MANIPAL INSTITUTE OF TECHNOLOGY
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Mini Project Report
of
Operating Systems LAB

TITLE
Process and System Resource Manager

Submitted by:

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ABSTRACT

- This Project is related to the Process Management concept of operating systems.

    Like the task manager in Windows Operating Systems, we use a system monitor in Linux to manage the tasks. It displays all the processes that are active along with their memory usage. In the Resources tab, we can also check additional system statistics like CPU usage per core, memory usage, network usage, and others. The processes tab is the next; the task manager is equivalent to this. We can sort according to process name and CPU utilization.

    The History of the CPU, network, and memory is shown in the Resource tab. It is beneficial for the System's Numerous troubleshooting operations. If the System monitor is running, the history is kept. Therefore, if we want to see a particular process's performance, we should ensure that it is a running process. The final tab is File Systems. It shows information about local hard discs and partitions. The directory shows where the division is located, and the device shows how a system detects it.

PROBLEM STATEMENT

To prevent Starvation of low-priority processes and decrease the priority of Unwanted processes

Description: Despite having process schedulers and CPU scheduling algorithms, some processes still struggle to find the resources; some processes may suffer Starvation. It is a problem that occurs when high-priority processes keep executing and low-priority processes get blocked for an indefinite time. A steady stream of higher-priority processes in a heavily loaded computer system can prevent a low-priority process from ever reaching the CPU. In Starvation, resources are continuously utilized by high-priority processes.

ALGORITHM/TECHNIQUE

We are using the Nice Command

This Linux command helps execute a program/process with modified scheduling priority. It launches a process with a user-defined scheduling priority. If we prioritize a process, Kernel will allocate more CPU time to that process.

METHODOLOGY

We have created an OS manager that prints all vital information on the processes and the OS itself. We used the Psutil library in the Python programming language to implement the OS manager. The Psutil library helps retrieve important information on running processes and system utilization. Using this library, we can also change the priority of some running processes.

To change the priority of some processes (mainly for processes that are either starving or hogging CPU), we have implemented four functions, namely:

1)Continue   -Skips a cycle for new current OS information

2)Increase Priority.   -Increase the priority of a process by specifying its PID

3)Decrease Priority   -Increase the priority of a process by specifying its PID

4)Kill Process   -Kills a process specified by a PID

After executing a function, all the OS and process information is listed again and is ready to perform another function. Some listed items are battery percentage, networks, memory, and process information.

We have used the nice command to change the priority of an essential process. Upon selecting the necessary process, the nice command changes the scheduling priority, which is specified by the user. To clean up the presentation of the information, we have used the common library 'pretty table.' This library represents or prints tables neatly and systematically.

IMPLEMENTATION

<u>Code:</u>

```python
import psutil

import time

from subprocess import call

from prettytable import PrettyTable


def increasePriority():
    pid = int(input("pid: "))
    process = psutil.Process(pid)
    priority = process.nice()
    print(f"Current priority of process {pid} is {priority}")
    priority += int(input("Increase by?: "))
    print(f"Increasing priority of {pid} to {priority}")
    process.nice(priority)
    time.sleep(2)


def decreasePriority():
    pid = int(input("pid: "))
    process = psutil.Process(pid)
    priority = process.nice()
    print(f"Current priority of process {pid} is {priority}")
    priority -= int(input("Decrease by?: "))
    print(f"Decreasing priority of {pid} to {priority}")
    process.nice(priority)
    time.sleep(2)
```

```python
def killProcess():
    pid = int(input("pid: "))
    print(f"Killing process {pid}")
    process = psutil.Process(pid)
    process.kill()
    time.sleep(2)


# Run an infinite loop to constantly monitor the system
while True:
    # Clear the screen using a bash command
    call('clear')


    print("=============================Process Monitor\
    ====================================")


    # Fetch the battery information
    battery = psutil.sensors_battery().percent
    print(" --- Battery Available: %d " % (battery,) + "%\n")
    print("----Processes --- ")
    process_table = PrettyTable(['PID', 'PNAME', 'STATUS',
                                                'CPU', 'NUM THREADS',
'MEMORY(MB)', 'PRIORITY'])
    proc = []
    # get the pids
    for pid in psutil.pids():
            try:
```

```python
            p = psutil.Process(pid)
            # trigger cpu_percent() the first time which leads to return of 0.0
            p.cpu_percent()
            proc.append(p)

        except Exception as e:
            pass
# sort by cpu_percent
top = {}
for p in proc:
    # trigger cpu_percent() the second time for measurement
    try:
        top[p] = p.cpu_percent()
    except:
        top[p] = 0
top_list = sorted(top.items(), key=lambda x: x[1])
top_list.reverse()
for p, cpu_percent in top_list[:30]:
# While fetching the processes, some of the subprocesses may exit
# Hence we need to put this code in try-except block
    try:
        # oneshot to improve info retrieve efficiency
        with p.oneshot():
            process_table.add_row([
                str(p.pid),
                p.name(),
```

```python
                        p.status(),

                        f'{cpu_percent:.2f}' + "%",

                        p.num_threads(),

                        f'{p.memory_info().rss / 1e6:.3f}',

                        p.nice()

                ])

        except Exception as e:

                pass

print(process_table)

print("1) Continue")

print("2) Increase Priority")

print("3) Decrease Priority")

print("4) Kill Process")

print("5) Exit")

option = int(input("Enter option: "))

if option == 1:

        continue

elif option == 2:

        increasePriority()

elif option == 3:

        decreasePriority()

elif option == 4:

        killProcess()

elif option==5:

        exit()
```

