CVE Project Documentation

1. Overall Scenario

This project aims to create a system for fetching, storing, and accessing Common Vulnerabilities and Exposures (CVE) data from the National Vulnerability Database (NVD) API. It consists of the following components:

- Data Fetching: Fetches CVE data from the NVD API and stores it in a MySQL database.
- Database Management: Sets up and manages the MySQL database, including data cleaning and validation.
- API: Provides API endpoints to access CVE data based on various criteria (CVE ID, year, score, modified date).
- Web UI: A basic web interface to display and search CVE data.
- Unit Tests: Tests to ensure the functionality of the application.
- Centralized Execution: A main.py script to orchestrate the execution of all components.

2. Project Structure

```
cve_project/
├── app2.py          # Flask application for the web UI
├── api_fetch.py     # Flask application for the API endpoints
├── config.py        # Configuration settings
├── database.py      # Database connection and setup
├── fetch_CVE_data.py # Fetches and stores CVE data
├── full_sync.py     # Refreshes all CVE data.
├── main.py          # Central execution script
├── requirements.txt  # Python dependencies
├── tests/           # Unit tests
│   └── unit_tests.py
├── templates/       # HTML templates for the web UI
│   ├── cve_detail.html
│   └── cve_list.html
└── mysql_code.sql     # Mysql database creation and modification script.
```

3. File Explanations

3.1. config.py

- Purpose: Contains configuration settings for the entire project.
- Content:
  - DB_HOST, DB_USER, DB_PASSWORD, DB_NAME: Database connection details.
  - API_URL: NVD API endpoint URL.
  - RESULTS_PER_PAGE: Number of CVEs to fetch per API request.
  - LOG_LEVEL: Logging level (e.g., INFO, DEBUG).
  - LOG_FILE: Log file path.
- Functionality: Provides a central location for storing and accessing configuration parameters.

3.2. database/cve_database.sql

- Purpose: Creates and modifies the MySQL database schema and data.
- Content:
  - CREATE DATABASE cve_database;: Creates the database.
  - USE cve_database;: Selects the database.
  - CREATE TABLE cve_data (...): Creates the cve_data table.
  - SHOW TABLES;, DESC cve_data;, SELECT ...: Queries and displays table information.
  - TRUNCATE TABLE cve_data;: Clears the table.
  - SET SQL_SAFE_UPDATES = 0;: Disables safe update mode.
  - Duplicate removal, null value handling, CVE ID validation, description trimming, base score validation, date validation, future CVE ID validation.
  - SET SQL_SAFE_UPDATES = 1;: Re-enables safe update mode.
- Functionality: Sets up the database and performs data cleaning and validation.

3.3. database.py

- Purpose: Establishes and manages the database connection.
- Content:
  - get_db_connection(): Creates and returns a MySQL database connection using mysql.connector.connect().
  - Handles mysql.connector.Error exceptions.
- **Functionality: Provides a reusable function for database connection.**

3.4. fetch_CVE_data.py

- Purpose: Fetches CVE data from the NVD API and stores it in the MySQL database.
- Content:

    - get_db_connection(): Establishes a database connection.
    - fetch_cve_data(start_index): Fetches CVE data from the API using requests.get().
    - insert_cve_data(cve_list, cursor): Inserts CVE data into the database.
    - main(): Orchestrates the fetching and insertion process with pagination and incremental commits.
- Functionality: Retrieves CVE data from the NVD API and populates the database.

3.5. full_sync.py

- Purpose: Clears the existing CVE data and re-fetches all data from the NVD API.
- Content:
    - get_db_connection(): Establishes a database connection.
    - fetch_cve_data(start_index): Fetches CVE data from the API.
    - insert_cve_data(cve_list): Inserts CVE data into the database.
    - refresh_data(): Clears the table and re-fetches data.
    - Main execution.
- Functionality: Performs a complete data refresh.

