Designing A Real Time System

—

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Overview

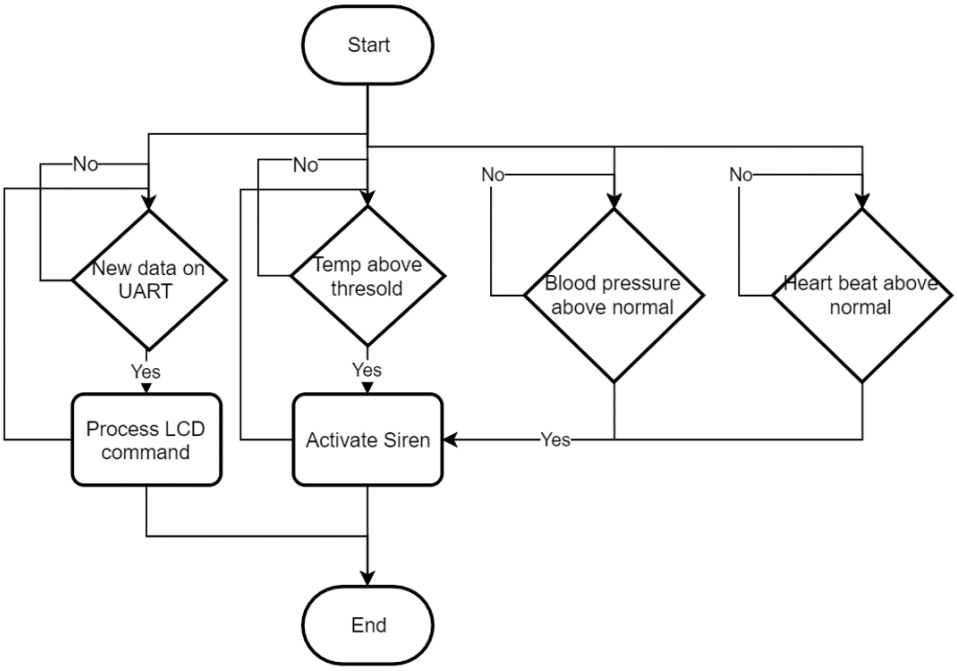
Design a healthcare system using RTOS with the following requirements:

- 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 micro - controller through UART with a speed of 9600 bps.[Execution time : 3ms]
- Blood pressure sensor with new data every 25 ms.[Execution time: 1.5ms]
- Heart beat detector with new data every 100ms .[Execution time: 2.5ms]
- Temperature sensor with new data every 10ms .[Execution time: 1 ms]
- Alert siren.

Goals

1. Decide how many tasks are needed
2. Decide the task parameters (Priority - Periodicity - Deadline).
3. Decide the system tick rate.
4. Calculate:
    - Hyperperiod
    - CPU load
    - Draw the timeline manually and analyze system schedulability.
    - Model the system in Simso and verify that your design is schedulable.

Flow chart



Tasks needed

Task 1 : Touch LCD

[P: 100ms, E: 2ms, D:100ms, Priority:1]

Task 2 : Blood Pressure Sensor

[P: 25ms, E: 3ms, D:25ms, Priority:1]

Task 3 : Heart Beat Detector

[P: 100ms, E: 1.5ms, D:100ms, Priority:1]

Task 4 : Temperature Sensor

[P: 10ms, E: 2.5ms, D:10ms, Priority:1]

Task 5 : Alart

[P: 10ms, E: 1ms, D:10ms, Priority:1]

System Tick Rate

- We can calculate System tick rate by summing all execution time of all tasks and take the system tick rate bigger than it.
- Sum of execution tasks = 2+3+1.5+2.5+1= 10 ms
- So .. System tick Rate > 10ms .... = **12 ms**

Hyperperiod

Hyperperiod = LCM(100,25,10)

