Curtin University

ISEC6000 – Assignment 1 Report

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GitLab repo:
https://gitlab.com/21953004_ChanukaAthalage/assignment_21953004

Docker hub repo:
https://hub.docker.com/repository/docker/21953004/assignment-21953004/general

Video link:
https://drive.google.com/file/d/11adFdOHZ8KgRTUz4uHpwLwFBbCtWNGnm/view?usp=sharing

Task 1: Run and Test a Python Demo App (Local)

I cloned an existing GitHub repository and ran the web app locally on port 5004 while addressing any encountered issues.

1.1   Clone

Caption: Cloning the git repository

1.2   Issues and fixes when making test

Caption: All the errors I encountered while executing the "make test" command.

- **Issue A — Pytest collection error**

  Symptom: TypeError: required field "lineno" missing from alias during pytest collection.

Cause: Project pinned pytest == 6.2.2 (incompatible with Python 3.12 assert-rewrite).

Fix (inside venv): Initially, my pytest version was 6.2.2, which was incompatible with the Python 3.12 version. Therefore, I executed the steps below to fix the issue

- ➤ **python3 -m venv .venv**
- ➤ **source .venv/bin/activate**
- ➤ **python -m pip install --upgrade pip setuptools wheel**
- ➤ **pip install "pytest>=8.2"**
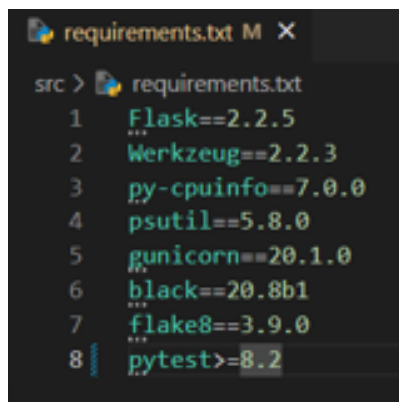
- **Issue B — Missing dependencies for tests/runtime**

Symptom: ModuleNotFoundError: cpuinfo (and psutil used by app/monitor).

Fix (inside venv): Below is the code I used to install the module

- ➤ **pip install py-cpuinfo psutil**

- **Below are the modules and versions I used for this assignment**

```
requirements.txt M  X
src >  requirements.txt
  1    Flask==2.2.5
  2    Werkzeug==2.2.3
  3    py-cpuinfo==7.0.0
  4    psutil==5.8.0
  5    gunicorn==20.1.0
  6    black==20.8b1
  7    flake8==3.9.0
  8    pytest>=8.2
```

Caption: All the versions of the modules used

1.3　Run the App on port 5004 and verify IP access

After fixing all the issues, I ran the following commands, which successfully
executed the program as expected

- ➢ **source .venv/bin/activate**
- ➢ **make test**
- ➢ **export PORT=5004**
- ➢ **make run**

Caption: Output of "make test" command after fixing issues

Caption: Output of "make run" command after fixing issues

1.4 Output of task 1
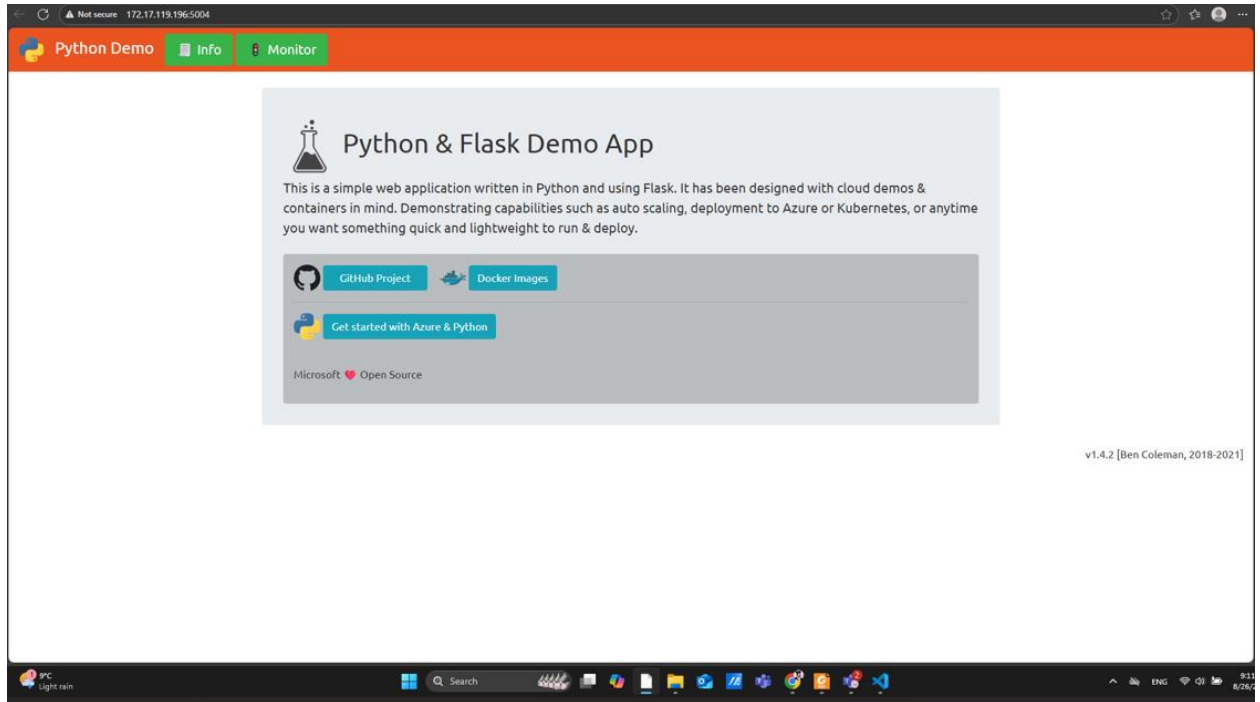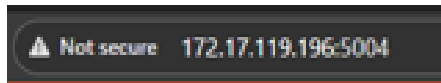
Caption: Web page running on local IP address on port 5004