3.6. api_fetch.py

- Purpose: Provides API endpoints for accessing CVE data.
- Content:
    - get_db_connection(): Establishes a database connection.
    - @app.route('/api/cve/id', methods=['GET']): Retrieves CVE details by CVE ID.
    - @app.route('/api/cve/year', methods=['GET']): Retrieves CVE details by year.
    - @app.route('/api/cve/score', methods=['GET']): Retrieves CVE details by score.
    - @app.route('/api/cve/modified', methods=['GET']): Retrieves CVE details modified in the last N days.
- Functionality: Exposes API endpoints for CVE data retrieval.

3.7. app2.py

- Purpose: Provides a web UI for displaying and searching CVE data.
- Content:
    - get_db_connection(): Establishes a database connection.
    - @app.route('/cves/list'): Displays a list of CVEs with pagination and search functionality.
    - @app.route('/cves/<cve_id>'): Displays details of a specific CVE.
- Functionality: Provides a web interface for CVE data.

3.8. main.py

- Purpose: Acts as a central execution script.
- Content:
  - run_script(script_path, description): Executes a Python script using subprocess.run().
  - main(): Parses command-line arguments and calls the appropriate scripts.
- Functionality: Orchestrates the execution of all components.

3.9. tests/unit_tests.py

- Purpose: Contains unit tests for the Flask application.
- Content:
  - FlaskTestCase: A test class that inherits from unittest.TestCase.
  - setUp(): Sets up the test database and data.
  - tearDown(): Cleans up the test database.
  - Test methods: Tests for various API endpoints and functionalities.
- Functionality: Ensures the functionality of the application.

3.10. requirements.txt

- Purpose: Lists the Python dependencies for the project.
- Content:
  - Flask
  - mysql-connector-python
  - requests
- Functionality: Specifies the required packages.

4. Execution Flow

1. Run python main.py --all to execute all scripts in order.
2. database.py sets up the database.
3. fetch_CVE_data.py fetches and stores CVE data.
4. full_sync.py refreshes all CVE data.
5. api_fetch.py starts the API server.
6. app2.py starts the web UI server.
7. unit_tests.py runs the unit tests.
8. Access the API endpoints and web UI through a browser or API testing tool.

API Endpoints

Base URL: http://127.0.0.1:5000/api/

- **2.1. Get All CVEs**
  - **Endpoint: /cves**
  - **Method: GET**
  - **Description: Returns all stored CVEs.**
- **2.2. Get CVE by ID**
  - **Endpoint: /cve/id**
  - **Method: GET**
  - **Description: Returns details of a specific CVE.**
  - **Example Request: http://127.0.0.1:5000/api/cve/id?cve_id=CVE-2023-1234 (Replace CVE-2023-1234 with an actual CVE ID from your database.)**
- **2.3. Get CVEs by Year**
  - **Endpoint: /cve/year**
  - **Method: GET**
  - **Description: Returns CVEs from a specific year.**
  - **Example Request: http://127.0.0.1:5000/api/cve/year?year=2023 (Replace 2023 with a year from your database.)**
- **2.4. Get CVEs by Score**
  - **Endpoint: /cve/score**
  - **Method: GET**
  - **Description: Filters CVEs with a CVSS base score above a threshold.**
  - **Example Request: http://127.0.0.1:5000/api/cve/score?score=7.0 (Replace 7.0 with a score from your database.)**
- **2.5. Get Recently Modified CVEs**
  - **Endpoint: /cve/modified**
  - **Method: GET**
  - **Description: Fetches CVEs modified in the last N days.**
  - **Example Request: http://127.0.0.1:5000/api/cve/modified?days=30 (This will return CVEs modified in the last 30 days.)**

3. Web User Interface (UI)

Base URL: http://127.0.0.1:5000/cves/list?page=1&resultsPerPage=10

- **3.1. CVE List Page**
  - **Endpoint: /cves/list**

- **Description: Displays a paginated list of CVEs.**
- **Parameters:**
  - **page (optional, integer): The page number to display. Default is 1.**
  - **resultsPerPage (optional, integer): The number of CVEs to display per page. Default is determined by the application.**
- **Example Request: http://127.0.0.1:5000/cves/list?page=1&resultsPerPage=10**
- **Functionality:**
  - **Presents CVE data in a user-friendly table format.**
  - **Allows users to navigate through pages of CVEs.**
  - **Provides search and filtering capabilities (if implemented).**
  - **Displays CVE details when a specific CVE is clicked.**

