# OPSYS TOOLKIT

A MINI-PROJECT REPORT
Submitted by

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## BONAFIDE CERTIFICATE

Certified that this project **“OPSYS TOOLKIT”** is the bonafide work of **“ RENUGA DEVI K & PRIYANKA E”** who carried out the project work under my supervision.

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This mini project report is submitted for the viva voce examination to be held on

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**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

## ABSTRACT:

**OPSYS TOOLKIT: Visualize, Learn, Simulate** is an innovative mobile application designed to revolutionize how Operating System concepts are understood and practiced. Built using Flutter, this offline-friendly app transforms core OS topics—CPU Scheduling, Memory Allocation, Deadlock Detection, and Page Replacement Algorithms—into interactive playground for learners. Unlike traditional learning tools, our app empowers users to simulate real-time scenarios, visualize complex processes, and grasp abstract algorithms through dynamic Gantt charts, memory bar graphs, resource allocation graphs, and page frame visualizations. Users can experiment with various algorithms including FCFS, SJF, Round Robin, Banker's Algorithm, and page replacement strategies like FIFO, LRU, and Optimal, observing their behaviour and outcomes instantly. Whether you're a Student preparing for exams or a curious mind exploring system-level operations, OS Toolkit offers a hands-on, visual-first approach that makes learning not just easier—but exciting. This project bridges the gap between theory and application, helping users move from memorization to mastery.

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# CHAPTER 1

# INTRODUCTION

## 1.1 INTRODUCTION

OPSYS Toolkit is a Flutter-based mobile application that provides interactive simulations and visualizations for key Operating System concepts. It focuses on enhancing learning and practical understanding of CPU Scheduling, Memory Allocation, Deadlock Detection, and Page Replacement algorithms. The app supports offline usage and provides visual representations through Gantt charts, memory bar graphs, resource allocation graphs, and page frame layouts.

## 1.2 SCOPE OF THE WORK

The scope of OPSYS Toolkit lies in offering a visual-first, hands-on simulation platform for learners and educators. It allows experimentation with multiple scheduling and memory strategies in real-time, catering to academic, experimental, and research needs.

## 1.3 PROBLEM STATEMENT

Operating System algorithms are conceptually rich but often difficult to visualize. Many learners struggle with understanding how abstract algorithms work behind the scenes. OPSYS Toolkit addresses this issue by offering a mobile-friendly, graphical simulation environment that bridges the gap between theory and practical understanding.

## 1.4 AIM AND OBJECTIVES OF THE PROJECT

The aim is to design a self-contained mobile app that enables interactive learning and analysis of Operating System concepts. The objectives include:

- Implementing multiple CPU scheduling algorithms (FCFS, SJF, RR)
- Visualizing memory allocation techniques
- Demonstrating deadlock detection using Banker's Algorithm
- Simulating page replacement strategies like FIFO, LRU, and Optimal
- Presenting results in user-friendly visual formats

# CHAPTER 2

# SYSTEM DESIGN AND FEATURES

## 2.1 CPU SCHEDULING

Supports FCFS, SJF, and Round Robin algorithms. Users can input arrival and burst times, view Gantt chart representations, and analyze average turnaround and waiting times.

## 2.2 MEMORY ALLOCATION

Visualizes memory usage and partitioning using bar graphs. Helps in understanding fragmentation and memory fit strategies.

## 2.3 DEADLOCK DETECTION

Implements Banker's Algorithm to simulate safe state checks. Uses resource allocation graphs to visually identify safe and unsafe states.

## 2.4 PAGE REPLACEMENT

Simulates FIFO, LRU, and Optimal algorithms with step-by-step frame changes and hit/miss count to understand paging mechanisms.

# CHAPTER 3

# ARCHITECTURE

The architecture of OPSYS Toolkit consists of:

- Input Interface: Flutter UI for accepting user inputs (processes, memory size, priorities, etc.)

