"Employing LLM-Based Evaluation for Memory Safety Bug Detection and Resolution C"

Check in Report 1: CS487 Final Projet

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We have focused on laying the groundwork and organization for a successful project, agreeing on tools, gathering trivial and real-world bug examples, creating git resources, meeting in person, created some source code for invoking APIs interactively, and added some example system and user prompts, and project structure for easy addition of new LLMs and bug types.

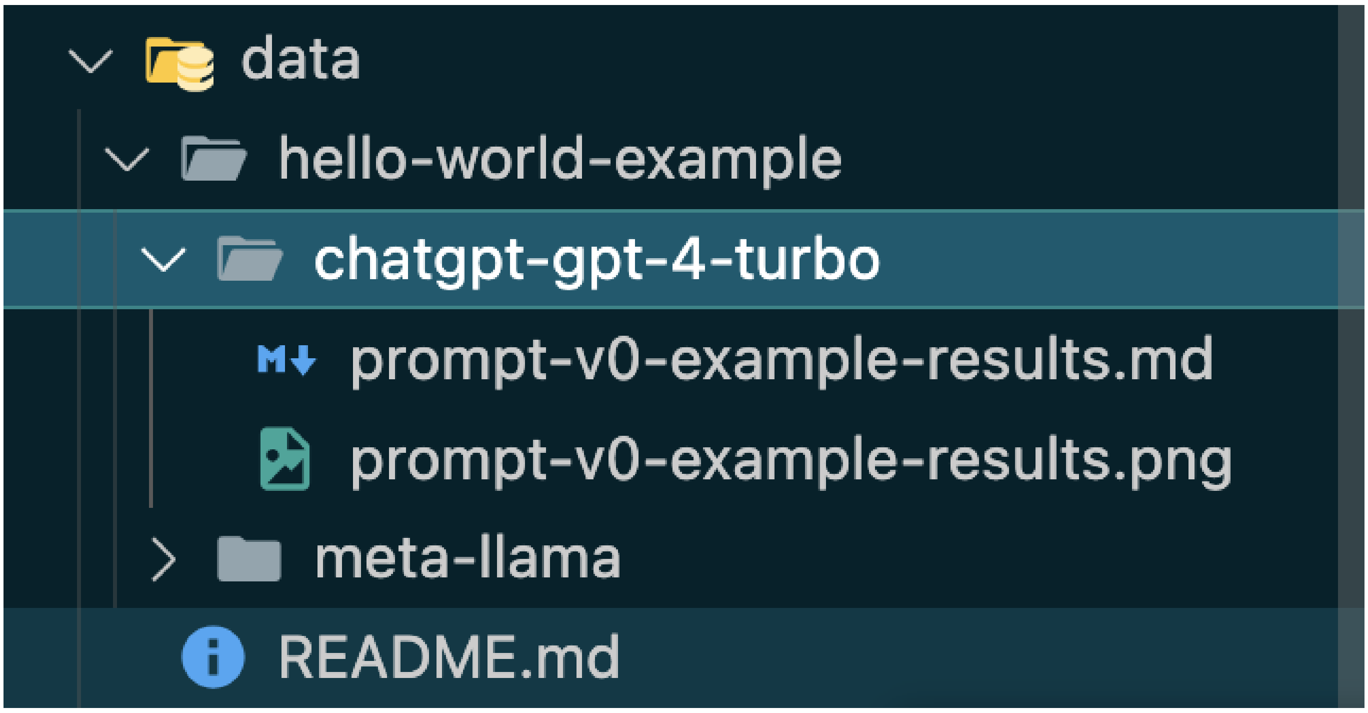
Here you can see the main branch with all the code: https://github.com/Rhernandez513/cs487-proj

And here you can see the pull request history with changes: https://github.com/Rhernandez513/cs487-proj/pulls?q=is%3Apr

V1 System Prompt:

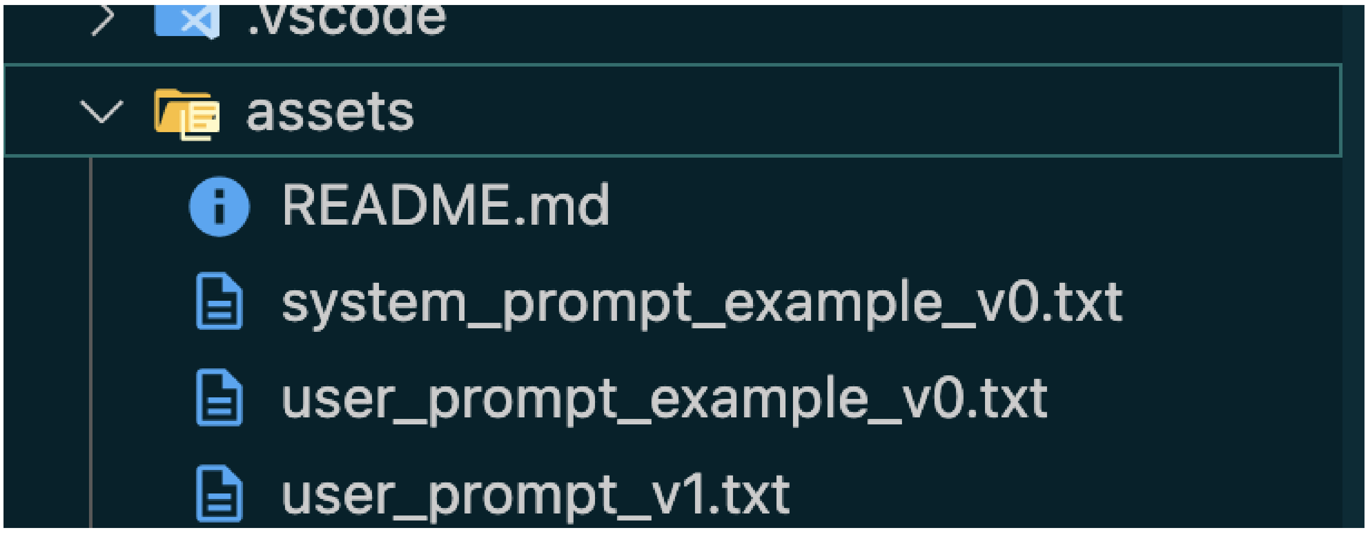
```
Evaluate the following code for memory-related errors, focusing on buffer
overflows, double free occurrences, and use-after-free vulnerabilities.
Identify any areas in the code where memory handling could lead to
security vulnerabilities or instability in execution. Provide an analysis
that includes specific lines or functions prone to these issues, and
suggest corrections if needed to ensure safe memory allocation, access,
and deallocation.
```

We have create a bit of project structure and organization for gathering data:



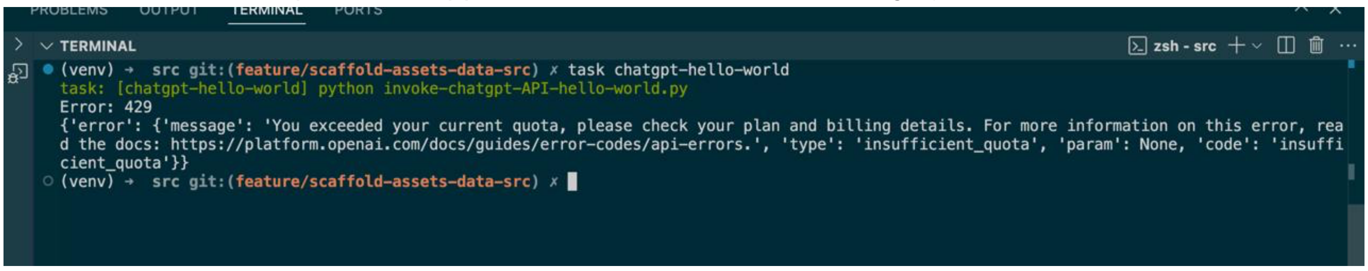
```
data
  hello-world-example
    chatgpt-gpt-4-turbo
      prompt-v0-example-results.md
      prompt-v0-example-results.png
    meta-llama
  README.md
```

A big of project structure and organization for sytem and user prompts that will be used as input into the LLMs



```
.vscode
assets
  README.md
  system_prompt_example_v0.txt
  user_prompt_example_v0.txt
  user_prompt_v1.txt
```