- **Server URL:** Python DemoApp

Task 2: Incremental GitLab CI/CD Pipeline

2.1 Create a GitLab project and pushing the code

After successfully executing the code locally, it's time to add it to GitLab for Continuous Integration (CI). To initiate this process, I began by pushing the code to GitLab using the git command in GitBash as follows.

Caption: Git commands used

First, I removed the **.git** directory from the repository because it was linked to the GitHub repository we used for this assignment. I accomplished this by using the command \`**rm -rf .git**\`. Next, I created a new **.git** directory by executing the command \`**git init**\`. After that, I added the remote GitLab repository to my local repository with the command \`**git remote add origin https://gitlab.com/21953004_ChanukaAthalage/assignment_21953004**\`.

Then, I staged all the files using the command \`**git add .**\`. Following that, I committed the changes with \`**git commit -m "<commit message>"**\`. Finally, I pushed all the files to the main branch on GitLab using the command \`**git push -u origin main**\`.

To keep everything organized, I included all virtual environment files in the **.gitignore** file, as shown below.

```
.gitignore
1    # Python cache
2    __pycache__/
3    *.pyc
4    *.pyo
5    *.pyd
6    .pytest_cache/
7
8    # Virtual environments
9    .venv/
10   src/.venv/
11
12   # IDE/OS-specific files
13   .vscode/
14   .idea/
15   .DS_Store
16   Thumbs.db
```

Caption: .gitignore file

Below is a snapshot of the GitLab repository after pushing the changes to it.
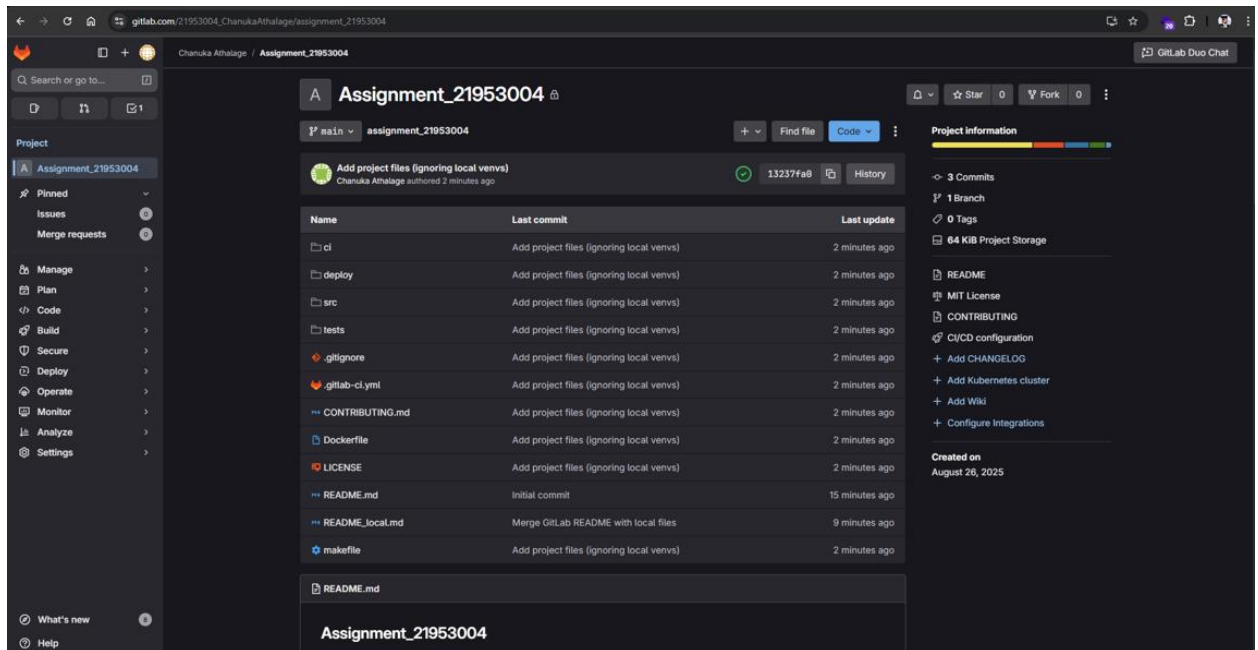
Caption: GitLab repository