5. Results

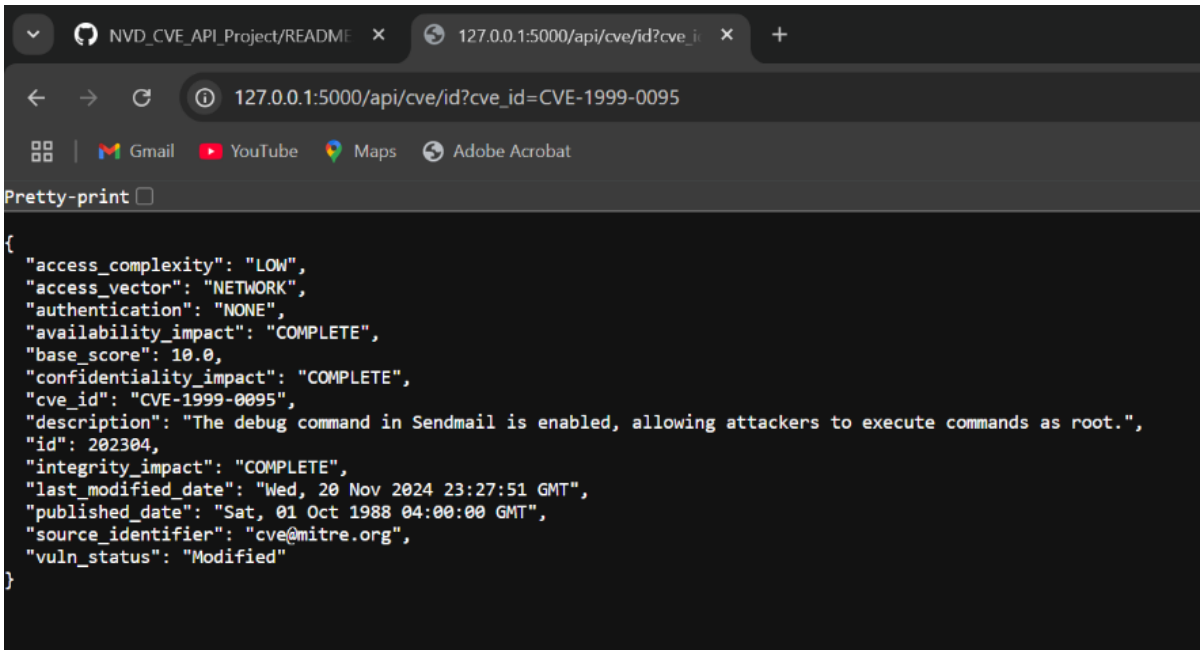


Figure 1: API filtering based on CVE_ID