Output:

Process Monitor:

Giving input to increase priority:

Displaying updated values after increasing priority:

```
● ● ●                         🗀 ~/Desktop/osproj — python3.9 ‹ sudo — Basic
=============================Process Monitor  ========================================
----Battery Available: 55 %

----Processes----
+-------+--------------------------------------+---------+--------+-------------+------------+----------+
|  PID  |                PNAME                 | STATUS  |  CPU   | NUM THREADS | MEMORY(MB) | PRIORITY |
+-------+--------------------------------------+---------+--------+-------------+------------+----------+
| 13642 |            dummy_process1            | running | 3.70%  |      1      |   1.196    |    8     |
| 13485 |            dummy_process2            | running | 3.50%  |      1      |   0.754    |    0     |
|   0   |             kernel_task              | running | 2.50%  |     486     |   0.000    |    0     |
| 12922 |             python3.9               | running | 2.40%  |      2      |   9.998    |    0     |
|  576  |             WindowServer             | running | 1.30%  |     24      |  125.403   |    0     |
| 16315 |      Google Chrome Helper (GPU)      | running | 0.10%  |     13      |   20.300   |    0     |
| 1808  |         Code Helper (GPU)           | running | 0.10%  |     14      |   40.747   |    0     |
| 97384 |             BiomeAgent               | running | 0.00%  |      2      |   4.178    |    0     |
| 97043 |                tccd                 | running | 0.00%  |      3      |   14.205   |    0     |
| 93585 |     WhatsApp Helper (Renderer)       | running | 0.00%  |     18      |   10.293   |    0     |
| 93208 |     com.apple.WebKit.WebContent      | running | 0.00%  |      4      |   67.518   |    0     |
| 87183 |     com.apple.WebKit.WebContent      | running | 0.00%  |      5      |   68.289   |    0     |
| 82349 |                 zsh                 | running | 0.00%  |      1      |   1.950    |    5     |
| 82026 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     17      |   18.465   |    0     |
| 81688 |               parsecd               | running | 0.00%  |      2      |   18.334   |    0     |
| 79985 |               cfprefsd              | running | 0.00%  |      3      |   4.063    |    0     |
| 79979 |               cfprefsd              | running | 0.00%  |      3      |   3.621    |    0     |
| 79891 |           PerfPowerServices         | running | 0.00%  |      4      |   18.055   |    0     |
| 79219 |          appstorecomponentsd        | running | 0.00%  |      4      |   6.554    |    0     |
| 76837 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     19      |   23.101   |    0     |
| 76836 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     17      |   18.465   |    0     |
| 76615 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     17      |   17.859   |    0     |
| 75893 |      com.apple.CodeSigningHelper     | running | 0.00%  |      3      |   3.850    |    0     |
| 74529 |            spindump_agent            | running | 0.00%  |      2      |   5.652    |    0     |
| 74354 |                 zsh                 | running | 0.00%  |      1      |   1.982    |    5     |
| 71117 |               distnoted             | running | 0.00%  |      2      |   1.245    |    0     |
| 70600 |                trustd               | running | 0.00%  |      2      |   12.616   |    0     |
| 67255 |            sharedfilelistd          | running | 0.00%  |      2      |   2.769    |    0     |
| 64193 |            NowPlayingTouchUI         | running | 0.00%  |      3      |   14.828   |    0     |
| 63690 | com.apphousekitchen.aldente-pro.helper | running | 0.00% |      2      |   5.358    |    0     |
+-------+--------------------------------------+---------+--------+-------------+------------+----------+
1) Continue
2) Increase Priority
3) Decrease Priority
4) Kill Process
5) Exit
Enter option: ▮
```

