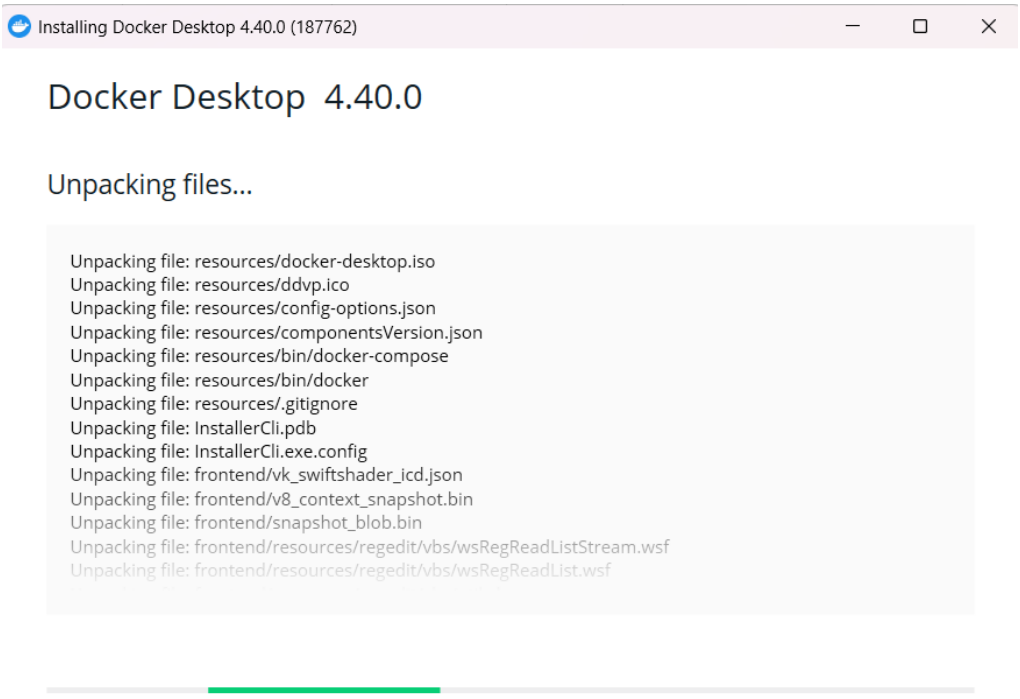
Docker is a platform designed to make it easier to create, deploy, and run applications using containers. Containers allow developers to package applications with all parts they need, such as libraries and other dependencies, and ship it all out as one package. This project involves building a simple web application and running it inside a Docker container while exploring key Docker commands that help manage container content and configuration.

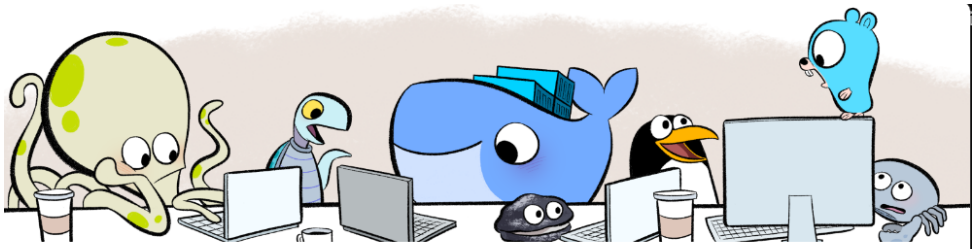
Steps Required:

Setup and Requirements:

- Docker installed on the system - https://docs.docker.com/desktop/setup/install/windows-install/
- Basic knowledge of Dockerfile and image building
- A simple web application (e.g., a static HTML page or a Node.js app)

Implementation:





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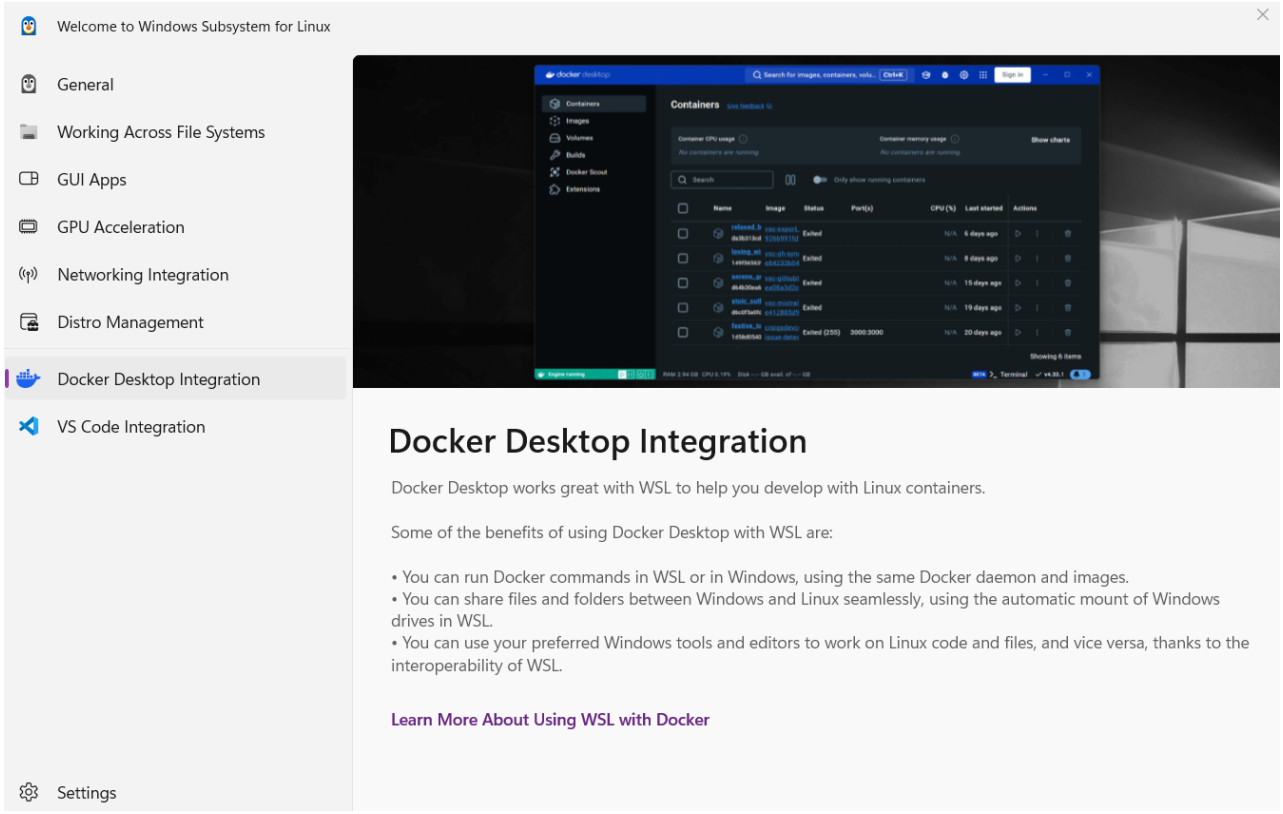
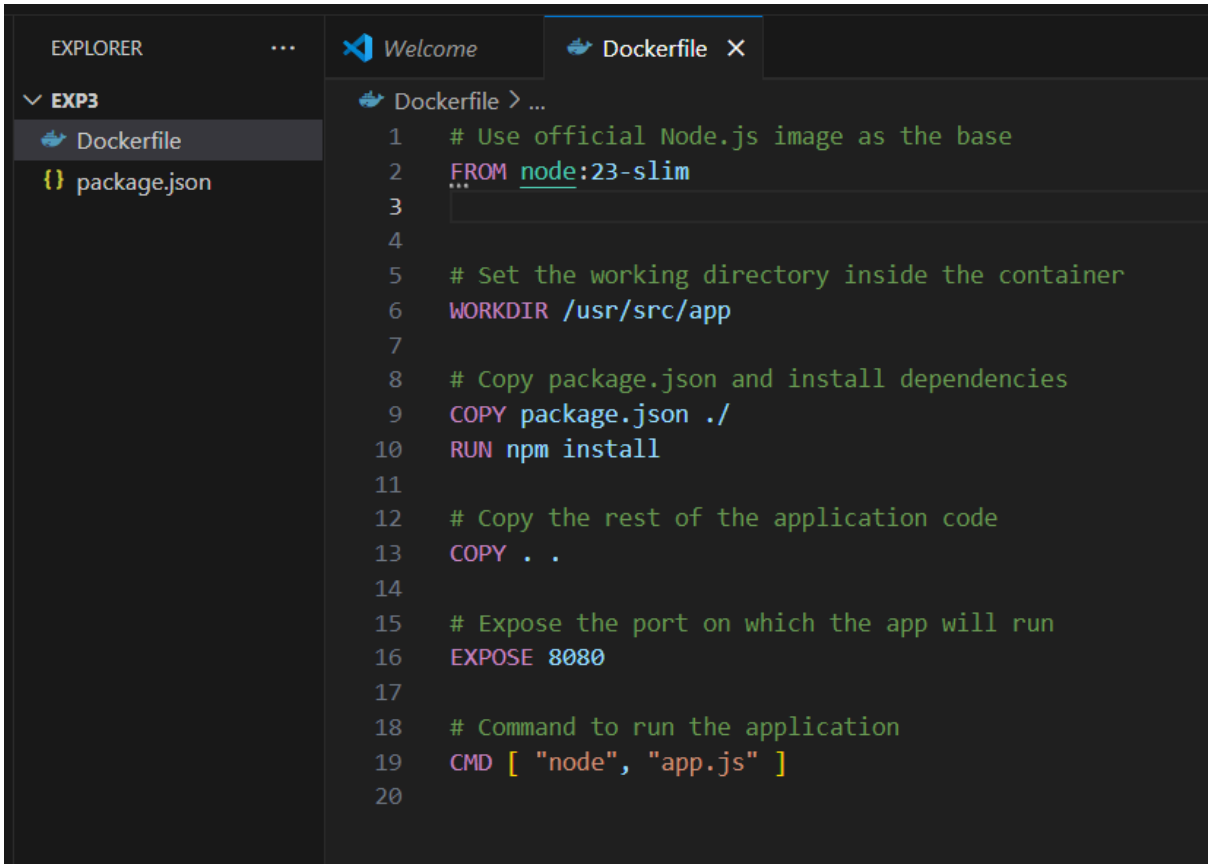
```
and 'wsl.exe --install <Distro>' to install.
PS C:\WINDOWS\system32> wsl --list --online
>>
The following is a list of valid distributions that can be installed.
Install using 'wsl.exe --install <Distro>'.

NAME                            FRIENDLY NAME
AlmaLinux-8                     AlmaLinux OS 8
AlmaLinux-9                     AlmaLinux OS 9
AlmaLinux-Kitten-10             AlmaLinux OS Kitten 10
Debian                          Debian GNU/Linux
FedoraLinux-42                  Fedora Linux 42
SUSE-Linux-Enterprise-15-SP5    SUSE Linux Enterprise 15 SP5
SUSE-Linux-Enterprise-15-SP6    SUSE Linux Enterprise 15 SP6
Ubuntu                          Ubuntu
Ubuntu-24.04                    Ubuntu 24.04 LTS
archlinux                       Arch Linux
kali-linux                      Kali Linux Rolling
openSUSE-Tumbleweed             openSUSE Tumbleweed
openSUSE-Leap-15.6              openSUSE Leap 15.6
Ubuntu-18.04                    Ubuntu 18.04 LTS
Ubuntu-20.04                    Ubuntu 20.04 LTS
Ubuntu-22.04                    Ubuntu 22.04 LTS
OracleLinux_7_9                 Oracle Linux 7.9
OracleLinux_8_7                 Oracle Linux 8.7
OracleLinux_9_1                 Oracle Linux 9.1
PS C:\WINDOWS\system32> wsl --install -d Ubuntu
>>
Downloading: Ubuntu
[========                  14.6%                           ]
```




```
PS C:\WINDOWS\system32> wsl -d Ubuntu
>>
Provisioning the new WSL instance Ubuntu
This might take a while...
Create a default Unix user account: geeta
New password:
Retype new password:
passwd: password updated successfully
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

Welcome to Ubuntu 24.04.2 LTS (GNU/Linux 5.15.167.4-microsoft-standard-WSL2 x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sun Apr 20 07:14:58 UTC 2025

  System load:  0.06               Processes:             32
  Usage of /:   0.1% of 1006.85GB  Users logged in:       0
  Memory usage: 5%                 IPv4 address for eth0: 172.17.247.16
  Swap usage:   0%


This message is shown once a day. To disable it please create the
/home/geeta/.hushlogin file.
geeta@Geeta:/mnt/c/WINDOWS/system32$
```

```
C:\Users\geeta>docker --version
Docker version 28.0.4, build b8034c0

C:\Users\geeta>docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
e6590344b1a5: Pull complete
Digest: sha256:c41088499908a59aae84b0a49c70e86f4731e588a737f1637e73c8c09d995654
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

For more examples and ideas, visit:
 https://docs.docker.com/get-started/
```

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> npm init -y
Wrote to C:\Users\geeta\OneDrive\Desktop\exp3\package.json:

{
  "name": "exp3",
  "version": "1.0.0",
  "main": "index.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "keywords": [],
  "author": "",
  "license": "ISC",
  "type": "commonjs",
  "description": ""
}
```



Part 1: Docker Commands for Content Management

Docker provides several useful commands for managing containers and images related to content management. Below are some essential Docker commands:

1. **Build an Image from a Dockerfile**
    - **Command:** *docker build -t <image_name>:<tag> <path_to_dockerfile>*
    - **Example:** *docker build -t myapp:1.0.*

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker build -t myapp:1.0 .
[+] Building 4.2s (10/10) FINISHED
 => [internal] load build definition from Dockerfile
 => => transferring dockerfile: 438B
 => [internal] load metadata for docker.io/library/node:23-slim
 => [internal] load .dockerignore
 => => transferring context: 2B
 => CACHED [1/5] FROM docker.io/library/node:23-slim@sha256:dfb18d8011c0b3a112214a32e772d9c6752131ffee512e974e59367e46fcee52
 => => resolve docker.io/library/node:23-slim@sha256:dfb18d8011c0b3a112214a32e772d9c6752131ffee512e974e59367e46fcee52
 => [internal] load build context
 => => transferring context: 315B
 => [2/5] WORKDIR /usr/src/app
 => [3/5] COPY package.json ./
 => [4/5] RUN npm install
 => [5/5] COPY . .
 => exporting to image
 => => exporting layers
 => => exporting manifest sha256:3441395ded66f9609070f5ceb3e0c28a5e66f315d95143c823610ab911e1c390
 => => exporting config sha256:c978258267da659fb970e16956813202e9ab536db4cea33e1058320878137578
 => => exporting attestation manifest sha256:55bfa841083bc37ca75ade628428328668fb3a6af766b82799cf78f7d63645d3
 => => exporting manifest list sha256:61ddcfe03aec7084dcaa89d602a2dd717d38da280b0c32e4ca95cde1dbfc1b28
 => => naming to docker.io/library/myapp:1.0
 => => unpacking to docker.io/library/myapp:1.0
```

This command builds an image from the Dockerfile located in the current directory (.)

