HEALTHCARE SYSTEM DESIGN USING RTOS

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Contenets

1-Introduction to the system

Design an healthcare system using RTOS with the following requirements:
- A touch LCD as input that can control the system and give commands.
  - Every LCD command is represented in 4 bytes.
  - The LCD is connected to the Mu through UART with speed 9600 bps[Bit per Second].
  - (Reading 4 bytes and processing the command takes 2ms).
- Blood pressure sensor with new data every 25ms.
  - (Reading the sensor and processing its data takes 3ms)
- Heart beat detector with new data every 100ms.
  - (Reading the sensor and processing its data takes 1.5ms)
- Temperature sensor with new data every 10ms.
  - (Reading the sensor and processing its data takes 3ms)
- Alert siren.(Activate or Deactivate the siren takes 3ms)

2- System Flowchart & Tasks
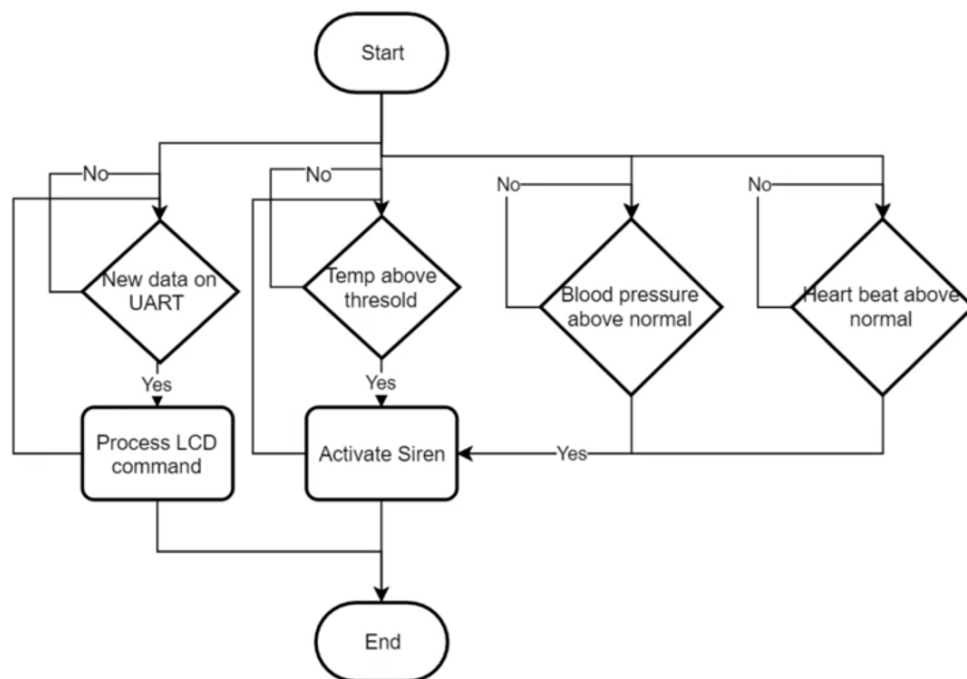
We have 5 Tasks:

Task_Name   {Periodicity, Execution Time, Deadline, Priority}
1- LCD_T1   {100ms , 2ms   , 100ms   , 1}
2- Alert_T2   {10ms   , 1ms   , 10ms   , 2}
3- Heart_T3 {100ms , 1.5ms , 100ms   , 3}
4- Blood_T4 {25ms   , 3ms   , 25ms   , 4}
5- Temp_T5 {10ms   , 2.5ms , 10ms   , 5}

Comments:

Sensors_Tasks are a higher priority to meet their deadlines.
LCD_task is the least priority because it is not a time-critical task.

3- Calculate the SysTick and Hyper Period.

SysTick is one of the most important parameters in designing a real-time solution.
Wrongly choosing the sysTick value might cause the following problems.
- SysTick rate = 5ms → according to the tasks (Temperature & Blood Pressure).
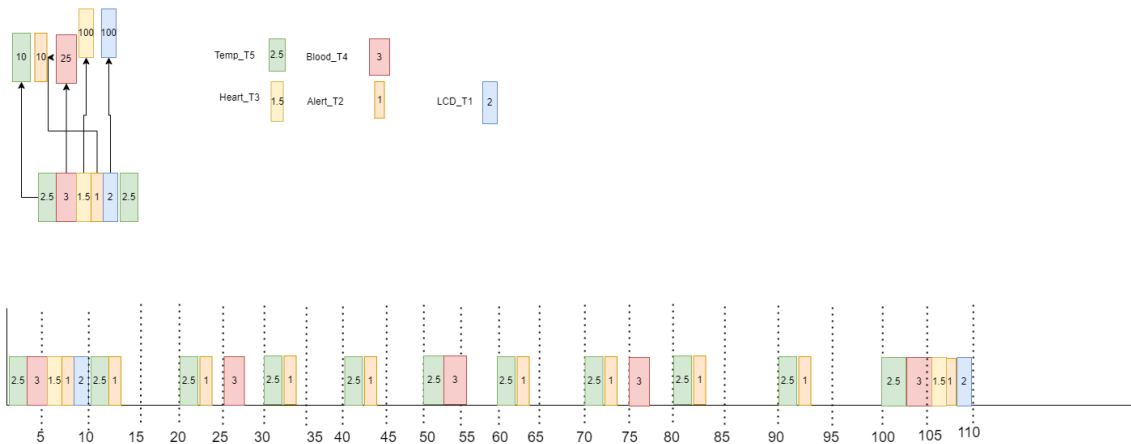- HyperPeriod (H) = LCM(Periodicity) → 100 ms

4- Calculate the CPU load.