Giving input to decrease priority:

```
● ● ●                         🗀 ~/Desktop/osproj — python3.9 ‹ sudo — Basic
=============================Process Monitor  ========================================
----Battery Available: 55 %

----Processes----
+-------+--------------------------------------+---------+--------+-------------+------------+----------+
|  PID  |                PNAME                 | STATUS  |  CPU   | NUM THREADS | MEMORY(MB) | PRIORITY |
+-------+--------------------------------------+---------+--------+-------------+------------+----------+
| 13642 |            dummy_process1            | running | 3.70%  |      1      |   1.196    |    8     |
| 13485 |            dummy_process2            | running | 3.50%  |      1      |   0.754    |    0     |
|   0   |             kernel_task              | running | 2.50%  |     486     |   0.000    |    0     |
| 12922 |             python3.9               | running | 2.40%  |      2      |   9.998    |    0     |
|  576  |             WindowServer             | running | 1.30%  |     24      |  125.403   |    0     |
| 16315 |      Google Chrome Helper (GPU)      | running | 0.10%  |     13      |   20.300   |    0     |
| 1808  |         Code Helper (GPU)           | running | 0.10%  |     14      |   40.747   |    0     |
| 97384 |             BiomeAgent               | running | 0.00%  |      2      |   4.178    |    0     |
| 97043 |                tccd                 | running | 0.00%  |      3      |   14.205   |    0     |
| 93585 |     WhatsApp Helper (Renderer)       | running | 0.00%  |     18      |   10.293   |    0     |
| 93208 |     com.apple.WebKit.WebContent      | running | 0.00%  |      4      |   67.518   |    0     |
| 87183 |     com.apple.WebKit.WebContent      | running | 0.00%  |      5      |   68.289   |    0     |
| 82349 |                 zsh                 | running | 0.00%  |      1      |   1.950    |    5     |
| 82026 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     17      |   18.465   |    0     |
| 81688 |               parsecd               | running | 0.00%  |      2      |   18.334   |    0     |
| 79985 |               cfprefsd              | running | 0.00%  |      3      |   4.063    |    0     |
| 79979 |               cfprefsd              | running | 0.00%  |      3      |   3.621    |    0     |
| 79891 |           PerfPowerServices         | running | 0.00%  |      4      |   18.055   |    0     |
| 79219 |          appstorecomponentsd        | running | 0.00%  |      4      |   6.554    |    0     |
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| 76836 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     17      |   18.465   |    0     |
| 76615 |    Google Chrome Helper (Renderer)   | running | 0.00%  |     17      |   17.859   |    0     |
| 75893 |      com.apple.CodeSigningHelper     | running | 0.00%  |      3      |   3.850    |    0     |
| 74529 |            spindump_agent            | running | 0.00%  |      2      |   5.652    |    0     |
| 74354 |                 zsh                 | running | 0.00%  |      1      |   1.982    |    5     |
| 71117 |               distnoted             | running | 0.00%  |      2      |   1.245    |    0     |
| 70600 |                trustd               | running | 0.00%  |      2      |   12.616   |    0     |
| 67255 |            sharedfilelistd          | running | 0.00%  |      2      |   2.769    |    0     |
| 64193 |            NowPlayingTouchUI         | running | 0.00%  |      3      |   14.828   |    0     |
| 63690 | com.apphousekitchen.aldente-pro.helper | running | 0.00% |      2      |   5.358    |    0     |
+-------+--------------------------------------+---------+--------+-------------+------------+----------+
1) Continue
2) Increase Priority
3) Decrease Priority
4) Kill Process
5) Exit
Enter option: 3
pid: 13485
Current priority of process 13485 is 0
Decrease by?: 3
Decreasing priority of 13485 to -3
▮
```

Displaying updated values after decreasing priority:

Conclusion:

With the help of this Feature, Now the User can increase and decrease the priority of the process according to his wish, by using this Process Manager we can avoid Starvation of the processes.

<u>REFERENCES</u>

Websites:

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- https://psutil.readthedocs.io/en/latest/
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Textbook:

- Operating System Concepts by Abraham Silberschatz, Greg Gagne, Peter B. Galvin 9th Edition