23CSE362

# RESOURCE ALLOCATION IN EDGE COMPUTING FOR HEALTH MONITORING SYSTEMS

# Introduction

- Edge Computing in Healthcare
  - Processes health data near the source
  - Reduces delay and improves real-time decision-making
- Problem: Hospital Workstations (HWs) have limited resources
- Need: Efficient resource allocation to manage critical health tasks

# How it is a Edge Problem?

- IoT devices (BP monitors, ECGs) generate real-time medical data
- Sending all data to the cloud = high latency, slow response, network congestion
- Emergency tasks (e.g., heart attack alerts) can’t afford delay

## Why Edge?

1. Processes data locally (hospital workstations or nearby nodes)
2. Faster decisions = better patient safety
3. Reduces bandwidth & energy use
4. Less cloud dependency, smarter task execution based on urgency

# Objective

01 Optimize resource usage in Hospital Workstations (HWs)

02 Ensure urgent (emergency) tasks get priority

03 Minimize overall latency and bandwidth usage

# IMPLEMENTATION DEVICES INVOLVED

Patient-Side(Input Devices)

- Temperature Sensor
- Blood Pressure Monitor
- Pulse Oximeter
- Glucose Meter
- ECG Sensor

Edge-Side
(Processing Unit):
Hospital Workstations(HW)

- Acts as the edge node
- Performs task processing for urgent tasks

Cloud-Side
(for Backup/Heavy Tasks):

- Remote cloud data
- Takes over low-priority
- Resource-heavy tasks

# CHALLENGS IN MEMORY ALLOCATION

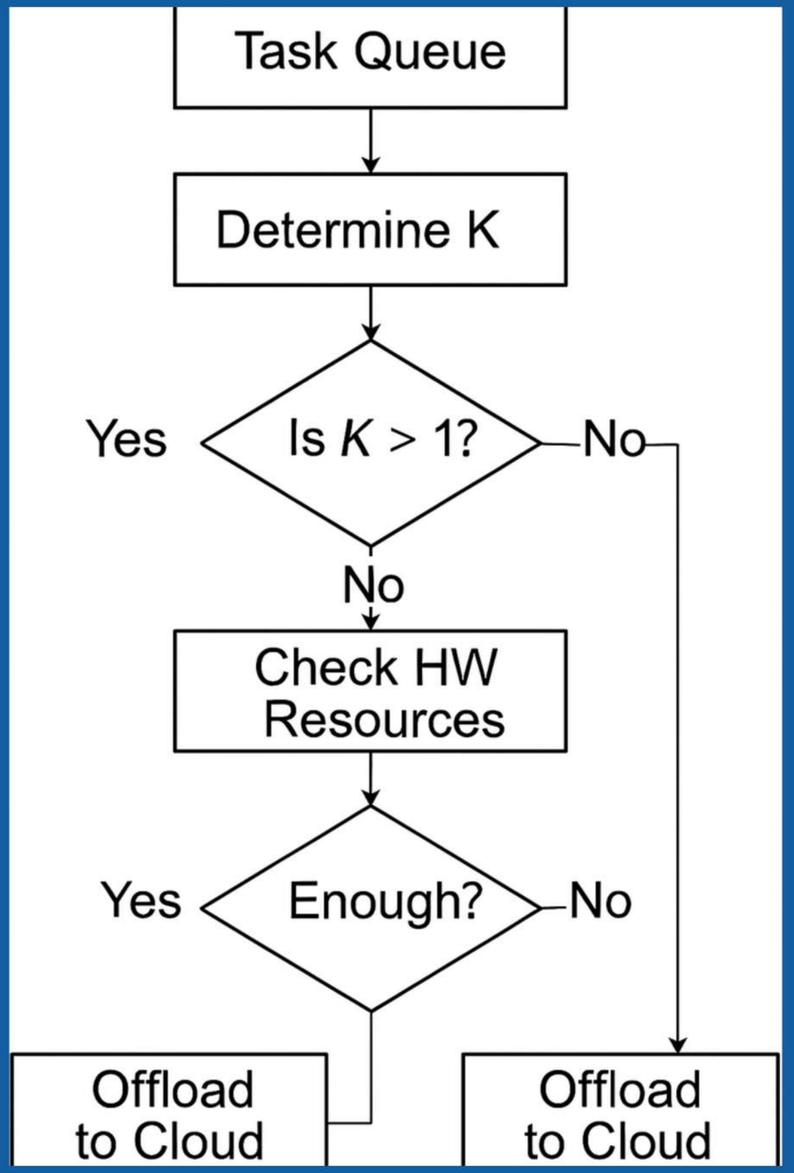
- Limited CPU and memory at HWs
- Diverse task requirements (size, priority, compute power)
- Latency-sensitive tasks (e.g., high BP, abnormal ECG)
- Trade-off between:
  - Local processing (fast, resource-limited)
  - Cloud offloading (slow, resource-rich)