CPU load can also be used in the design phase to decide whether to add new features to the system or not.
- U(Utilization) = R(Requirements:Busy Time) / C(Capacity: Busy Time + IDLE Time).
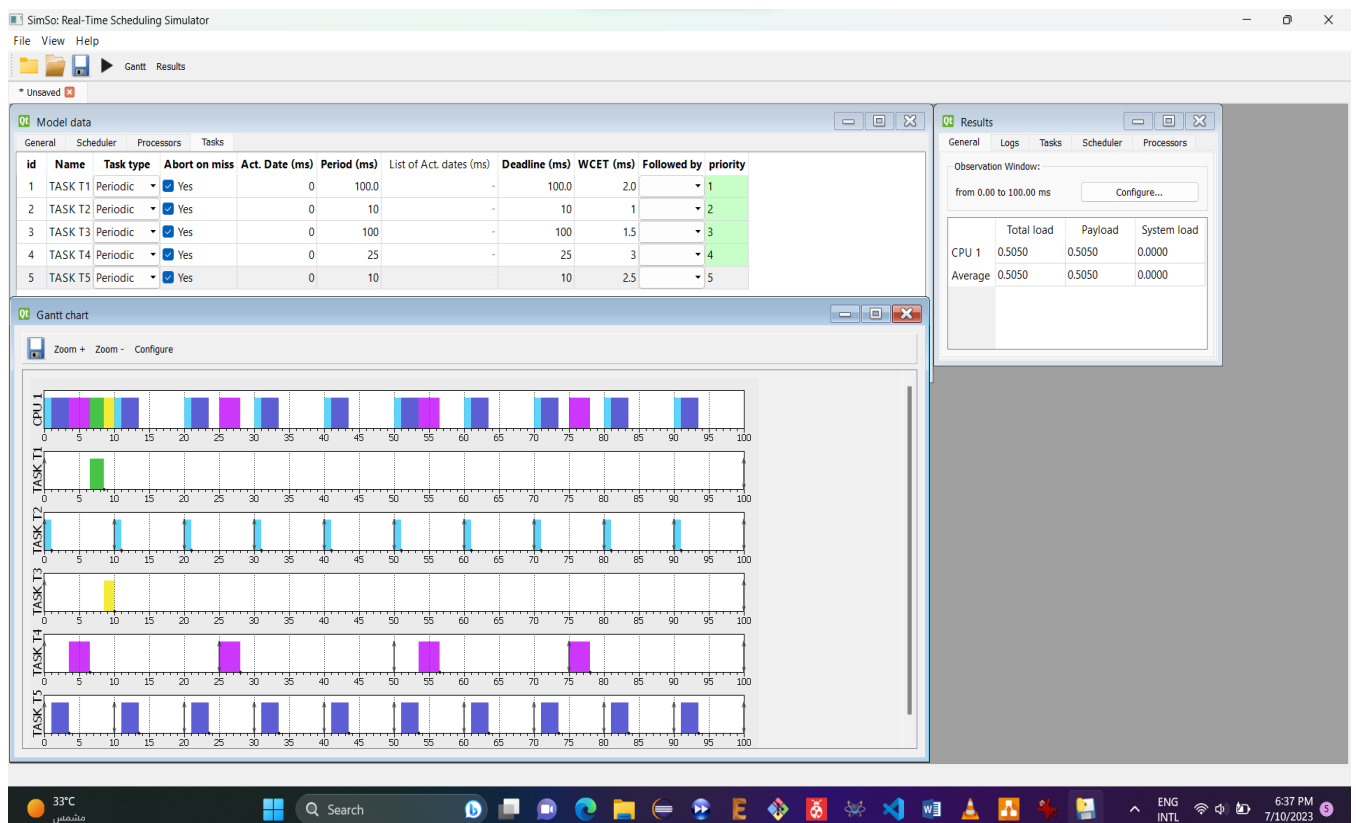
- **U = (E1+E2+E3+E4+E5) / H** = ((10*2.5) + (4*3) + (1*1.5) + (10*1) + 2) / **100 = 0.505**
- **U = (50.5%)**

5- System Schedulability.

6- System Design Analysis using Simso.

7- System Specs.

- The system is schedulable because all tasks are finished before their deadlines.
- The system is not loaded CPU_Load is ~ 50%.