After successfully pushing the code to GitLab, I reviewed the **.gitlab-ci.yml** file and the log data. Snapshots of them are included below.


```
.gitlab-ci.yml
1    run_tests:
2      image: python:3.9-slim
3      before_script:
4        - apt-get update && apt-get install make
5      script:
6        - make test
```
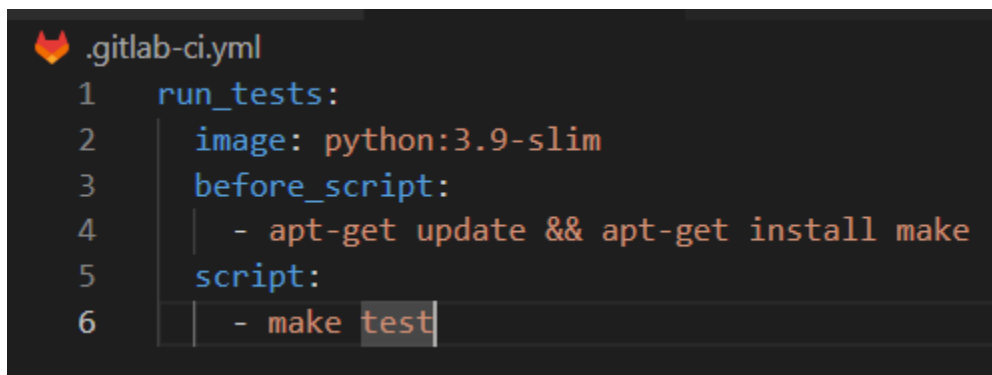
Caption: .gitlab-ci.yml file view of task 1

```
167  src/app/tests/test_api.py::test_api_monitor PASSED                          [ 25%]
168  src/app/tests/test_views.py::test_home PASSED                               [ 50%]
169  src/app/tests/test_views.py::test_page_content PASSED                       [ 75%]
170  src/app/tests/test_views.py::test_info PASSED                               [100%]
171  ============================= 4 passed in 2.23s ===============================
172  Cleaning up project directory and file based variables
173  Job succeeded
```

Caption: Output after running the pipeline successfully

2.2 Basic Pipeline

In this task, I needed to include my name and student ID in the **.gitlab-ci.yml** file and
display them in the log. To accomplish this, I added an **echo** statement in the **script**
section of the file. The modified file, preview of changes and the corresponding log are
shown below.

- **Modified file**

```
.gitlab-ci.yml  214 B

1  run_tests:
2    image: python:3.9-slim
3    before_script:
4      - apt-get update && apt-get install make
5    script:
6      - make test
7      - echo "Hi all, my name is Chanuka Dilusha Athalage, my student id is 21953004."
8
```

Caption: .gitlab-ci.yml file view of task 2

- **Preview of changes**

```
.gitlab-ci.yml

1  1    run_tests:
2  2      image: python:3.9-slim
3  -      before_script:
   3  +    before_script:
4  4        - apt-get update && apt-get install make
5  5      script:
6  -        - make test
          \ No newline at end of file
   6  +      - make test
   7  +      - echo "Hi all, my name is Chanuka Dilusha Athalage, my student id is 21953004."
   8  +
```

Caption: Displaying what changes are being made to the previous file

- **Log**

```
167  src/app/tests/test_api.py::test_api_monitor PASSED                    [ 25%]
168  src/app/tests/test_views.py::test_home PASSED                         [ 50%]
169  src/app/tests/test_views.py::test_page_content PASSED                 [ 75%]
170  src/app/tests/test_views.py::test_info PASSED                         [100%]
171  ============================ 4 passed in 2.23s ============================
172  $ echo "Hi all, my name is Chanuka Dilusha Athalage, my student id is 21953004."
173  Hi all, my name is Chanuka Dilusha Athalage, my student id is 21953004.
174  Cleaning up project directory and file based variables
175  Job succeeded
```

Caption: Output after running the pipeline successfully

2.3 Docker Build & Push (hardcoded credentials)

In this task, I needed to create a Docker Hub repository, build a **Docker image** using the `.gitlab-ci.yml` file, and then push the image to **Docker Hub** using **hardcoded credentials**. I used an **access token** for the password, which eliminates the need to mask it explicitly for the report. Below are the modified file, a preview of the changes, and the corresponding log.