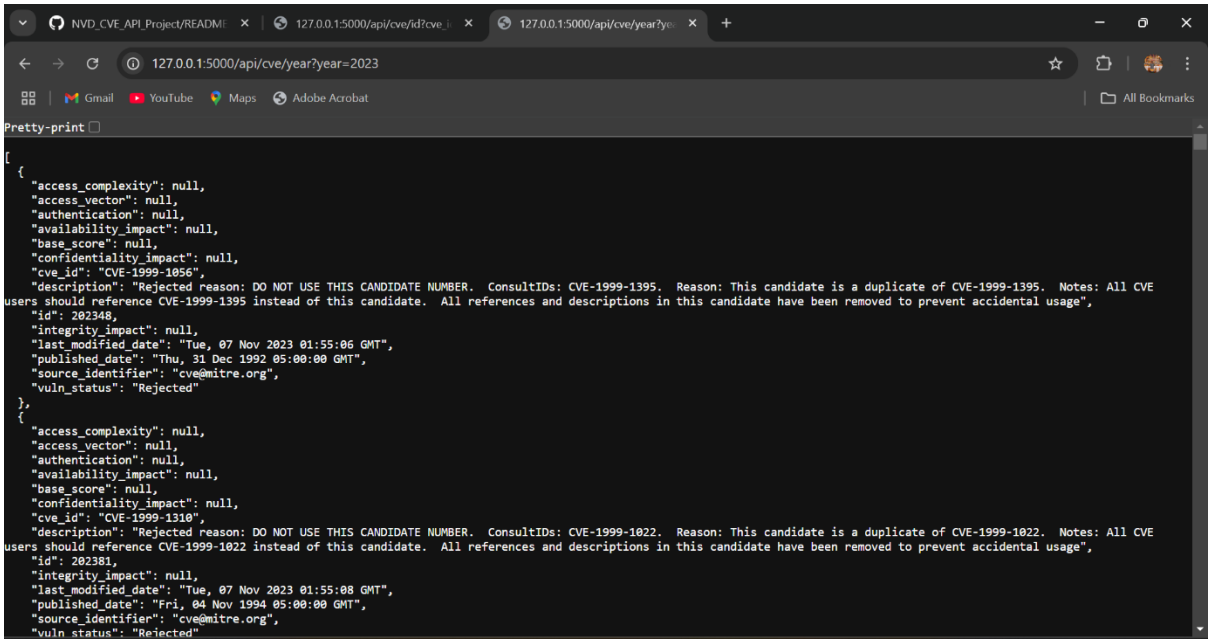


Figure 2: API Filtering based of year

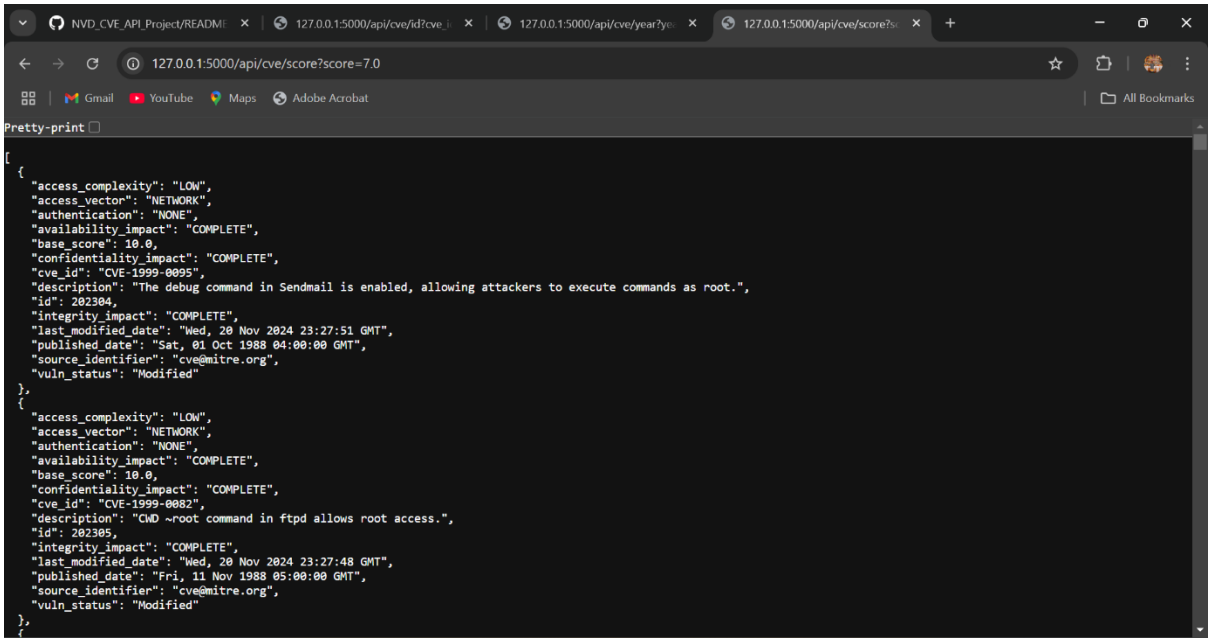