List Docker Images

- **Command:** *docker images*
- **Example:** *docker images*

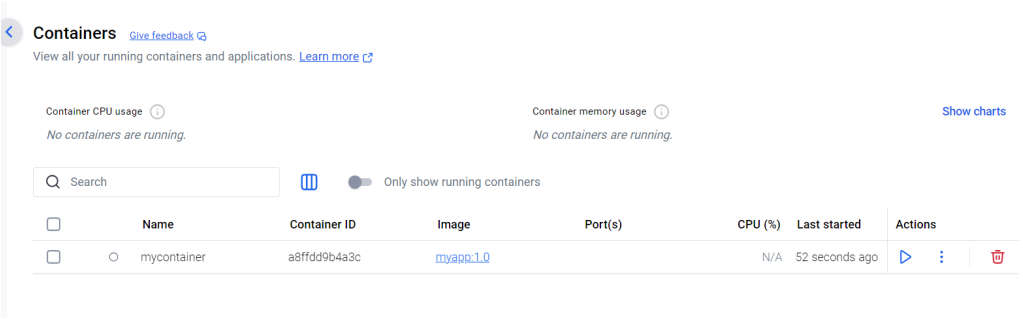
```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker images
REPOSITORY          TAG       IMAGE ID       CREATED          SIZE
myapp               1.0       61ddcfe03aec   44 seconds ago   332MB
node-redis-api-app  latest    3ef30ad3329e   21 minutes ago   364MB
hello-world         latest    c41088499908   2 months ago     20.4kB
redis               latest    fbdbaea47b9a   3 months ago     173MB
```

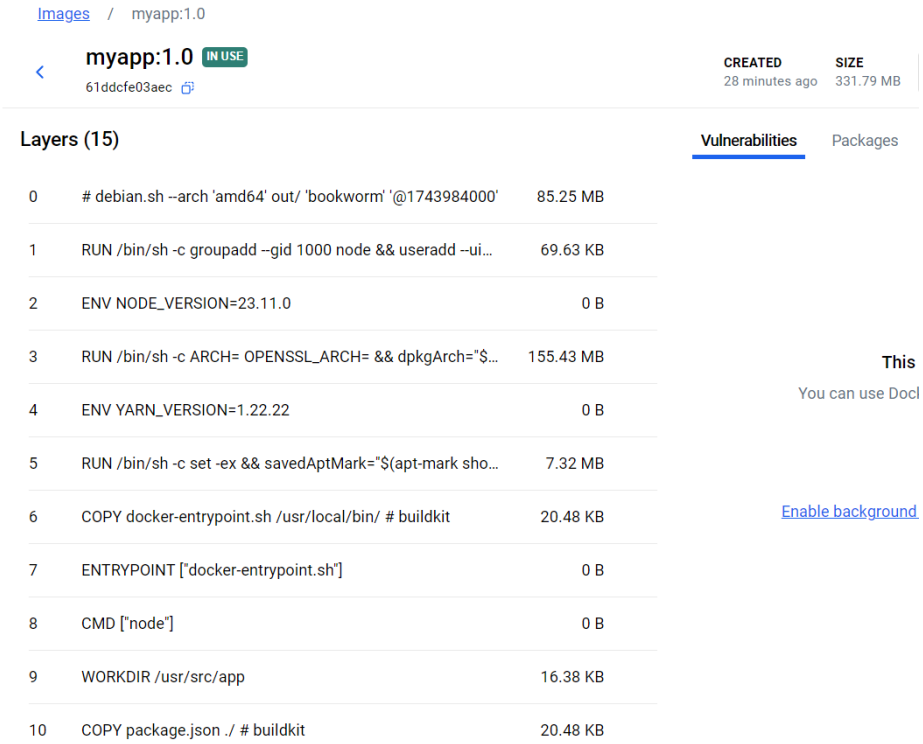
Run a Container from an Image

- **Command:** *docker run -d --name <container_name> <image_name>:<tag>*
- **Example:** *docker run -d --name mycontainer myapp:1.0*

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker run -d --name mycontainer myapp:1.0
a8ffdd9b4a3cf928358b29583a641d2dd06e717bcbd5994fc9e284b44ec38c73
```

This runs the container in detached mode (-d) from the specified image.





11	RUN /bin/sh -c npm install # buildkit	3.04 MB
12	COPY . . # buildkit	20.48 KB
13	EXPOSE map[8080/tcp:{}]	0 B
14	CMD ["node" "app.js"]	0 B

List Running Containers

- **Command:** *docker ps*
- **Example:** *docker ps*

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker ps
 => CACHED [1/5] FROM docker.io/library/node:23-slim@sha256:dfb18d8011c0b3a112214a32e772d9c6752131ffee512e974e59367e46fcee52
 => => resolve docker.io/library/node:23-slim@sha256:dfb18d8011c0b3a112214a32e772d9c6752131ffee512e974e59367e46fcee52
 => [internal] load build context
 => => transferring context: 315B
 => [2/5] WORKDIR /usr/src/app
 => [3/5] COPY package.json ./
 => [4/5] RUN npm install
 => [5/5] COPY . .
 => exporting to image
 => => exporting layers
 => => exporting manifest sha256:3441395ded66f9609070f5ceb3e0c28a5e66f315d95143c823610ab911e1c390
 => => exporting config sha256:c978258267da659fb970e16956813202e9ab536db4cea33e1058320878137578
 => => exporting attestation manifest sha256:55bfa841083bc37ca75ade628428328668fb3a6af766b82799cf78f7d63645d3
 => => exporting manifest list sha256:61ddcfe03aec7084dcaa89d602a2dd717d38da280b0c32e4ca95cde1dbfc1b28
 => => naming to docker.io/library/myapp:1.0
 => => unpacking to docker.io/library/myapp:1.0
```

This shows a list of all running containers.

Stop a Running Container

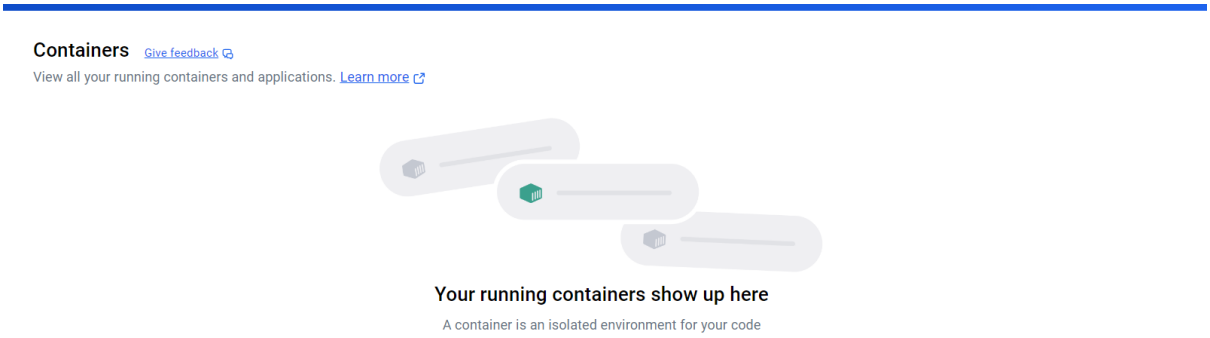
- **Command:** docker stop <container_name>
- **Example:** *docker stop mycontainer*

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker stop mycontainer
mycontainer
PS C:\Users\geeta\OneDrive\Desktop\exp3>
```

Remove a Container

- **Command:** docker rm <container_name>
- **Example:** *docker rm mycontainer*

```
mycontainer                                    docker rm mycontainer
mycontainer\geeta\OneDrive\Desktop\exp3>
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker rm mycontainer
Error response from daemon: No such container: mycontainer
PS C:\Users\geeta\OneDrive\Desktop\exp3>
```



Remove an Image

- **Command:** docker rmi <image_name>:<tag>
- **Example:** *docker rmi myapp:1.0*

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker rmi myapp:1.0
Untagged: myapp:1.0
Deleted: sha256:61ddcfe03aec7084dcaa89d602a2dd717d38da280b0c32e4ca95cde1dbfc1b28
PS C:\Users\geeta\OneDrive\Desktop\exp3>
```

View Logs of a Running Container

- **Command:** docker logs <container_name>
- **Example:** *docker logs mycontainer*

```
PS C:\Users\geeta\OneDrive\Desktop\exp3> docker logs mycontainer
Error response from daemon: No such container: mycontainer
PS C:\Users\geeta\OneDrive\Desktop\exp3>
```

Part 2: Developing a Simple Containerized Application

Let’s create a simple Node.js web application that serves a "Hello, Docker!" message. We will containerize this application using Docker.