- **Modified file**

Caption: .gitlab-ci.yml file view for task 3

- **Preview of changes**

Caption: Displaying what changes are being made to the previous file

- **Log**
  - **run_tests**

```
166   collecting ... collected 4 items
167   src/app/tests/test_api.py::test_api_monitor PASSED              [ 25%]
168   src/app/tests/test_views.py::test_home PASSED                   [ 50%]
169   src/app/tests/test_views.py::test_page_content PASSED           [ 75%]
170   src/app/tests/test_views.py::test_info PASSED                   [100%]
171   ============================== 4 passed in 2.27s ==============================
172   Cleaning up project directory and file based variables
173   Job succeeded
```

Caption: Output after running the test successfully

  - **build_image**

```
200   $ docker push 21953004/assignment-21953004:v1
201   The push refers to repository [docker.io/21953004/assignment-21953004]
202   a658bf6b7c77: Preparing
203   641cf5d3877a: Preparing
204   fee668dd4162: Preparing
205   2ca1f55fd5b7: Preparing
206   426856515173: Preparing
207   067ea27560c1: Preparing
208   7fb1037e08b3: Preparing
209   14cbeede8d6e: Preparing
210   ae2d55769c5e: Preparing
211   e2ef8a51359d: Preparing
212   14cbeede8d6e: Waiting
213   ae2d55769c5e: Waiting
214   067ea27560c1: Waiting
215   7fb1037e08b3: Waiting
216   e2ef8a51359d: Waiting
217   426856515173: Pushed
218   2ca1f55fd5b7: Pushed
219   a658bf6b7c77: Pushed
220   641cf5d3877a: Pushed
221   067ea27560c1: Mounted from library/python
222   7fb1037e08b3: Mounted from library/python
223   ae2d55769c5e: Mounted from library/python
224   14cbeede8d6e: Mounted from library/python
225   e2ef8a51359d: Mounted from library/python
226   fee668dd4162: Pushed
227   v1: digest: sha256:f198010a88505a72cb3eaee8d0b36fd5fc243880d62de00900dc46a9a78e9cb7 size: 2411
228   Cleaning up project directory and file based variables
229   Job succeeded
```
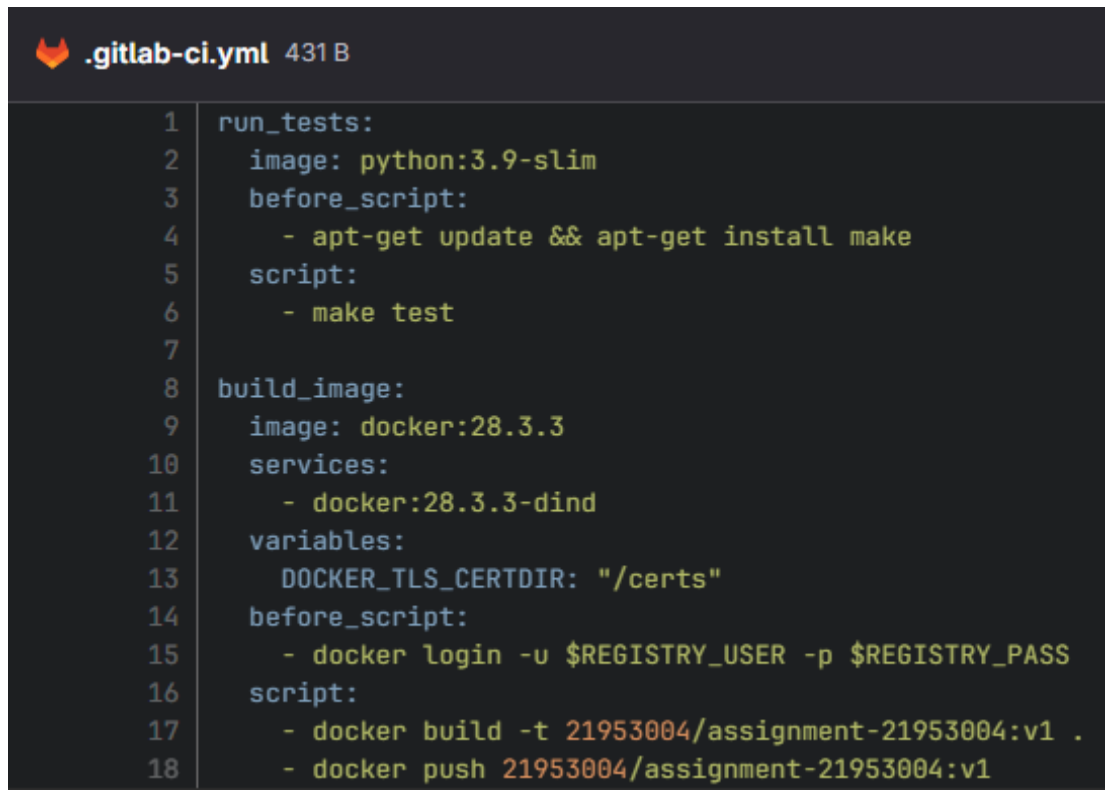
Caption: Output after building the image successfully

2.4 Secure with GitLab Variable

In this task, I needed to eliminate hardcoded Docker Hub credentials from the `.gitlab-ci.yml` file and replace them with **GitLab CI/CD** variables. This modification prevents secrets from being stored in the repository or appearing in logs. By doing so, it reduces the risk of credential exposure to attackers and enhances the security of the system. Below are the snapshots of important tasks.