Hyperperiod = **100 ms**

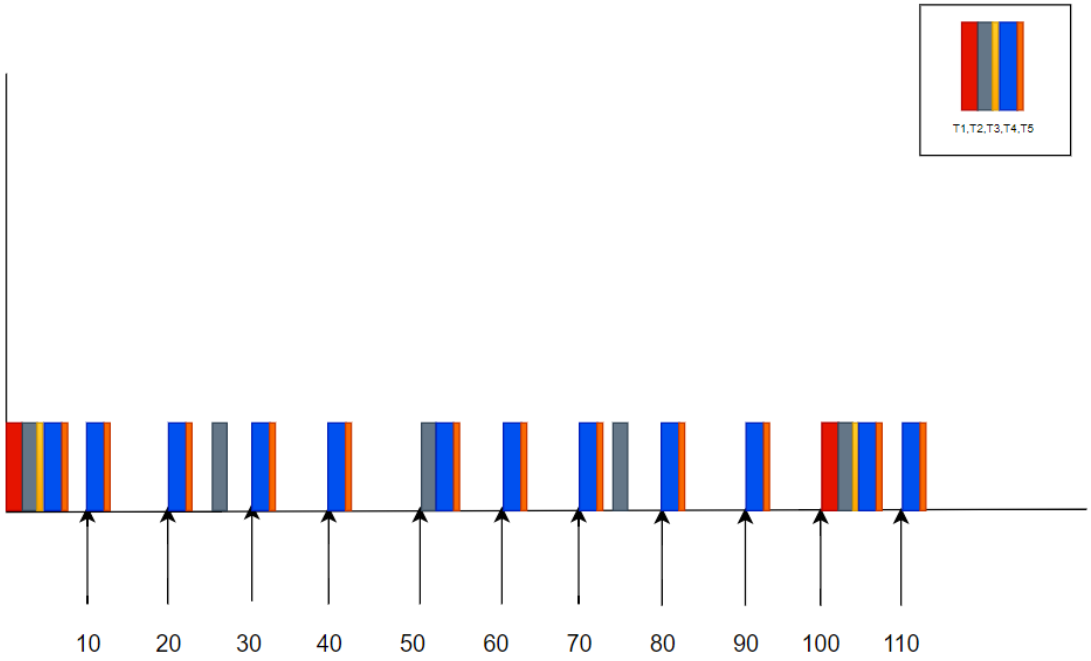
CPU Load

Task	Periodicity	Execution Time	Hyperperiod	Number of repetitions of task	Busy Time
Task1	**100**	**2**	**100**	**1**	**2x1=2**
Task2	**25**	**3**	**100**	**4**	**3x4=12**
Task3	**100**	**1.5**	**100**	**1**	**1.5x1=1.5**
Task4	**10**	**2.5**	**100**	**10**	**2.5x10=25**
Task5	**10**	**1**	**100**	**10**	**1x10=10**
Total Busy Time = 2+12+1.5+25+10 = 50.5 ms					

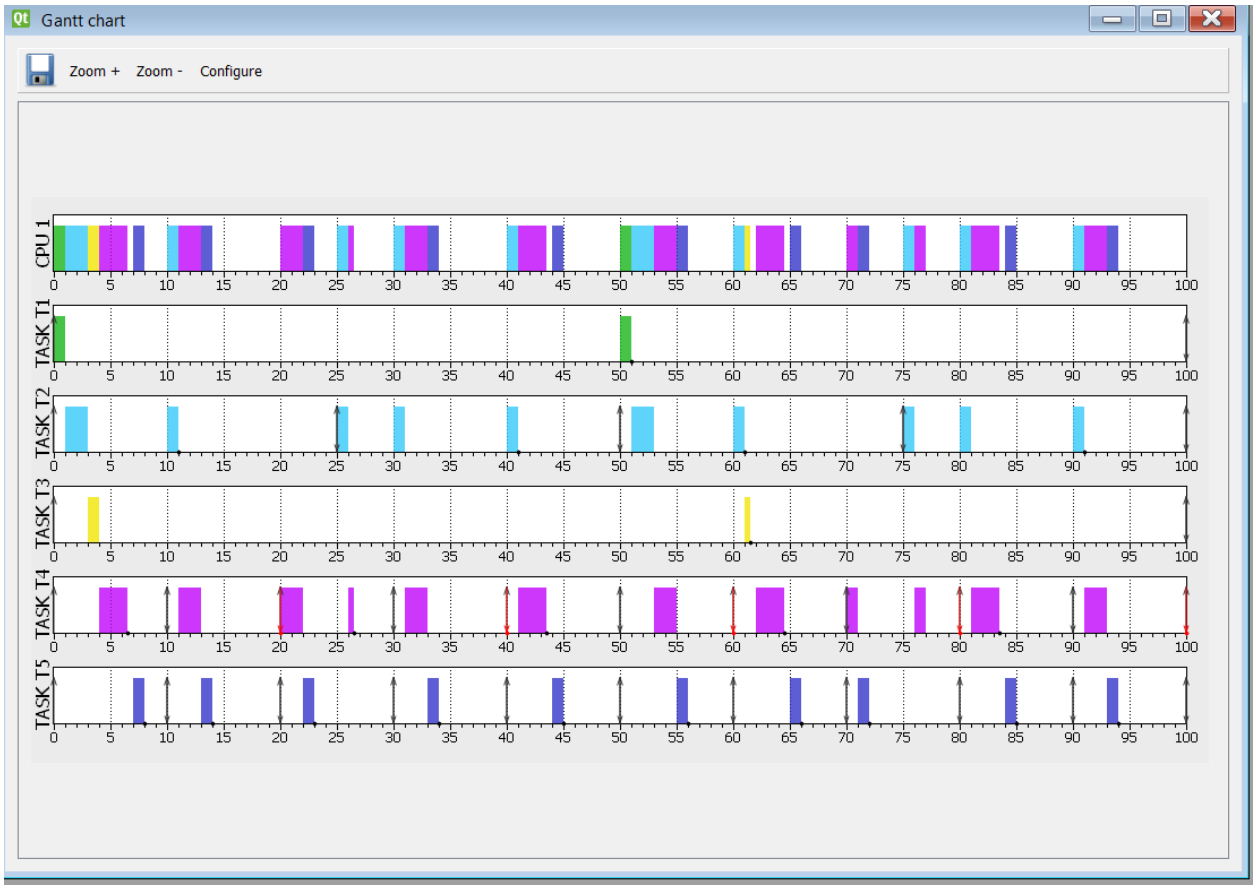
So … CPU load = (50.5 * 100)/100 = 50.5%