Step 1: Create the Application

1. **Create a new directory for your application.**

```
PS C:\Users\geeta\OneDrive\Desktop> mkdir my-docker-app


    Directory: C:\Users\geeta\OneDrive\Desktop


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----        20-04-2025     14:21                my-docker-app
```

Create the Node.js application:

- Create a file called app.js with the following content:

```
app.js > ...
1   const http = require('http');
2   const port = 8080;
3
4   const requestHandler = (req, res) => {
5     res.write('Hello, Docker!');
6     res.end();
7   };
8
9   const server = http.createServer(requestHandler);
10
11  server.listen(port, () => {
12    console.log(`Server is running on http://localhost:${port}`);
13  });
14
```

Create a package.json file:

- Run npm init -y to generate a basic package.json file, and then run: npm install http

```
PS C:\Users\geeta\OneDrive\Desktop\my-docker-app> npm init -y
Wrote to C:\Users\geeta\OneDrive\Desktop\my-docker-app\package.json:

{
  "name": "my-docker-app",
  "version": "1.0.0",
  "main": "index.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "keywords": [],
  "author": "",
  "license": "ISC",
  "type": "commonjs",
  "description": ""
}
```

```
                                                    npm install http
>> C:\Users\geeta\OneDrive\Desktop\my-docker-app>

added 1 package, and audited 2 packages in 1s

found 0 vulnerabilities
PS C:\Users\geeta\OneDrive\Desktop\my-docker-app>
```

Step 2: Create the Dockerfile

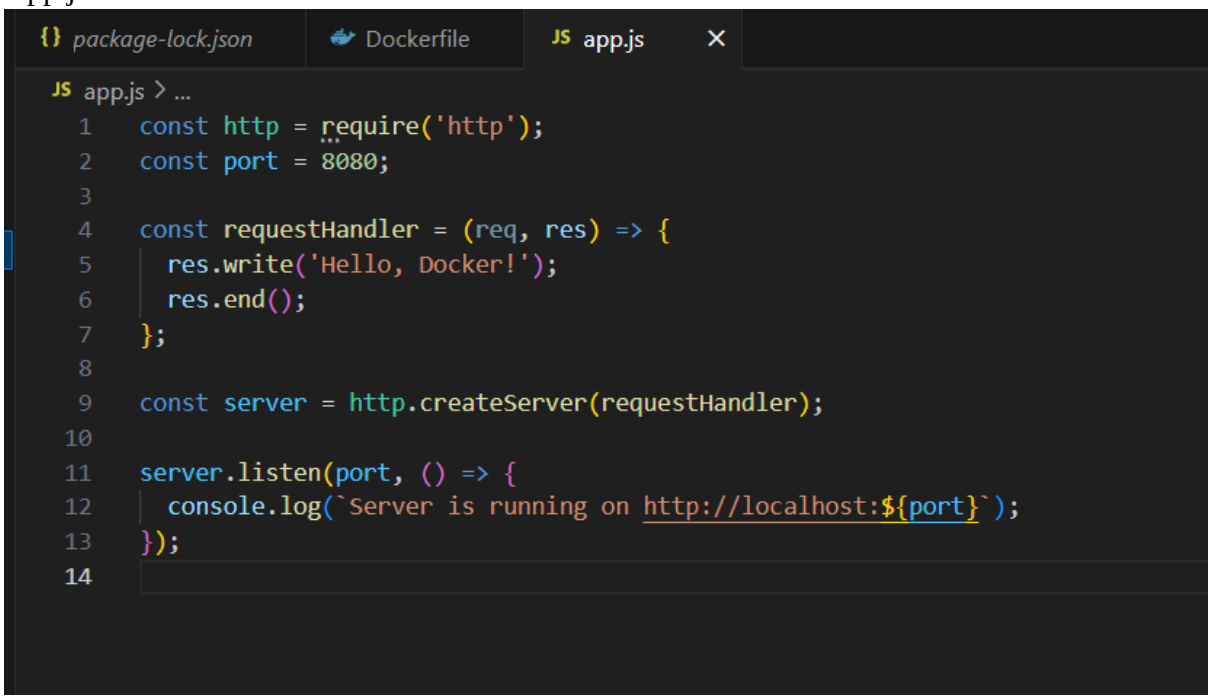
1. **Create a Dockerfile in the same directory with the following content:**

package-lock.json | Dockerfile | app.js

Dockerfile > ...

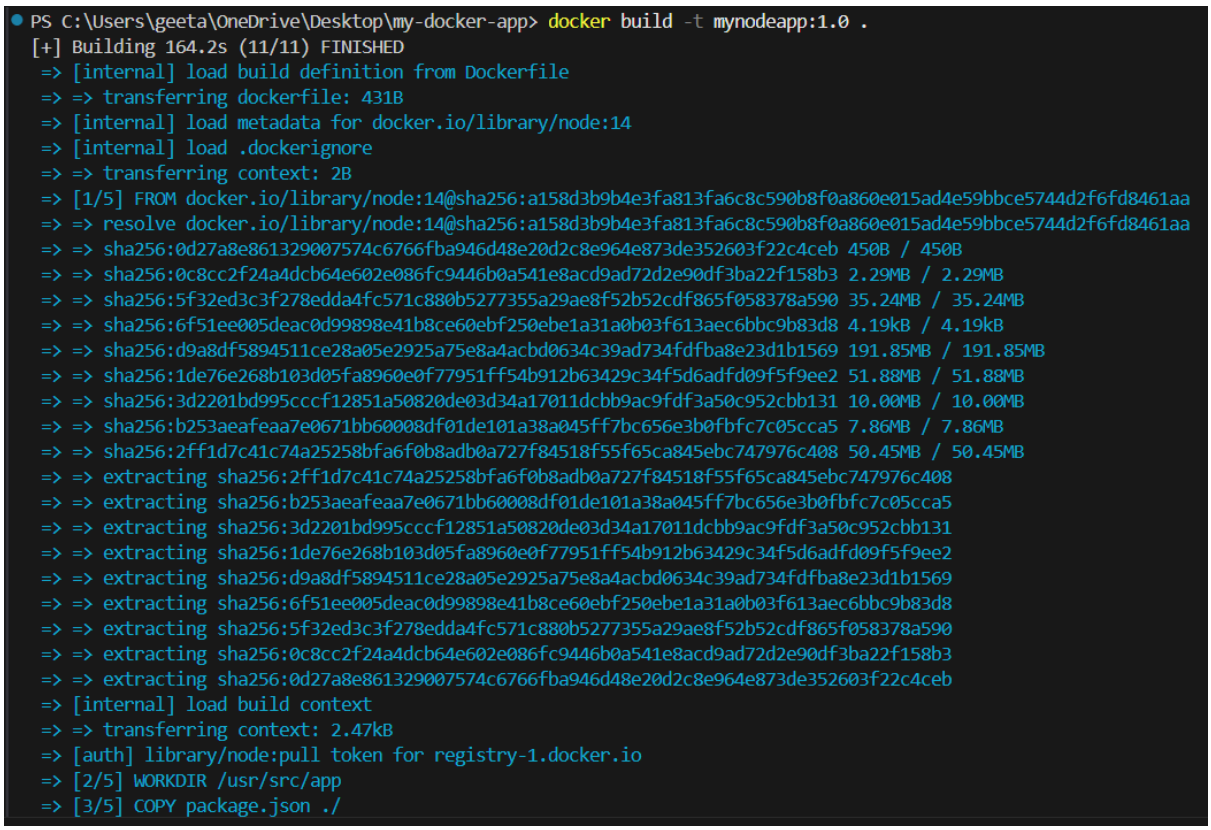
```
# Use official Node.js image as the base
FROM node:23-slim


# Set the working directory inside the container
WORKDIR /usr/src/app

# Copy package.json and install dependencies
COPY package.json ./
RUN npm install

# Copy the rest of the application code
COPY . .

# Expose the port on which the app will run
EXPOSE 8080

# Command to run the application
CMD [ "node", "app.js" ]