- **Modified file**

```
.gitlab-ci.yml  431 B
 1  run_tests:
 2    image: python:3.9-slim
 3    before_script:
 4      - apt-get update && apt-get install make
 5    script:
 6      - make test
 7
 8  build_image:
 9    image: docker:28.3.3
10    services:
11      - docker:28.3.3-dind
12    variables:
13      DOCKER_TLS_CERTDIR: "/certs"
14    before_script:
15      - docker login -u $REGISTRY_USER -p $REGISTRY_PASS
16    script:
17      - docker build -t 21953004/assignment-21953004:v1 .
18      - docker push 21953004/assignment-21953004:v1
```

Caption: .gitlab-ci.yml file view for task 4

- **Preview of changes**

Caption: Displaying what changes are being made to the previous file

- **Log**
  - **run_tests**

Caption: Output after running the tets successfully

- build_image

```
203  $ docker push [MASKED]/assignment-[MASKED]:v1
204  The push refers to repository [docker.io/[MASKED]/assignment-[MASKED]]
205  7240893d682a: Preparing
206  f416122e844a: Preparing
207  e3bbee44c6d8: Preparing
208  2c4584ff655a: Preparing
209  159c331f53e8: Preparing
210  067ea27560c1: Preparing
211  7fb1037e08b3: Preparing
212  14cbeede8d6e: Preparing
213  ae2d55769c5e: Preparing
214  e2ef8a51359d: Preparing
215  067ea27560c1: Waiting
216  7fb1037e08b3: Waiting
217  14cbeede8d6e: Waiting
218  ae2d55769c5e: Waiting
219  e2ef8a51359d: Waiting
220  2c4584ff655a: Pushed
221  159c331f53e8: Pushed
222  7240893d682a: Pushed
223  067ea27560c1: Layer already exists
224  f416122e844a: Pushed
225  14cbeede8d6e: Layer already exists
226  7fb1037e08b3: Layer already exists
227  ae2d55769c5e: Layer already exists
228  e2ef8a51359d: Layer already exists
229  e3bbee44c6d8: Pushed
230  v1: digest: sha256:9bd14d5efdccb6a06e6cf72aacf535d62ee121d6c098b79c5cce95bb82dbd35d size: 2411
231  Cleaning up project directory and file based variables
232  Job succeeded
```

Caption: Output after building the image successfully

- **CI/CD variables**

<div style="text-align:center">

Caption: User name and password saved as CI/CD variables

</div>

- **Image in Docker Hub repository**

<div style="text-align:center">
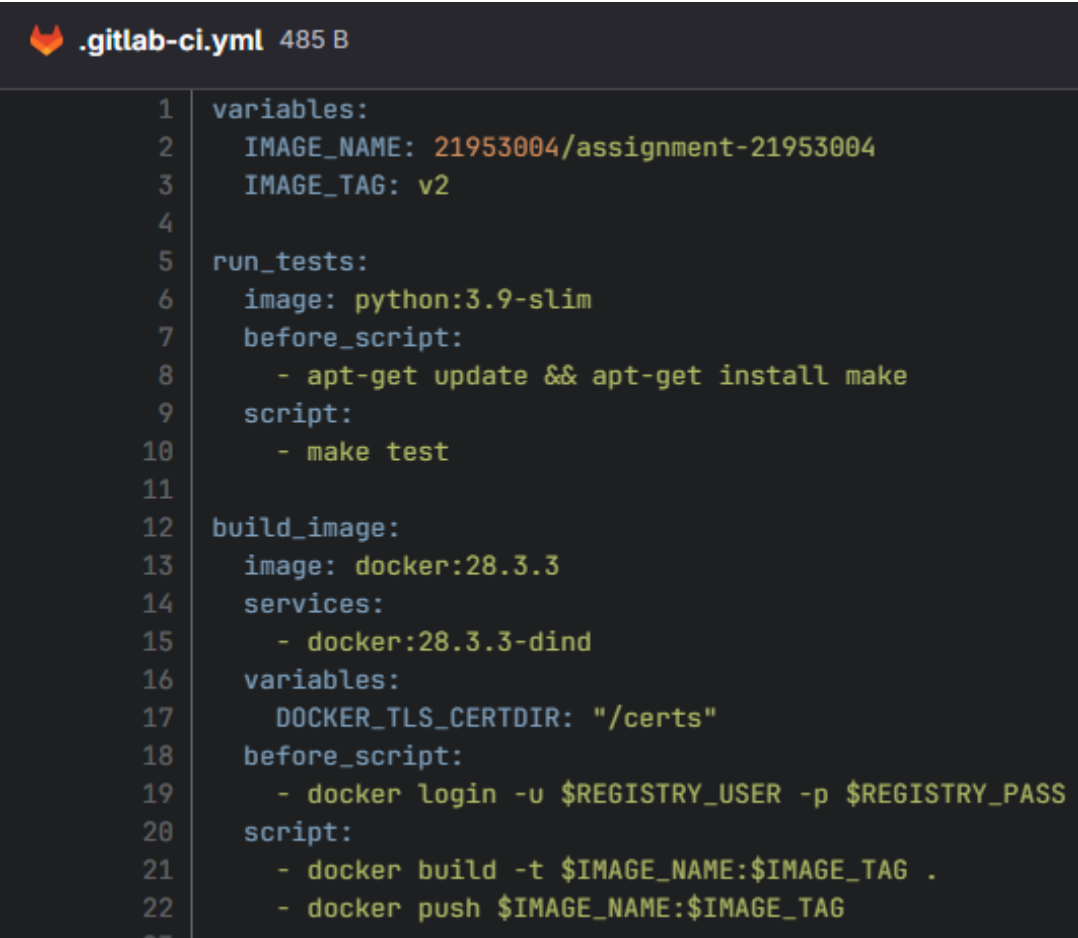
Caption: Docker image created for the task with v1 tag

