Sprints

Designing a real-time Health-care system

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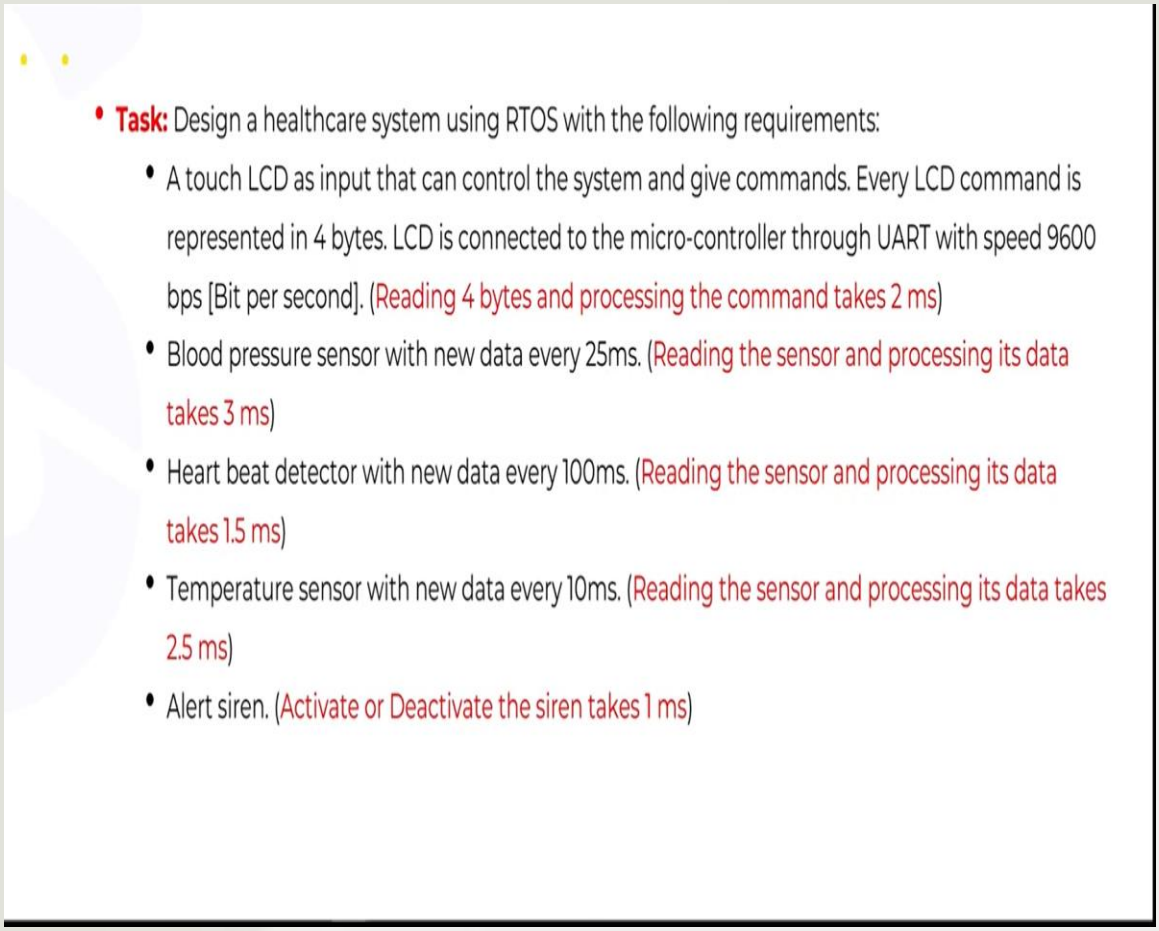
System Requirement



System consists of the following tasks:

LCD: execution time 2ms

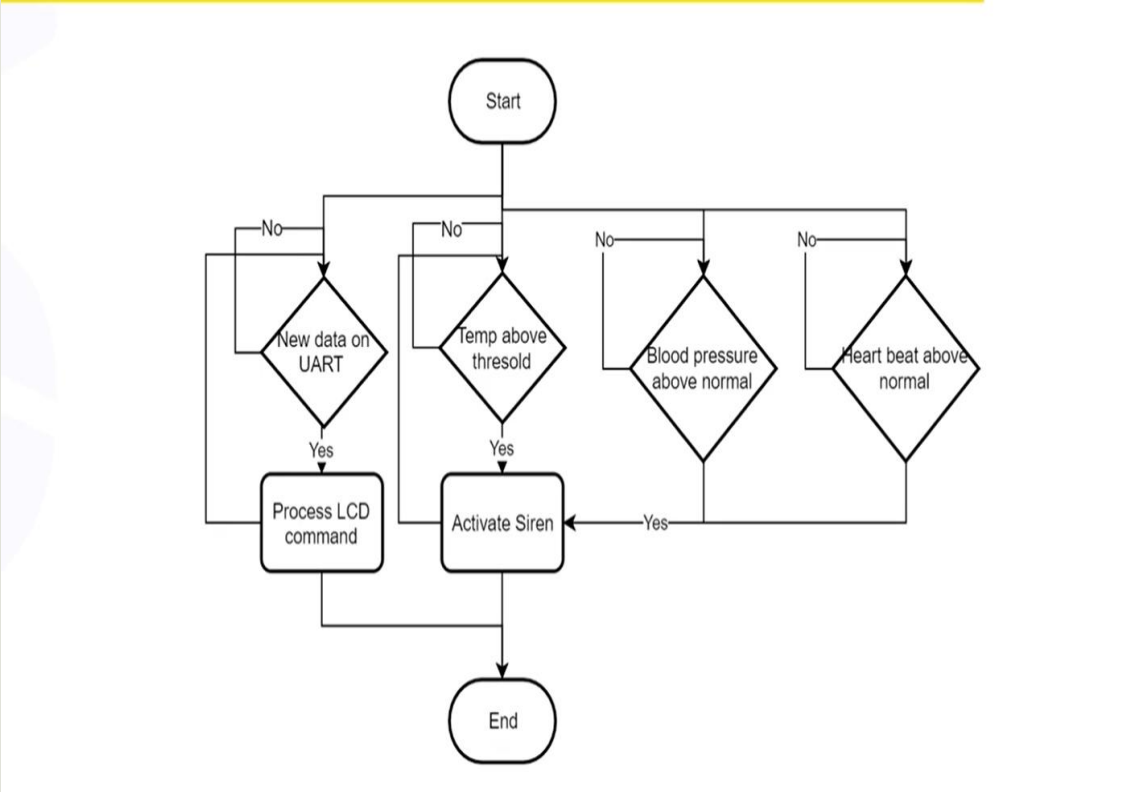
Blood pressure sensor: new data every 25ms-execution time 3ms

Heart-beat detector: new data every 100ms-execution time 1.5ms

Temperature sensor: new data every 10ms-execution time 2.5ms

Alert siren: execution time 1ms

System flow chart



Number of tasks needed:

5-Tasks are needed as following:

Task 1: Blood pressure sensor- Reading

Task 2: Heart-beat detector - Reading

Task 3: Temperature sensor - Reading

Task 4: Sending LCD input to UART

Task 5: Alert siren

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Tasks' parameters: (priority-periodicity-deadline):

T1:Blood pressure sensor
{Priority:2
,Periodicity:10ms
,Deadline:10ms }

T2:Heart-beat detector
{Priority:2
,Periodicity:50ms
,Deadline:50ms }

T3:Temperature sensor
{Priority:2
,Periodicity:5ms
,Deadline:5ms }

T4:LCD & UART
{Priority:3
,Periodicity:50ms
,Deadline :50ms }

T5:Alert siren
{Priority:1
,Periodicity:suspended on event
,Deadline:2ms }

System tick rate:

Systick value = total execution time of all tasks.