# FOCUSED ON RESOURCE ALLOCATION

- Assign resources based on task urgency level (K)
- Evaluate task requirements:
  - CPU cycles needed
  - Storage size
  - Bandwidth required
- Decide whether to process locally or remotely

# RESOURCE ALLOCATION LOGIC

- If HW has enough resources AND task is urgent (K > 1):
  - Allocate resources
  - Process locally
- If HW resources are insufficient OR task is not urgent:
  - Offload to cloud for processing


Task Queue
Determine K
Yes
Is K > 1?
No
No
Check HW Resources
Yes
Enough?
No
Offload to Cloud
Offload to Cloud

# Conclusion

01 PTS-RA system enables real-time healthcare monitoring by prioritizing tasks based on emergency level

02 Timely response in healthcare = saved lives

03 Foundation for future real-world edge-based health systems

# STATE-OF-THE-ART LITERATURE

Research Paper: "Priority-based Task Scheduling and Resource Allocation in Edge Computing for Health Monitoring System"
(Sharif et al., Journal of King Saud University – Computer and Information Sciences, 2023)

# Key Research Focus:

- Efficient task scheduling and resource allocation in healthcare IoT
- Reducing latency, bandwidth usage, and energy consumption
- Real-time decision-making for emergency vs. non-urgent tasks

# Notable Techniques & Works:

- PTS-RA – Priority-based Task Scheduling & Resource Allocation
  - Uses patient vitals to assign urgency
  - Executes emergency tasks locally
  - (Sharif et al., 2023)
- HealthFog – Real-time heart monitoring using edge & fog
  - (Tuli et al., 2020)

# Our Work

01 Studying the logic of PTS-RA

02 Building the scheduling and resource allocation strategy

03 Preparing for simulation and result analysis

# TASK SPLIT

| PHASE | CSE23151 | CSE23139 | CSE23141 | CSE23257 |
|---|---|---|---|---|
| SYSTEM DESIGN | ARCHITECTURE DIAGRAM | PRIORITY MODEL(K) | HW SPECS | PLANNING AND TIMELINE |
| DATA SIMULATION | HEARTRATE/ ECG DATA | BODY TEMP DATA | BP & OXYGEN DATA | MERGE AND VALIDATE ALL |
| EDGE DEVELOPMENT | RESOURCE ALLOCATION LOGIC | RESOURCE ALLOCATION LOGIC | EXECUTION TIME LOGIC | EDGE VS CLOUD DECISION |
| CLOUD OFFLOADING | CLOUD QUEUE | TRANSMISSION LATENCY | OFFLOADING LOGIC | RETURN RESULT SYSTEM |
| RESOURCE ALLOCATION | EQUATIONS AND CODING | PRIORITY ALLOCATION AND CODING | REJECTION LOGIC AND CODING | CONSTRAINTS LOGIC AND CODING |
| TESTING | HIGH PRIORITY TESTS | LOW PRIORITY TESTS | LOAD TEST | CLOUD TEST |