</div>

2.5 Use Non-Sensitive Variables

In this task, I replaced hardcoded image references in the **.gitlab-ci.yml** file with **non-sensitive GitLab CI/CD variables**: IMAGE_NAME and IMAGE_TAG. This change enhances maintainability and reduces the potential for human error by centralising the repository and tag information in one location. Additionally, it simplifies the process of updating versions or reusing the same pipeline for different environments (such as v3, v4, staging, and production) without the need to edit the YAML file each time. Below are snapshots of the key tasks involved.

- **Modified file**

```
.gitlab-ci.yml  485 B

1    variables:
2      IMAGE_NAME: 21953004/assignment-21953004
3      IMAGE_TAG: v2
4
5    run_tests:
6      image: python:3.9-slim
7      before_script:
8        - apt-get update && apt-get install make
9      script:
10       - make test
11
12   build_image:
13     image: docker:28.3.3
14     services:
15       - docker:28.3.3-dind
16     variables:
17       DOCKER_TLS_CERTDIR: "/certs"
18     before_script:
19       - docker login -u $REGISTRY_USER -p $REGISTRY_PASS
20     script:
21       - docker build -t $IMAGE_NAME:$IMAGE_TAG .
22       - docker push $IMAGE_NAME:$IMAGE_TAG
23
```

Caption: .gitlab-ci.yml file view for task 5

- **Preview of changes**


```
     .gitlab-ci.yml

1    + variables:
2    +     IMAGE_NAME: 21953004/assignment-21953004
3    +     IMAGE_TAG: v2
4    +
1  5      run_tests:
2  6        image: python:3.9-slim
3  7        before_script:
...  ...  @@ -14,5 +18,5 @@ build_image:
14 18        before_script:
15 19          - docker login -u $REGISTRY_USER -p $REGISTRY_PASS
16 20        script:
17   -          - docker build -t 21953004/assignment-21953004:v1 .
18   -          - docker push 21953004/assignment-21953004:v1
     \ No newline at end of file
   21 +        - docker build -t $IMAGE_NAME:$IMAGE_TAG .
   22 +        - docker push $IMAGE_NAME:$IMAGE_TAG
```

Caption: Displaying what changes are being made to the previous file

- **Log**
  - **run_tests**


```
166  collecting ... collected 4 items
167  src/app/tests/test_api.py::test_api_monitor PASSED                   [ 25%]
168  src/app/tests/test_views.py::test_home PASSED                        [ 50%]
169  src/app/tests/test_views.py::test_page_content PASSED                [ 75%]
170  src/app/tests/test_views.py::test_info PASSED                        [100%]
171  =============================== 4 passed in 2.21s ===============================
172  Cleaning up project directory and file based variables
173  Job succeeded
```