Figure 3: API filtering based on score

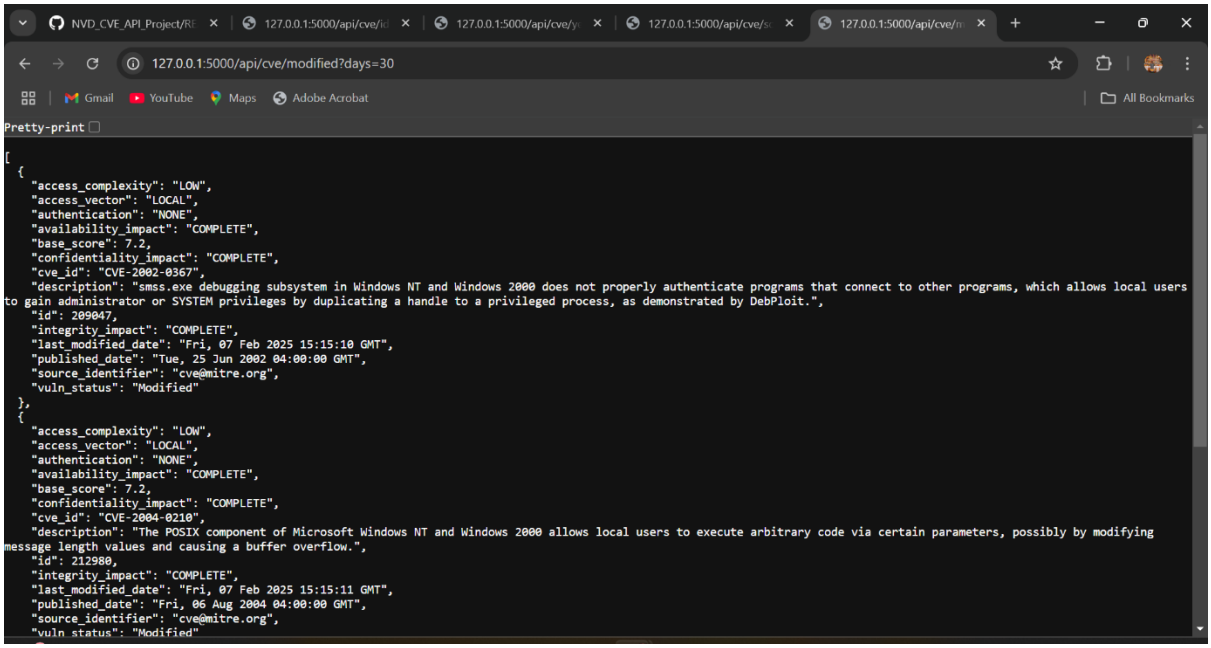
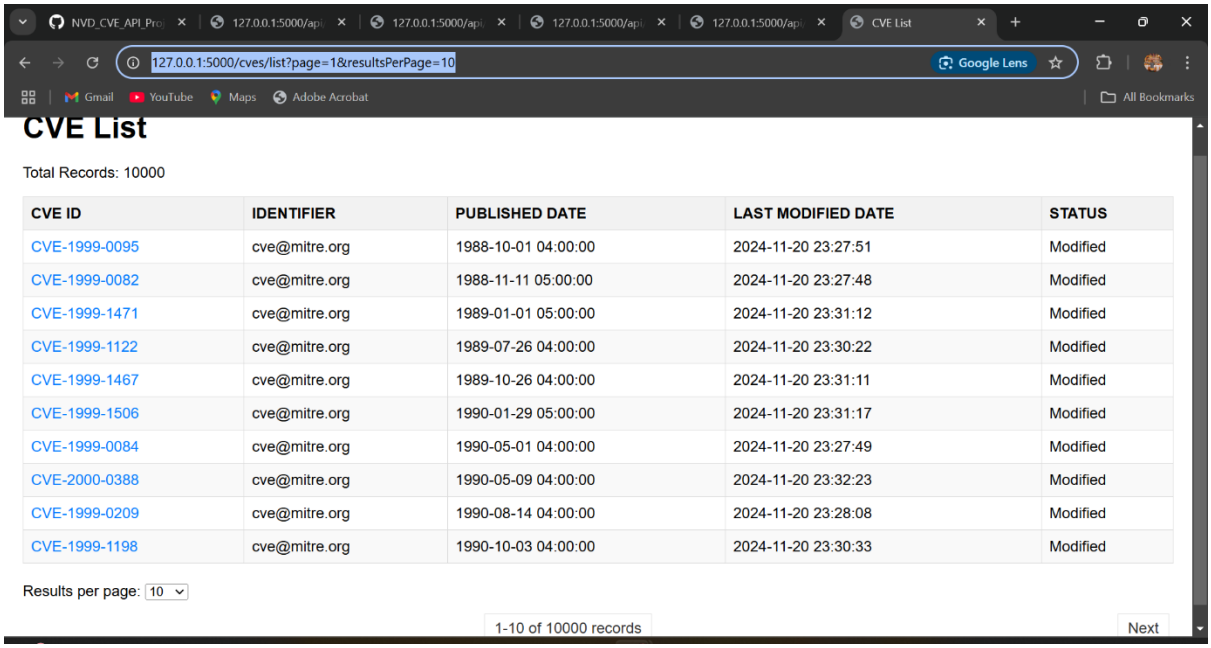