- Logic Engine: Dart logic to simulate algorithms (scheduling, memory, deadlock, paging)

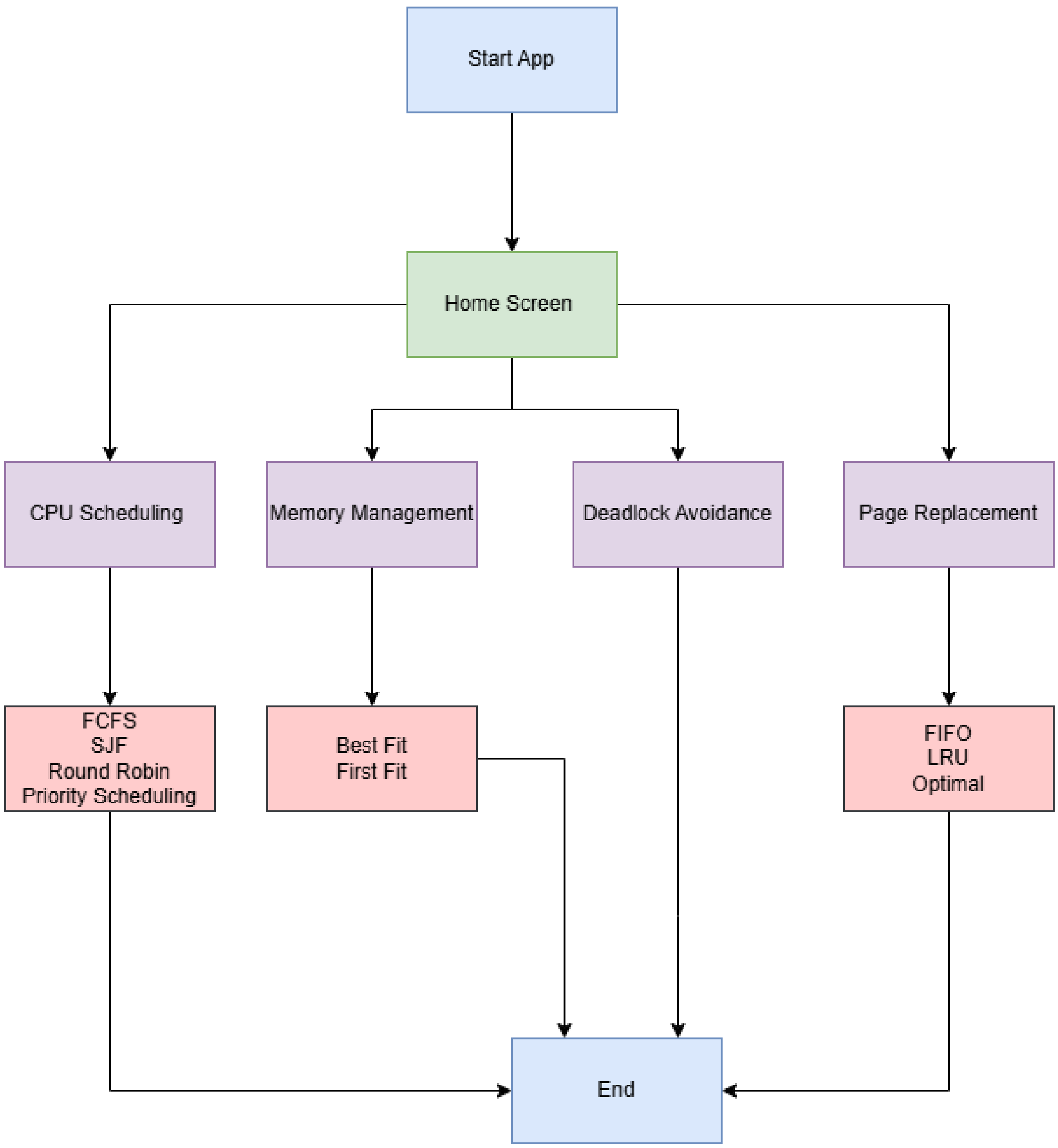
- Visualization Layers: Charts and graphs (Gantt chart, bar graphs, resource allocation graphs) for each module

**Output Summary**: Shows turnaround time, waiting time, page faults, and memory stats

All modules are encapsulated within a mobile app architecture supporting offline use with responsive performance.