Caption: Output after running the test successfully

o **build_image**

```
200  $ docker push $IMAGE_NAME:$IMAGE_TAG
201  The push refers to repository [docker.io/[MASKED]/assignment-[MASKED]]
202  ae35c4a10b36: Preparing
203  9ceda5bab5e6: Preparing
204  2ace3a587d0c: Preparing
205  b1099bf62173: Preparing
206  ab19b4c6c00d: Preparing
207  067ea27560c1: Preparing
208  7fb1037e08b3: Preparing
209  14cbeede8d6e: Preparing
210  ae2d55769c5e: Preparing
211  e2ef8a51359d: Preparing
212  067ea27560c1: Waiting
213  7fb1037e08b3: Waiting
214  14cbeede8d6e: Waiting
215  ae2d55769c5e: Waiting
216  e2ef8a51359d: Waiting
217  ab19b4c6c00d: Pushed
218  b1099bf62173: Pushed
219  9ceda5bab5e6: Pushed
220  ae35c4a10b36: Pushed
221  067ea27560c1: Layer already exists
222  14cbeede8d6e: Layer already exists
223  7fb1037e08b3: Layer already exists
224  ae2d55769c5e: Layer already exists
225  e2ef8a51359d: Layer already exists
226  2ace3a587d0c: Pushed
227  v2: digest: sha256:3a83dac51be5b9aec75da4a8807b85e55c75d417e497bb2fe5d2ec504b4b14df size: 2411
228  Cleaning up project directory and file based variables
229  Job succeeded
```

Caption: Output after building the image successfully

• **Image in Docker Hub repository**

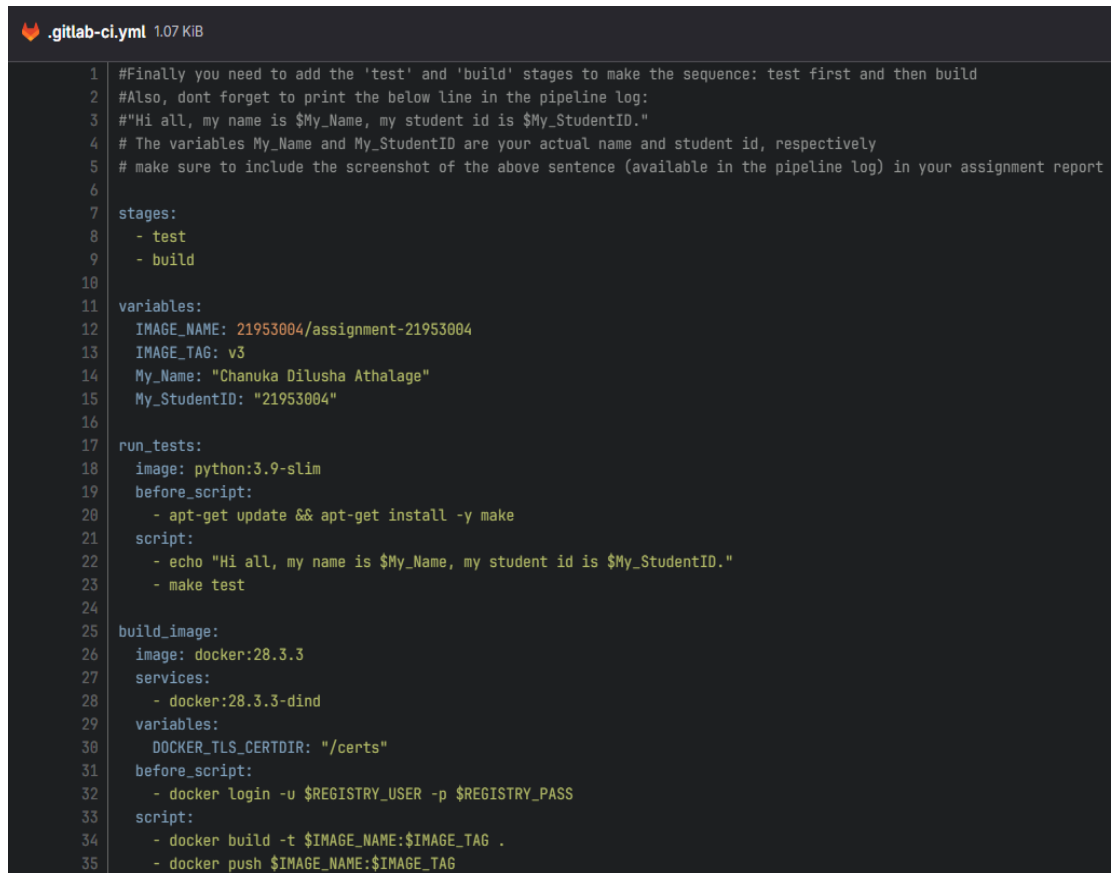| ● v2 | ⟨logo⟩ | Image | less than 1 day | about 10 hours |

Caption: Docker image created for the task with v2 tag

2.6 Finalised Pipeline

I finalised the CI/CD pipeline, ensuring that tests run first and that the image build and push occur second. I printed the required greeting using $My_Name and $My_StudentID, and I parameterised the image reference so the build step utilises "$IMAGE_NAME:$IMAGE_TAG" (in my case, 21953004/assignment-21953004:v3).

This structure is important because enforcing the test-before-build sequence guarantees that quality checks are performed before any artifacts are published. The greeting in the logs verifies the author's identity as specified in the brief. Additionally, using variables makes the pipeline more maintainable, allowing for easy changes to tags or repositories without needing to modify the build logic itself.