Figure 4: API Filitering based of N number of days modifications made



CVE ID	IDENTIFIER	PUBLISHED DATE	LAST MODIFIED DATE	STATUS
CVE-1999-0095	cve@mitre.org	1988-10-01 04:00:00	2024-11-20 23:27:51	Modified
CVE-1999-0082	cve@mitre.org	1988-11-11 05:00:00	2024-11-20 23:27:48	Modified
CVE-1999-1471	cve@mitre.org	1989-01-01 05:00:00	2024-11-20 23:31:12	Modified
CVE-1999-1122	cve@mitre.org	1989-07-26 04:00:00	2024-11-20 23:30:22	Modified
CVE-1999-1467	cve@mitre.org	1989-10-26 04:00:00	2024-11-20 23:31:11	Modified
CVE-1999-1506	cve@mitre.org	1990-01-29 05:00:00	2024-11-20 23:31:17	Modified
CVE-1999-0084	cve@mitre.org	1990-05-01 04:00:00	2024-11-20 23:27:49	Modified
CVE-2000-0388	cve@mitre.org	1990-05-09 04:00:00	2024-11-20 23:32:23	Modified
CVE-1999-0209	cve@mitre.org	1990-08-14 04:00:00	2024-11-20 23:28:08	Modified
CVE-1999-1198	cve@mitre.org	1990-10-03 04:00:00	2024-11-20 23:30:33	Modified