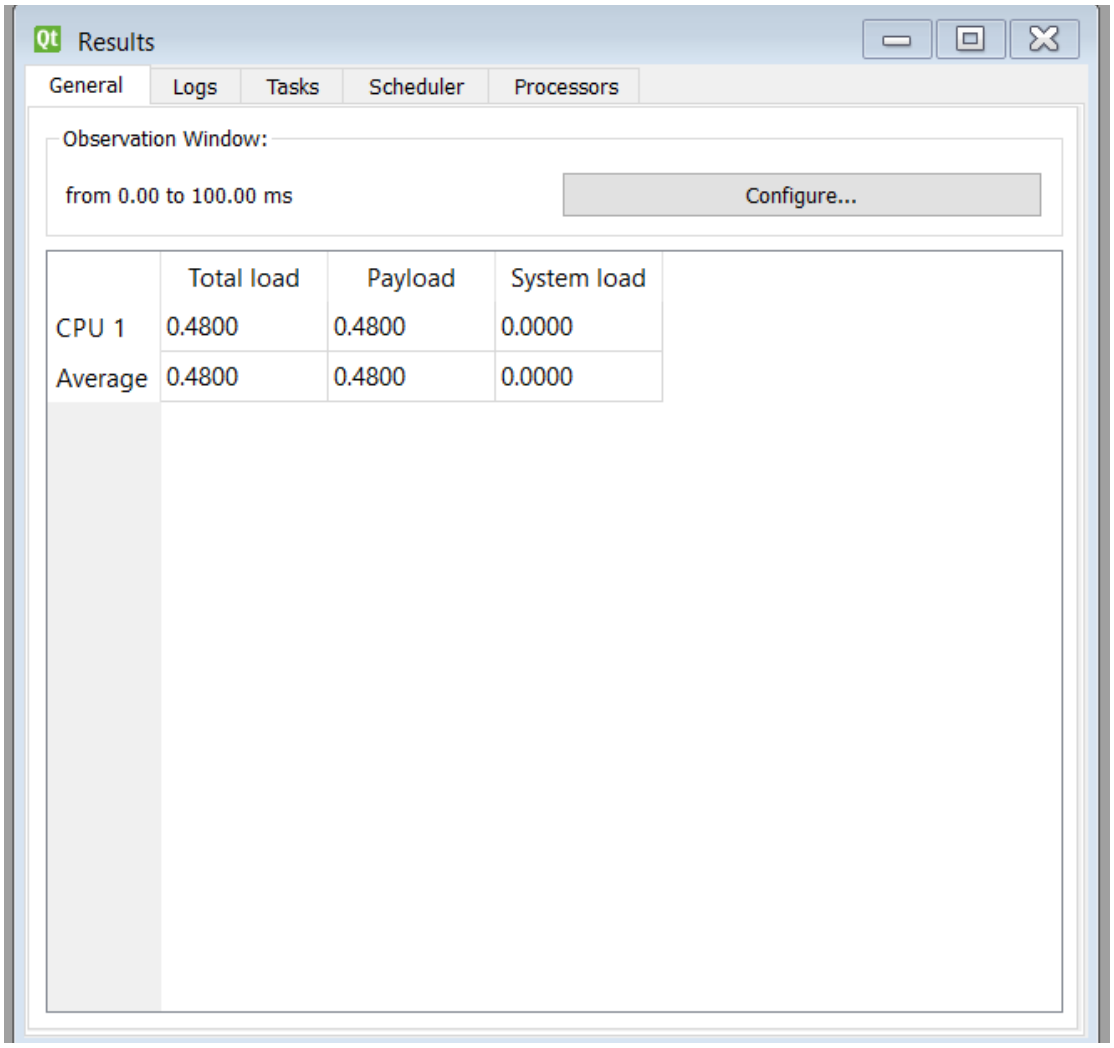
- The System has a good schedulability

Timeline Manually



Design in Simso




Results
General
Logs
Tasks
Scheduler
Processors
Observation Window:
from 0.00 to 100.00 ms
Configure...
Total load
Payload
System load
CPU 1
0.4800
0.4800
0.0000
Average
0.4800
0.4800
0.0000