- **Modified file**

```
.gitlab-ci.yml  1.07 KiB

 1  #Finally you need to add the 'test' and 'build' stages to make the sequence: test first and then build
 2  #Also, dont forget to print the below line in the pipeline log:
 3  #"Hi all, my name is $My_Name, my student id is $My_StudentID."
 4  # The variables My_Name and My_StudentID are your actual name and student id, respectively
 5  # make sure to include the screenshot of the above sentence (available in the pipeline log) in your assignment report
 6
 7  stages:
 8    - test
 9    - build
10
11  variables:
12    IMAGE_NAME: 21953004/assignment-21953004
13    IMAGE_TAG: v3
14    My_Name: "Chanuka Dilusha Athalage"
15    My_StudentID: "21953004"
16
17  run_tests:
18    image: python:3.9-slim
19    before_script:
20      - apt-get update && apt-get install -y make
21    script:
22      - echo "Hi all, my name is $My_Name, my student id is $My_StudentID."
23      - make test
24
25  build_image:
26    image: docker:28.3.3
27    services:
28      - docker:28.3.3-dind
29    variables:
30      DOCKER_TLS_CERTDIR: "/certs"
31    before_script:
32      - docker login -u $REGISTRY_USER -p $REGISTRY_PASS
33    script:
34      - docker build -t $IMAGE_NAME:$IMAGE_TAG .
35      - docker push $IMAGE_NAME:$IMAGE_TAG
```

Caption: .gitlab-ci.yml file view for task 1

- **Preview of changes**


```
v  .gitlab-ci.yml                                                                                    +15 -2
       1  + #Finally you need to add the 'test' and 'build' stages to make the sequence: test first and then build
       2  + #Also, dont forget to print the below line in the pipeline log:
       3  + #"Hi all, my name is $My_Name, my student id is $My_StudentID."
       4  + # The variables My_Name and My_StudentID are your actual name and student id, respectively
       5  + # make sure to include the screenshot of the above sentence (available in the pipeline log) in your assignment report
       6  +
       7  + stages:
       8  +   - test
       9  +   - build
      10  +
   1  11    variables:
   2  12      IMAGE_NAME: 21953004/assignment-21953004
   3  -       IMAGE_TAG: v2
      13  +   IMAGE_TAG: v3
      14  +   My_Name: "Chanuka Dilusha Athalage"
      15  +   My_StudentID: "21953004"
   4  16
   5  17    run_tests:
   6  18      image: python:3.9-slim
)  7  19      before_script:
   8  -         - apt-get update && apt-get install make
      20  +       - apt-get update && apt-get install -y make
   9  21      script:
      22  +       - echo "Hi all, my name is $My_Name, my student id is $My_StudentID."
      23        - make test
  10  24
  11  25    build_image:
```

Caption: Displaying what changes are being made to the previous file

- **Log**
  - **run_tests**


```
168  collecting ... collected 4 items
169  src/app/tests/test_api.py::test_api_monitor PASSED                                    [ 25%]
170  src/app/tests/test_views.py::test_home PASSED                                         [ 50%]
171  src/app/tests/test_views.py::test_page_content PASSED                                 [ 75%]
172  src/app/tests/test_views.py::test_info PASSED                                         [100%]
173  ============================ 4 passed in 2.20s ============================
174  Cleaning up project directory and file based variables
175  Job succeeded
```

Caption: Output after running the test successfully

o **build_image**

```
198  $ docker push $IMAGE_NAME:$IMAGE_TAG
199  The push refers to repository [docker.io/[MASKED]/assignment-[MASKED]]
200  e567f371bf8a: Preparing
201  73fec360fa55: Preparing
202  f8ca59fd5d67: Preparing
203  e2d0a1b91f62: Preparing
204  379668b65a5b: Preparing
205  067ea27560c1: Preparing
206  7fb1037e08b3: Preparing
207  14cbeede8d6e: Preparing
208  ae2d55769c5e: Preparing
209  e2ef8a51359d: Preparing
210  067ea27560c1: Waiting
211  ae2d55769c5e: Waiting
212  e2ef8a51359d: Waiting
213  7fb1037e08b3: Waiting
214  14cbeede8d6e: Waiting
215  379668b65a5b: Pushed
216  73fec360fa55: Pushed
217  e567f371bf8a: Pushed
218  e2d0a1b91f62: Pushed
219  067ea27560c1: Layer already exists
220  7fb1037e08b3: Layer already exists
221  14cbeede8d6e: Layer already exists
222  ae2d55769c5e: Layer already exists
223  e2ef8a51359d: Layer already exists
224  f8ca59fd5d67: Pushed
225  v3: digest: sha256:821435d2b2409f02422f381fced7623be0ae0a198036df9fecdf63a134c13c96 size: 2411
226  Cleaning up project directory and file based variables
227  Job succeeded
```

Caption: Output after building the image successfully

- **Image in Docker Hub repository (All the images)**

Caption: All Docker images