```

2. App.js



Step 3: Build the Docker Image

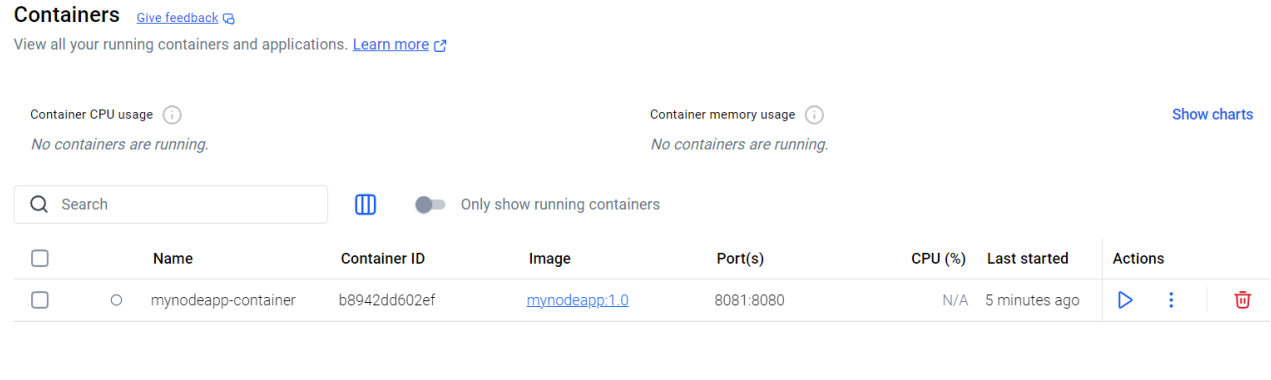
1. **Build the Docker image using the command: docker build -t mynodeapp:1.0 .**

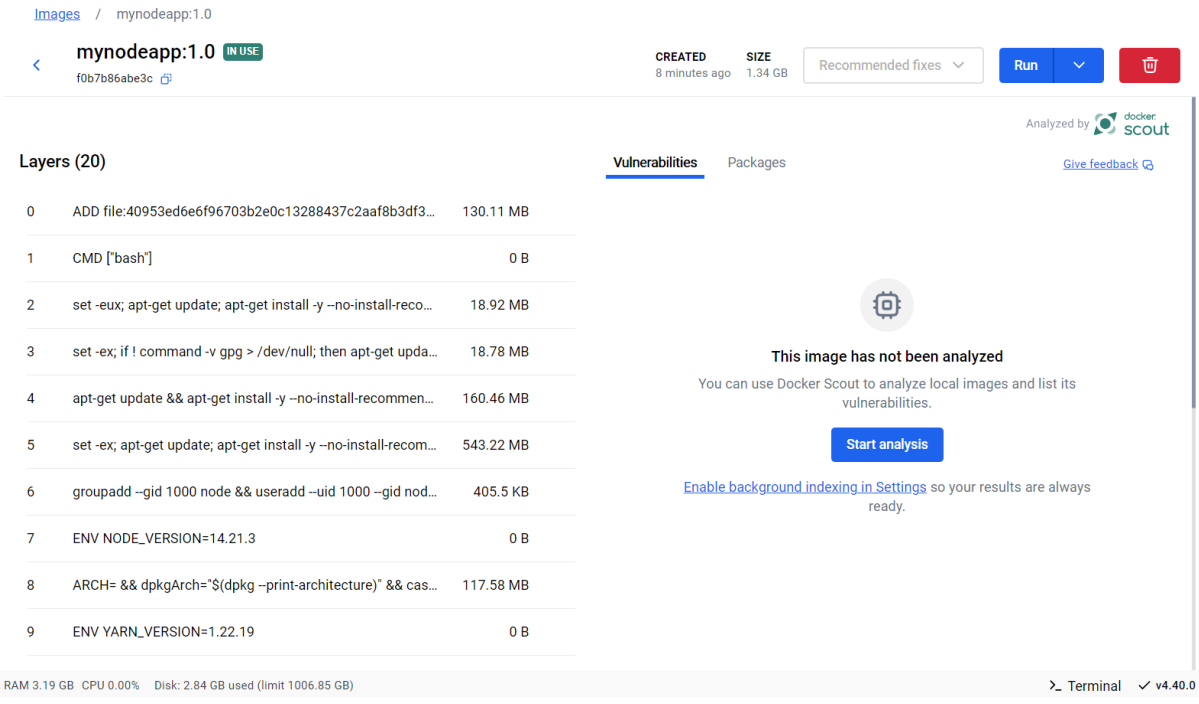


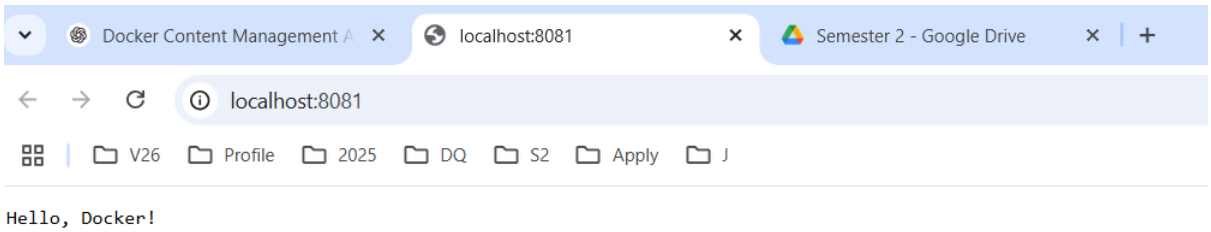
Step 4: Run the Docker Container

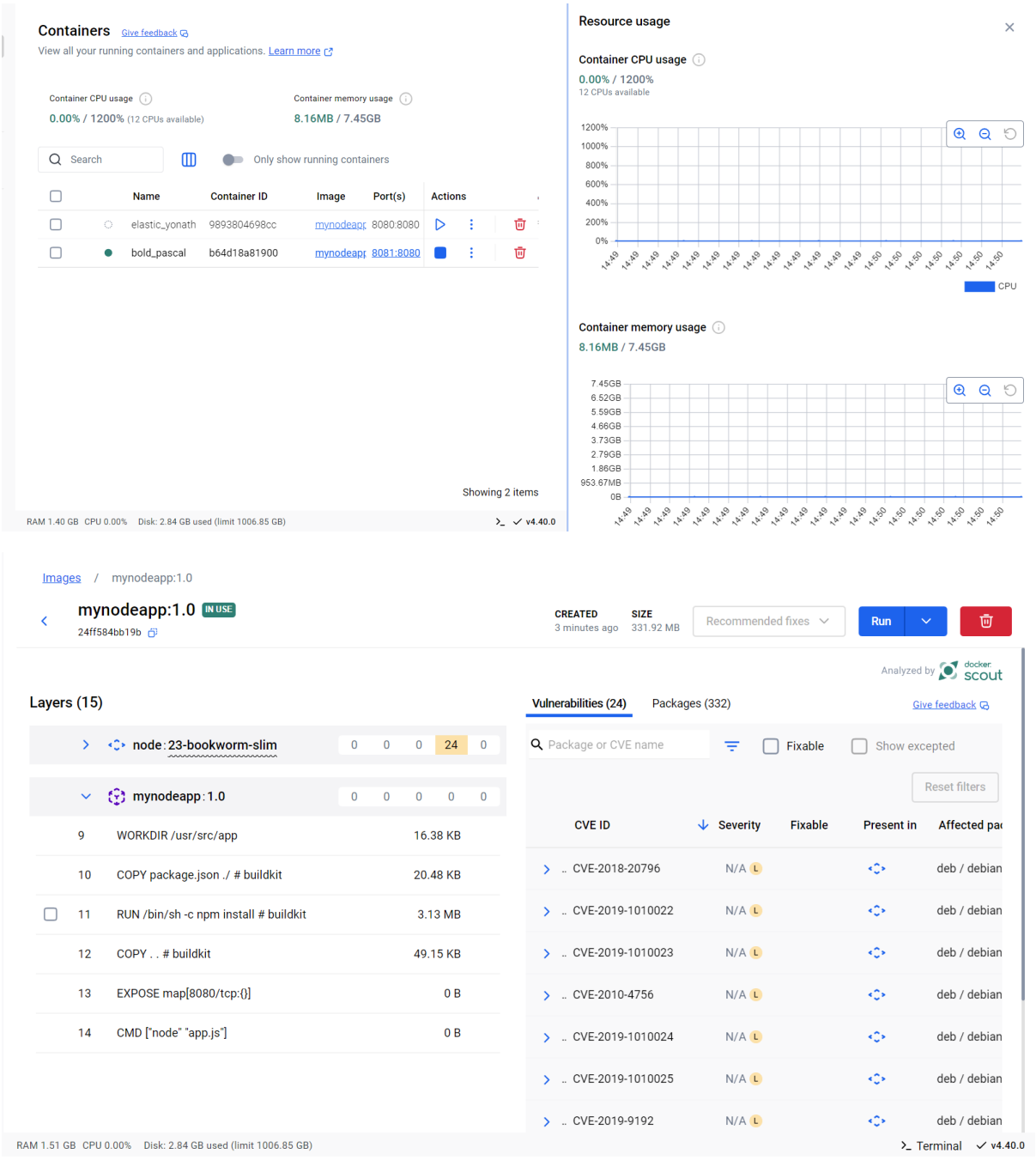
1. **Run the container: docker run -d -p 8081:8080 --name mynodeapp-container mynodeapp:1.0**

```
PS C:\Users\geeta\OneDrive\Desktop\my-docker-app> docker run -d -p 8081:8080 --name mynodeapp-container mynodeapp:1.0
b8942dd602ef929d9bc547720ff42af7ee1ff2a4635671c0397c090d3e233a93
PS C:\Users\geeta\OneDrive\Desktop\my-docker-app>
```