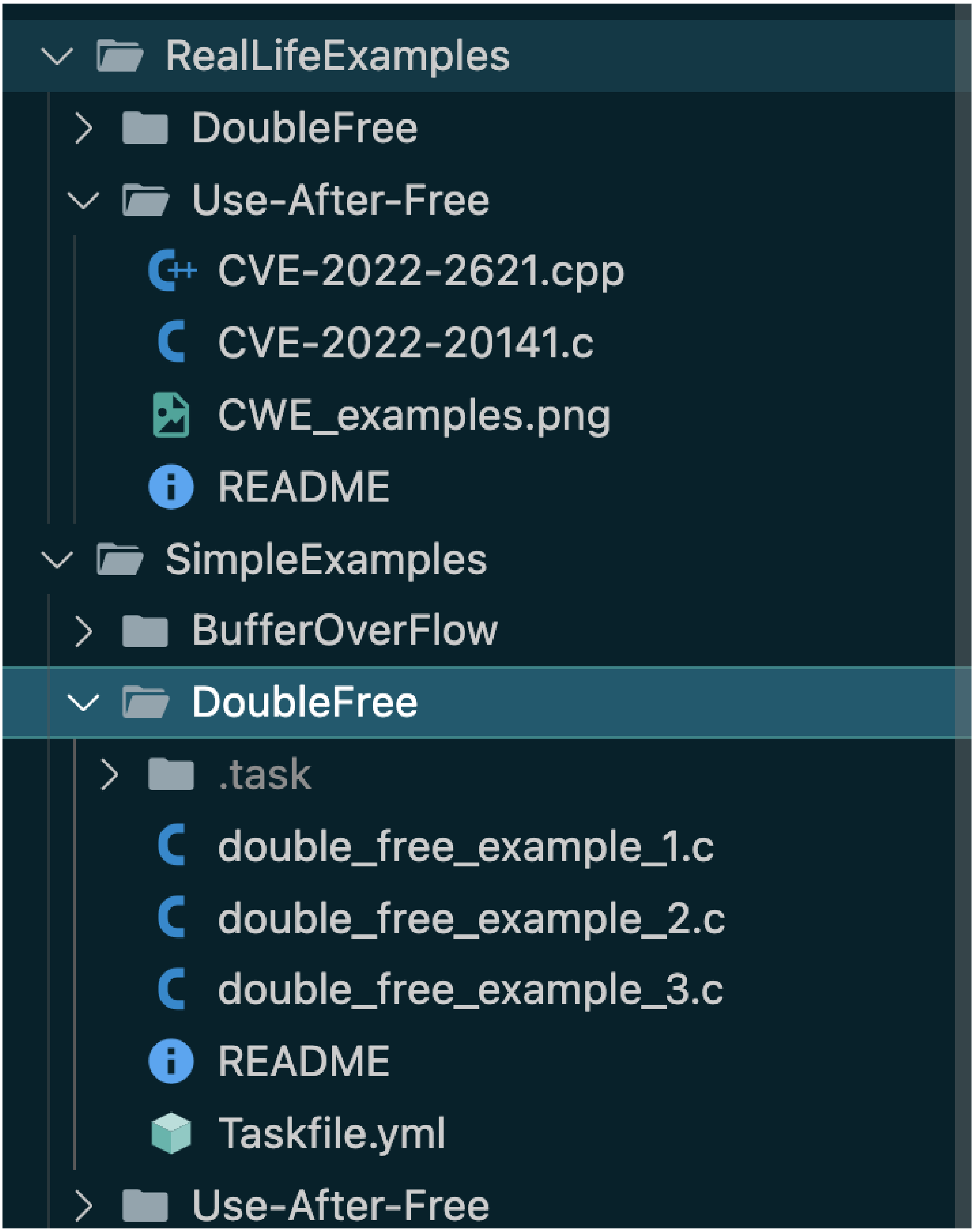
Interactive use of a simple code snippet to invoke the OPENAI API using Python:



```
(venv) → src git:(feature/scaffold-assets-data-src) ✗ task chatgpt-hello-world
task: [chatgpt-hello-world] python invoke-chatgpt-API-hello-world.py
Error: 429
{'error': {'message': 'You exceeded your current quota, please check your plan and billing details. For more information on this error, rea
d the docs: https://platform.openai.com/docs/guides/error-codes/api-errors.', 'type': 'insufficient_quota', 'param': None, 'code': 'insuffi
cient_quota'}}
(venv) → src git:(feature/scaffold-assets-data-src) ✗
```

We have additionally gathered 3x trivial examples of each bug type we intend to test (BufferOverFlow, DoubleFree, Use After Free) and a couple of real life bug examples.

Example bugs:



```
RealLifeExamples
  DoubleFree
  Use-After-Free
    CVE-2022-2621.cpp
    CVE-2022-20141.c
    CWE_examples.png
    README
SimpleExamples
  BufferOverFlow
  DoubleFree
    .task
    double_free_example_1.c
    double_free_example_2.c
    double_free_example_3.c
    README
    Taskfile.yml
  Use-After-Free
```