Operating Systems Project Report

Course Code: CSE316

Project Title: Adaptive Resource Allocation in Multiprogramming Systems

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1. Project Overview

The project 'Adaptive Resource Allocation in Multiprogramming Systems' simulates a simplified operating system that manages multiple processes running concurrently and dynamically adjusts CPU and memory allocations in real time.

The adaptive logic modifies time quantum and process priorities depending on real-time performance, ensuring fair CPU time distribution, efficient memory utilization, and prevention of starvation. The simulation improves CPU and memory usage, reduces average waiting time, and enhances throughput.

2. Module-Wise Breakdown

Module 1: Process and System Monitoring

- Simulates processes with PID, burst time, priority, memory, and states.

- Tracks CPU and memory utilization and process waiting times.

Module 2: Adaptive Resource Allocation Engine

- Implements Round Robin scheduling with dynamic time quantum and priority adjustment.

- Reallocates CPU and memory based on system load.

Module 3: Visualization and Control

- Displays process states and metrics in real time.

- Logs adaptive updates and shows system summary.

3. Functionalities

- Process creation and management

- Multiprogramming simulation using Round Robin scheduling

- Real-time performance monitoring (CPU, memory, waiting time)

- Adaptive scheduling (dynamic quantum and priority adjustment)

- Simplified memory allocation

- Summary report generation

4. Technology Used

Programming Language: C++

Libraries: <bits/stdc++.h>, <queue>, <vector>, <iostream>

IDE: VS Code / Code::Blocks / GCC

Version Control: Git + GitHub

5. Flow Diagram

Start -> Initialize Processes -> Select Process -> Execute -> Update Metrics -> Apply Adaptive Logic
-> Check Completion -> Display Summary

6. Revision Tracking on GitHub

#1: Initial project structure

#2: Added process and queue system

#3: Implemented Round Robin scheduler

#4: Added adaptive logic and metrics

#5: Final testing and report upload

Repository: adaptive-resource-allocation

7. Conclusion and Future Scope

The simulation demonstrates adaptive resource allocation improving CPU utilization and process fairness. Future work may include I/O-bound process handling, GUI visualization, and ML-based prediction for resource adjustment.

8. References

1. Silberschatz, Galvin & Gagne, Operating System Concepts.

2. TutorialsPoint: CPU Scheduling in OS.

3. GeeksforGeeks: Memory Management.

4. AI guidance from ChatGPT (OpenAI GPT-5).