Example 2: Docker Implementation on Mini Project

1. Create a Dockerfile

The Dockerfile is a text file that contains instructions for Docker to create an image. In this case, you'll use a lightweight web server (like Nginx) to serve your static files.

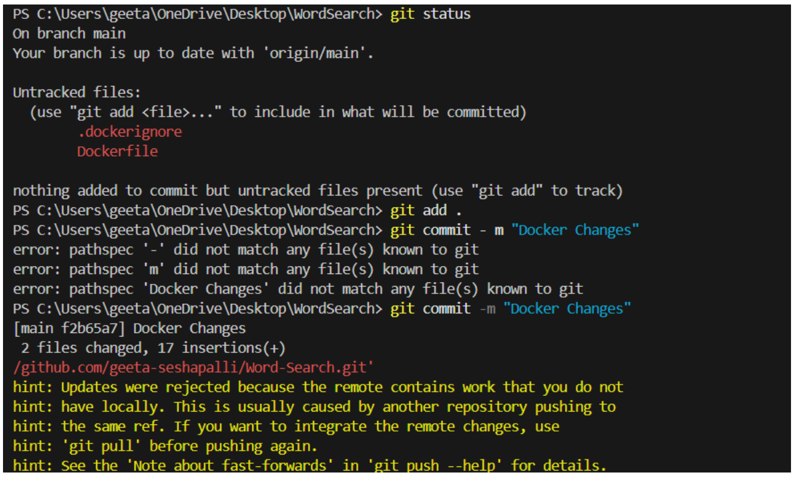
In the root of your Word Search project directory, create a file named Dockerfile (without any file extension).

Dockerfile:

```
# Use an official Nginx image from Docker Hub
FROM nginx:alpine
```

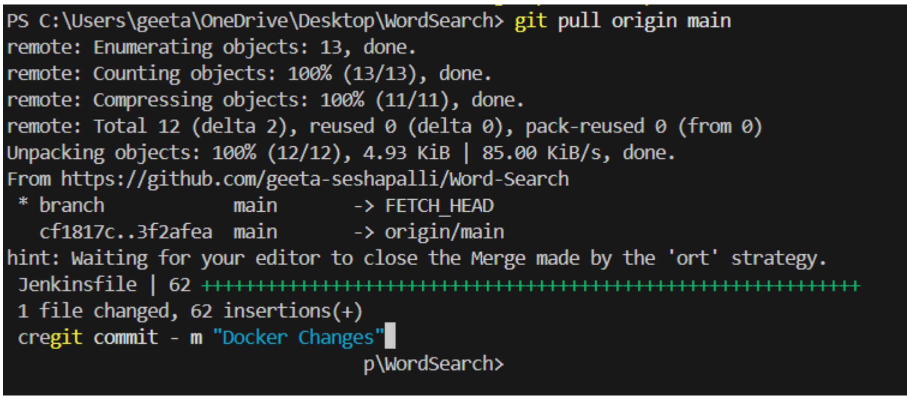
```
# Set the working directory inside the container
WORKDIR /usr/share/nginx/html

# Copy the contents of the local directory to the Nginx container directory
COPY . .

# Expose port 80 so that it can be accessed from the outside
EXPOSE 80

# Start the Nginx service when the container is run
CMD ["nginx", "-g", "daemon off;"]
```

- FROM nginx:alpine: This uses an official, minimal version of the Nginx web server.
- WORKDIR /usr/share/nginx/html: Sets the working directory inside the container to where Nginx serves files.
- COPY . .: Copies all files from your local directory (where the Dockerfile is located) into the working directory inside the container.
- EXPOSE 80: Exposes port 80 for the web server.
- CMD ["nginx", "-g", "daemon off;"]: Tells Docker to run Nginx in the foreground.



```
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> git status
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        .dockerignore
        Dockerfile

nothing added to commit but untracked files present (use "git add" to track)
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> git add .
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> git commit - m "Docker Changes"
error: pathspec '-' did not match any file(s) known to git
error: pathspec 'm' did not match any file(s) known to git
error: pathspec 'Docker Changes' did not match any file(s) known to git
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> git commit -m "Docker Changes"
[main f2b65a7] Docker Changes
 2 files changed, 17 insertions(+)
/github.com/geeta-seshapalli/Word-Search.git'
hint: Updates were rejected because the remote contains work that you do not
hint: have locally. This is usually caused by another repository pushing to
hint: the same ref. If you want to integrate the remote changes, use
hint: 'git pull' before pushing again.
hint: See the 'Note about fast-forwards' in 'git push --help' for details.
```

Description: Docker Files update in git



```
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> git pull origin main
remote: Enumerating objects: 13, done.
remote: Counting objects: 100% (13/13), done.
remote: Compressing objects: 100% (11/11), done.
remote: Total 12 (delta 2), reused 0 (delta 0), pack-reused 0 (from 0)
Unpacking objects: 100% (12/12), 4.93 KiB | 85.00 KiB/s, done.
From https://github.com/geeta-seshapalli/Word-Search
 * branch            main       -> FETCH_HEAD
   cf1817c..3f2afea  main       -> origin/main
hint: Waiting for your editor to close the Merge made by the 'ort' strategy.
 Jenkinsfile | 62 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 1 file changed, 62 insertions(+)
 cregit commit - m "Docker Changes"
                                p\WordSearch>
```

Description: Docker Changes

```
 1 file changed, 62 insertions(+)
 cregit push
Enumerating objects: 8, done.    p\WordSearch>
Counting objects: 100% (8/8), done.
Delta compression using up to 12 threads
Compressing objects: 100% (5/5), done.
Writing objects: 100% (6/6), 942 bytes | 157.00 KiB/s, done.
Total 6 (delta 1), reused 0 (delta 0), pack-reused 0 (from 0)
remote: Resolving deltas: 100% (1/1), done.
To https://github.com/geeta-seshapalli/Word-Search.git
   3f2afea..8e1d1fb  main -> main
PS C:\Users\geeta\OneDrive\Desktop\WordSearch>
```