According to the following information:

LCD and UART: execution time 2ms

Blood pressure sensor: execution time 3ms

Heart-beat detector: execution time 1.5ms

Temperature sensor: execution time 2.5ms

Alert siren: execution time 1ms

Then:

System tick rate= 3ms + 1.5ms+ 2.5ms+ 2ms+ 1ms= **10ms**

Calculations: (Hyper period-CPU load):

(1)- Hyperperiod:

Hyperperiod (H) = LCM(Pi)

Hyperperiod= **100ms.**

(2) CPU load:

CPU load (U) = E/H

E= (E1+E2+E3+E4+E5+E6) = (3*10 + 1.5*2+ 2.5*20+ 2*2) = 87

U= 87/100=0.87%

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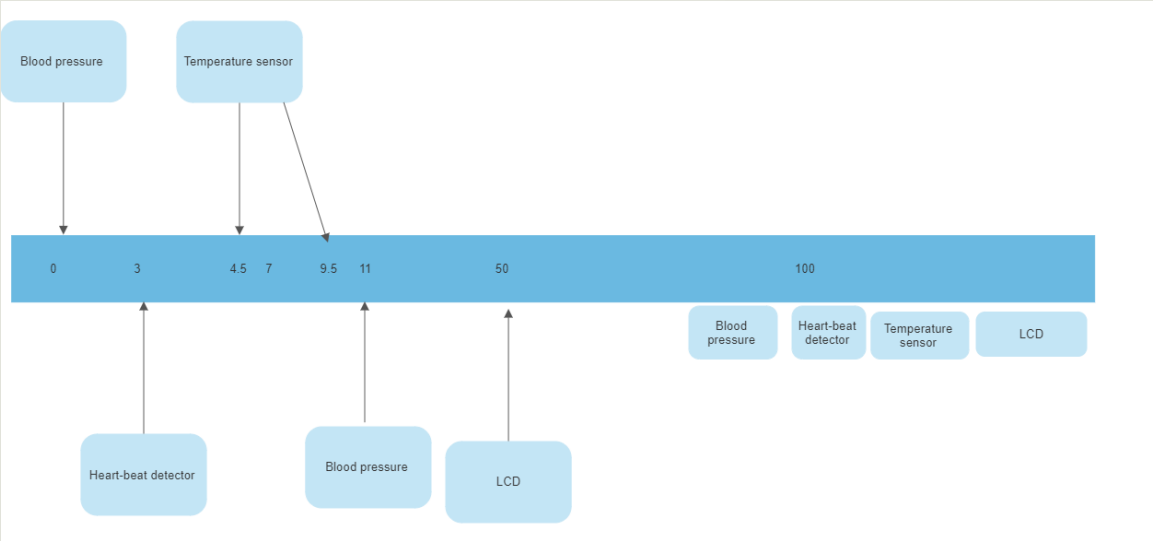
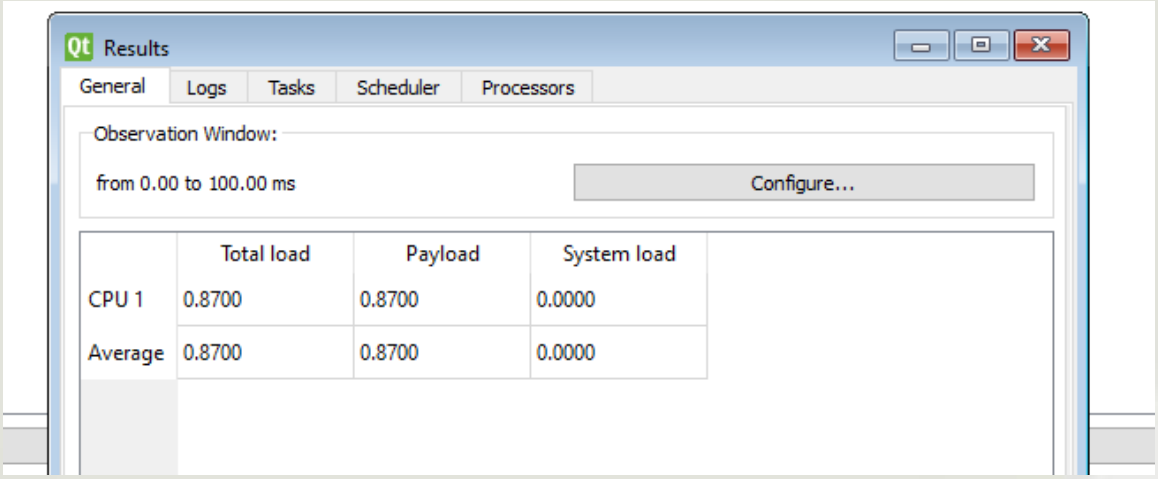