# CHAPTER 4

# FLOWCHART



# CHAPTER 5
# CODE IMPLEMENTATION

The OPSYS Toolkit is built using Flutter (Dart) and follows modular implementation:

CPU Scheduling: Separate functions for FCFS, SJF, RR using list sorting and time tracking

Memory Allocation: Uses dynamic list structures to simulate block allocation and visualize fragmentation

Deadlock Detection: Implements Banker's Algorithm with matrix input and safe state detection

Page Replacement: Array and queue-based logic for FIFO, LRU, Optimal page simulation

Visualization is done using Flutter charts, and all results are displayed in-app in an intuitive format.

# CHAPTER 6

# SCREENSHOTS

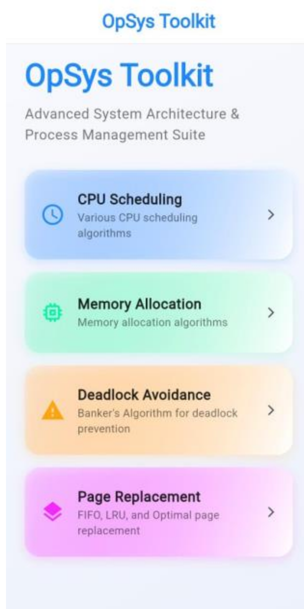



Fig 1. App Introduction Page

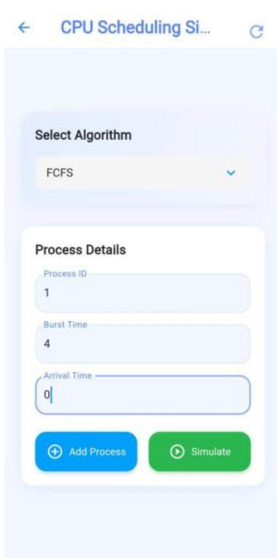



Fig 2. Input Section for CPU Scheduling

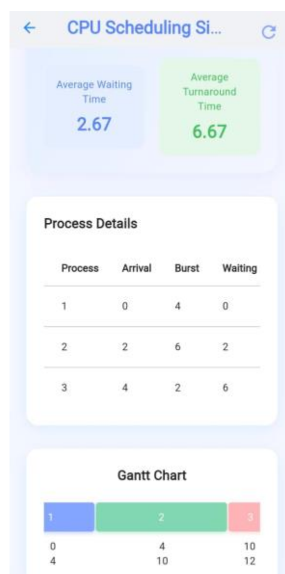



Fig 3. Gantt Chart Output for FCFS

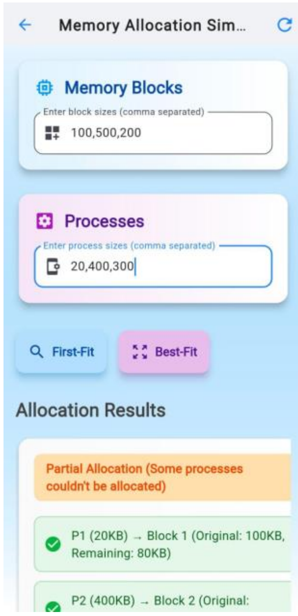



Fig 4. Memory Allocation Visualization


Fig 5. Deadlock Resource Graph


Fig 6. Page Replacement Frame Changes

# CHAPTER 7

## CONCLUSION

OPSYS Toolkit successfully bridges the gap between theoretical learning and practical application of Operating System concepts. It makes abstract algorithms interactive and visual, helping learners grasp critical ideas through simulation. The offline, mobile-friendly design adds accessibility and convenience.

# CHAPTER 8

## FUTURE WORK

- Add Multilevel Queue and Feedback Scheduling
- Real-time process monitoring through OS APIs
- Export results to PDF or Excel
- Add quiz or challenge modes for gamified learning
- Introduce multiprocessor simulation and visual comparison
- Support dark mode and accessibility features

# CHAPTER 9

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