Description: Docker Changes

Build the Docker Image

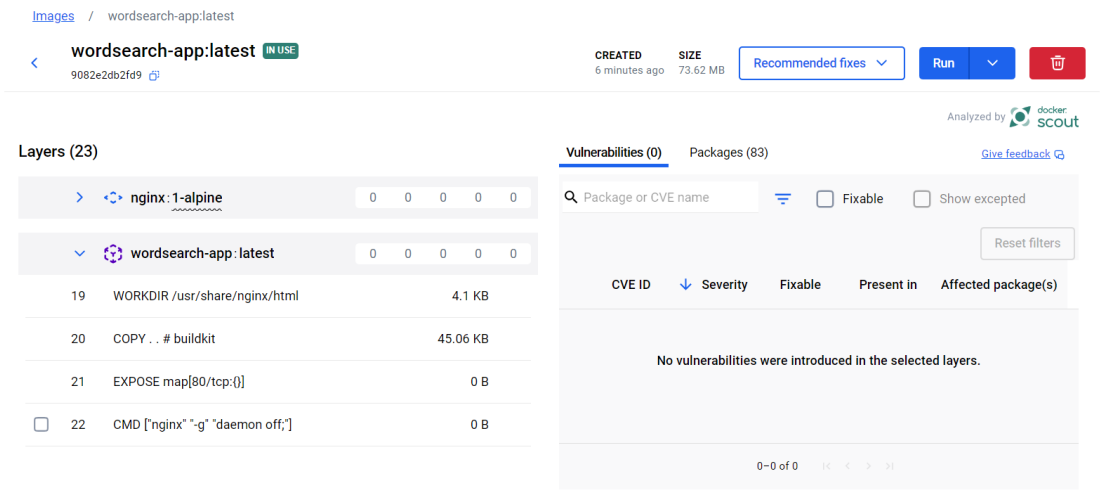
To build the Docker image. Open your terminal, navigate to your project folder, and run the following command:

```
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> docker build -t wordsearch-app .
[+] Building 8.7s (9/9) FINISHED                                                docker:desktop-linux
 => [internal] load build definition from Dockerfile                                          0.0s
 => => transferring dockerfile: 443B                                                          0.0s
 => [internal] load metadata for docker.io/library/nginx:alpine                               2.5s
 => [auth] library/nginx:pull token for registry-1.docker.io                                  0.0s
 => [internal] load .dockerignore                                                             0.0s
 => => transferring context: 67B                                                              0.0s
 => [1/3] FROM docker.io/library/nginx:alpine@sha256:65645c7bb6a0661892a8b03b89d0743208a18dd2f3f17a54ef4b76fb8e2f2a10  4.7s
 => => resolve docker.io/library/nginx:alpine@sha256:65645c7bb6a0661892a8b03b89d0743208a18dd2f3f17a54ef4b76fb8e2f2a10  0.0s
 => => sha256:39c2ddfd6010082a4a646e7ca44e95aca9bf3eaebc00f17f7ccc2954004f2a7d 15.52MB / 15.52MB  3.9s
 => => sha256:34a64644b756511a2e217f0508e11d1a572085d66cd6dc9a555a082ad49a3102 1.40kB / 1.40kB  1.0s
 => => sha256:197eb75867ef4fcecd4724f17b0972ab0489436860a594a9445f8eaff8155053 1.21kB / 1.21kB  1.1s
 => => sha256:81bd8ed7ec6789b0cb7f1b47ee731c522f6dba83201ec73cd6bca1350f582948 402B / 402B      1.0s
 => => sha256:d7e5070240863957ebb0b5a44a5729963c3462666baa2947d00628cb5f2d5773 955B / 955B      0.3s
 => => sha256:b464cfdf2a6319875aeb27359ec549790ce14d8214fcb16ef915e4530e5ed235 629B / 629B      0.3s
 => => sha256:61ca4f733c802afd9e05a32f0de0361b6d713b8b53292dc15fb093229f648674 1.79MB / 1.79MB  1.0s
 => => sha256:f18232174bc91741fdf3da96d85011092101a032a93a388b79e99e69c2d5c870 3.64MB / 3.64MB  1.6s
 => => extracting sha256:f18232174bc91741fdf3da96d85011092101a032a93a388b79e99e69c2d5c870      0.2s
 => => extracting sha256:61ca4f733c802afd9e05a32f0de0361b6d713b8b53292dc15fb093229f648674      0.2s
 => => extracting sha256:b464cfdf2a6319875aeb27359ec549790ce14d8214fcb16ef915e4530e5ed235      0.0s
 => => extracting sha256:d7e5070240863957ebb0b5a44a5729963c3462666baa2947d00628cb5f2d5773      0.0s
 => => extracting sha256:81bd8ed7ec6789b0cb7f1b47ee731c522f6dba83201ec73cd6bca1350f582948      0.0s
 => => extracting sha256:197eb75867ef4fcecd4724f17b0972ab0489436860a594a9445f8eaff8155053      0.0s
 => => extracting sha256:34a64644b756511a2e217f0508e11d1a572085d66cd6dc9a555a082ad49a3102      0.0s
 => => extracting sha256:39c2ddfd6010082a4a646e7ca44e95aca9bf3eaebc00f17f7ccc2954004f2a7d      0.6s
 => [internal] load build context                                                             0.1s
 => => transferring context: 11.04kB                                                          0.0s
 => [2/3] WORKDIR /usr/share/nginx/html                                                       0.1s
 => [3/3] COPY . .                                                                            0.1s
 => exporting to image                                                                        0.3s
 => => exporting layers                                                                       0.1s
 => => exporting manifest sha256:ca2911b7510b60965111c58fc958c542e57e4b03cff4d045b8545541e848fd8d  0.0s
 => => exporting config sha256:aae85ea8be647c1386390f05a39574eff367298e542d4b68d97346d73a8a8108  0.0s
 => => exporting attestation manifest sha256:177c9617b10b06ca2268817cc65ad21545d85b63b0b7e38a16d1d4776b12e3f1  0.0s
 => => exporting manifest list sha256:9082e2db2fd050ad71eff1451b6f7a560cea6ed99ce54a40ac138aaf049e752a  0.0s
```

Description: Build the Docker Image

```
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> docker run -d -p 8081:80 --name wordsearch-container wordsearch-app
75c8795ccf823e9ae0376f1f91eedaa1ff42c93f7904ee275a4a0320890eb3c7
PS C:\Users\geeta\OneDrive\Desktop\WordSearch> docker ps
CONTAINER ID   IMAGE                 COMMAND                  CREATED              STATUS              PORTS                  NAMES
da25cb1b4d73   wordsearch-app:latest   "/docker-entrypoint.…"   36 seconds ago       Up 36 seconds       80/tcp                 flamboyant_raman
75c8795ccf82   wordsearch-app          "/docker-entrypoint.…"   About a minute ago   Up About a minute   0.0.0.0:8081->80/tcp   wordsearch-container
PS C:\Users\geeta\OneDrive\Desktop\WordSearch>
                                                                                  Ln 5, Col 30  Spaces: 4  UTF-8  CRLF  Dockerfile
```

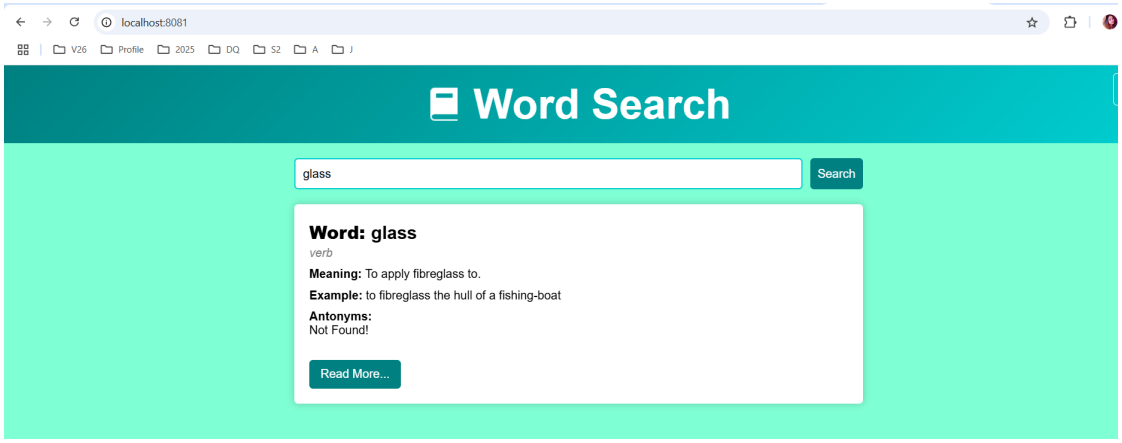
- -d: This runs the container in detached mode (in the background).
- -p 8081:80: This maps port 80 on the container to port 8080 on your host system. You can change 8081 to any port of your choice.
- --name wordsearch-container: This names your container wordsearch-container.
- wordsearch-app: This is the name of the image you created earlier.