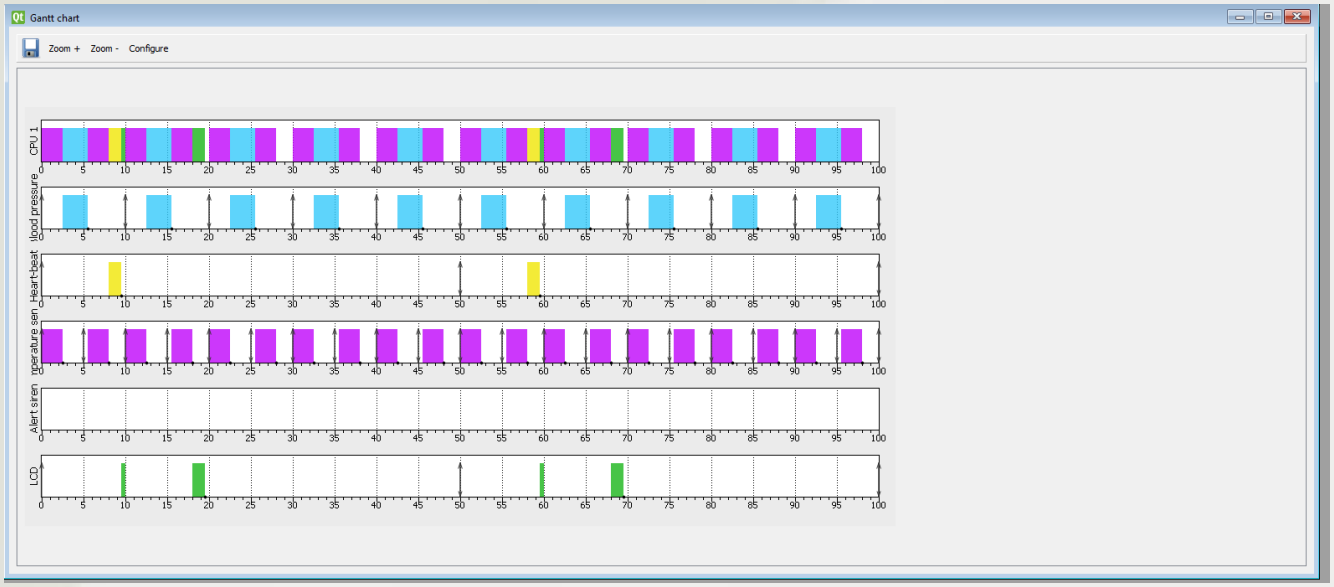
Timeline manually :



Simso Model :


Results
General
Logs
Tasks
Scheduler
Processors
Observation Window:
from 0.00 to 100.00 ms
Configure...
Total load
Payload
System load
CPU 1
0.8700
0.8700
0.0000
Average
0.8700
0.8700
0.0000


Gantt chart
Zoom +
Zoom -
Configure
CPU 1
Heart-beat
Alert siren
LCD

Comments on the results and analysis:

* The simulation verifies the same output as the analytical calculations CPU load=87%

* it’s already obvious that the system is heavily loaded!

* The system is schedulable as no task has missed its deadline.

* The Alert siren task is suspended upon event (as getting threshold value reading from the sensors)