Figure 5: UI interface

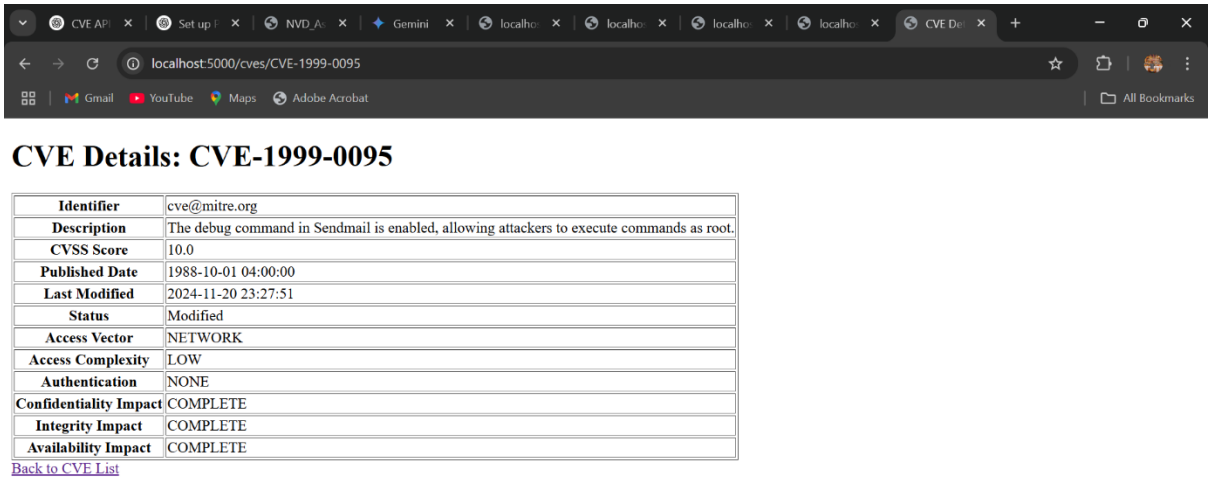


Figure 6: UI interface details of CVE

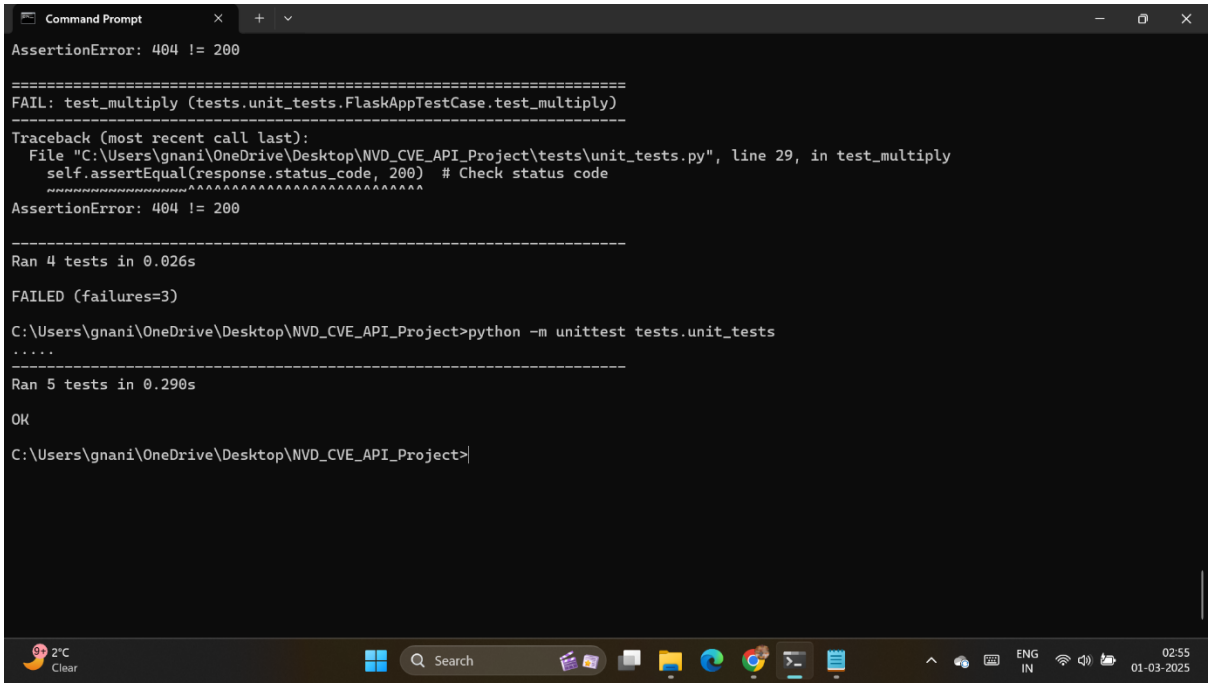


Figure 7: Output after executing unit tests