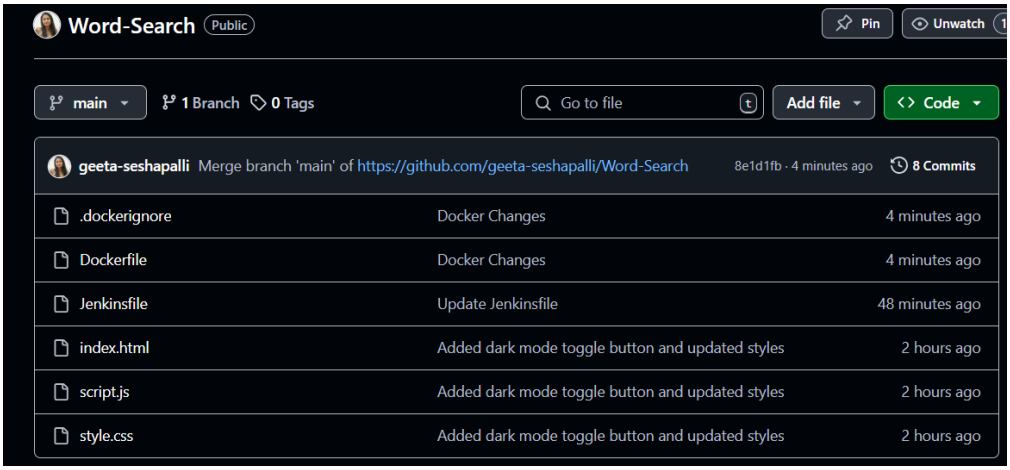
Description: Docker Image

Access Your Application in the Browser

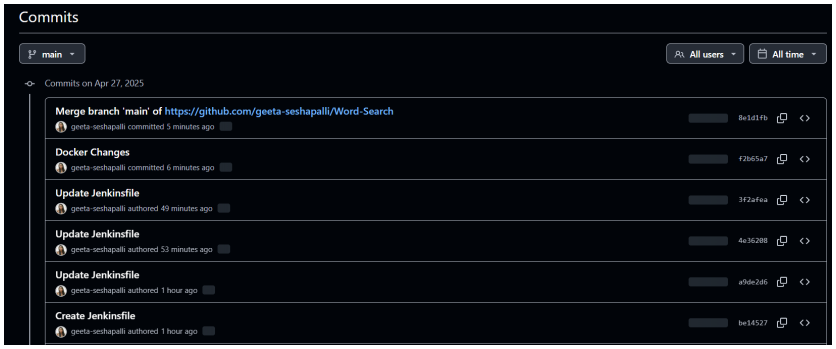
Once the container is running, you should be able to access your WordSearch app in the browser. You mapped port 8081 on your local machine to port 80 in the container, so open your browser and visit:



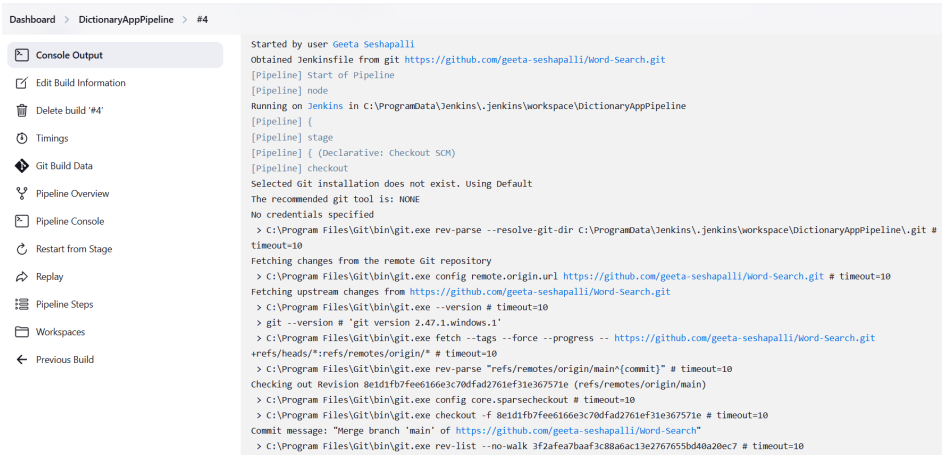
Description: Access Your Application in the Browser



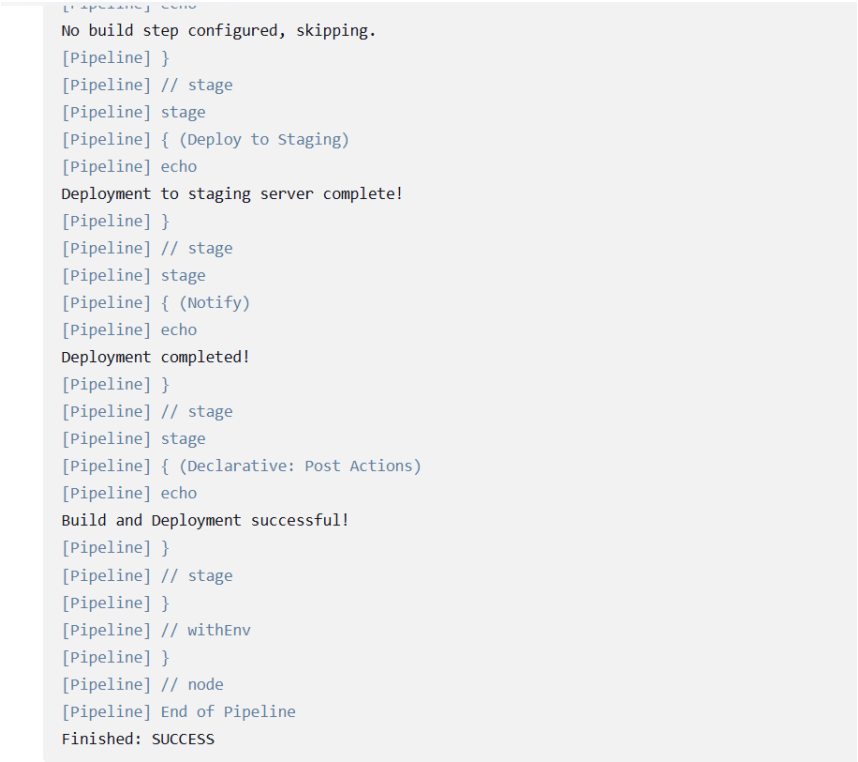
Description: Docker Changes



Description: Docker Commit Changes



Description: Docker Changes in Jenkins



Description: Docker Changes in Jenkins

Outcome:

- A functional containerized application that runs independently of the host system's environment
- Practical experience with Docker commands and concepts such as images, containers, volumes, and networking
- Understanding of how Docker facilitates efficient content and configuration management

Conclusion:

Through this project, a strong foundation in Docker's core commands and concepts was developed. The hands-on experience of containerizing a simple application demonstrated the power of Docker in managing application content, dependencies, and deployment with ease. This forms a stepping stone toward container orchestration and more complex DevOps implementations.