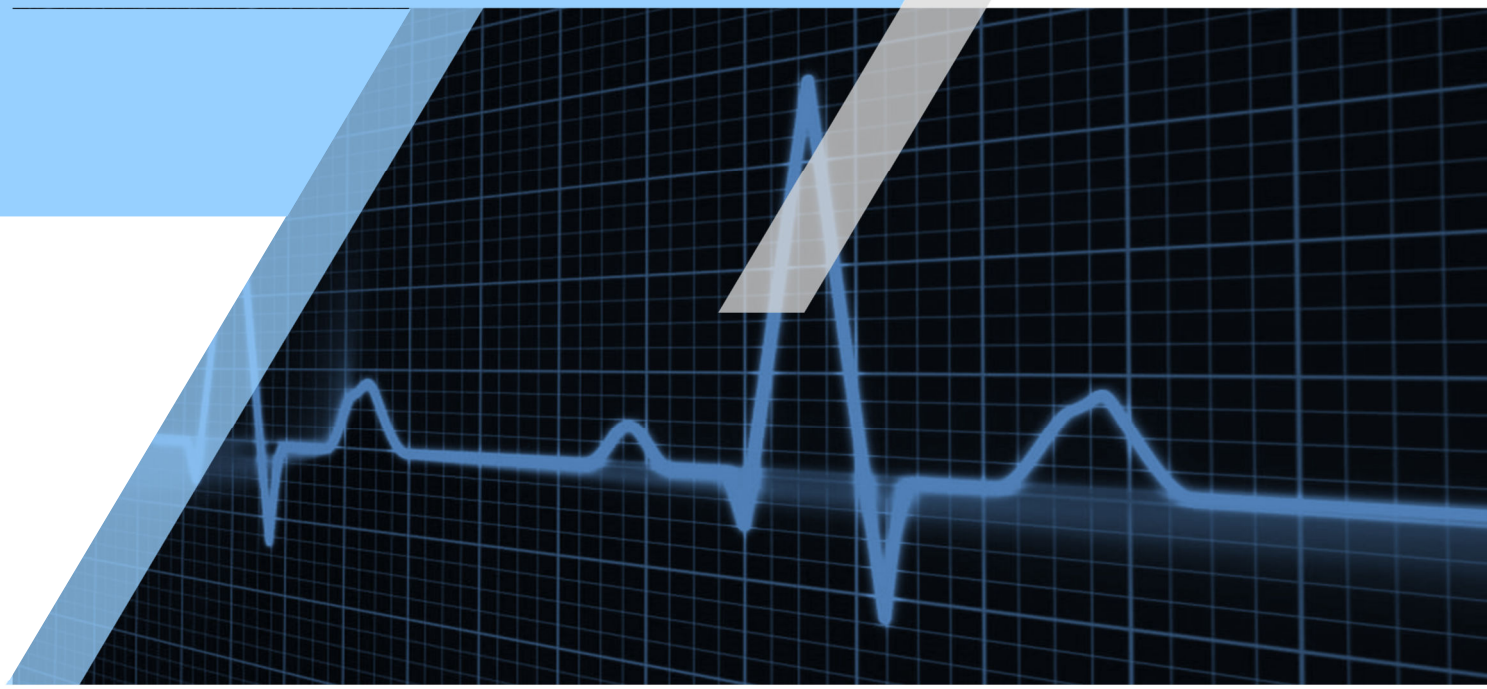
Sprints

RTOS – Design

Healthcare system Design



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System Analysis

Requirements

Required to design a healthcare system using RTOS, consisting of a touch LCD connected with UART, Blood pressure sensor, heart beat detector, temperature sensor and an alert siren.

Tasks Layout

Task	Display	Comm	Heartbeat	BPS	Temper.	Siren
Type	Periodic	Periodic	Periodic	Periodic	Periodic	Sporadic (critical)
Periodicity (ms)	100	25	50	10	5	on evt.
Execution (ms)	1	2	1.5	3	2.5	1
Deadline (ms)	100	25	50	10	5	5
Priority (red: highest)	1	2	3	4	5	6

Calculations

System Tick

$$Rule: Systick > \ total\ tasks\ execution\ time$$

$$\boldsymbol{Total\ tasks\ (e)\ time = 1 + 2 + 1.5 + 3 + 2.5 + 1 = 11\ ms}$$

$$\therefore \text{Systick} = 12 \text{ ms}$$

Hyperperiod

$$\boldsymbol{Hyperperiod = LCM(Pi) = LCM(5, 10, 25, 50, 100) = 100ms}$$

CPU Load

$$\boldsymbol{CPU\ Load = \frac{Req}{Capacity} = \frac{\sum(e_i)\ per\ period}{Hyperperiod}}$$

$$= \frac{\boldsymbol{1 + (2 * 4) + (1.5 * 2) + (3 * 10) + (2.5 * 20) + (1n_{siren})}}{\boldsymbol{100}}$$

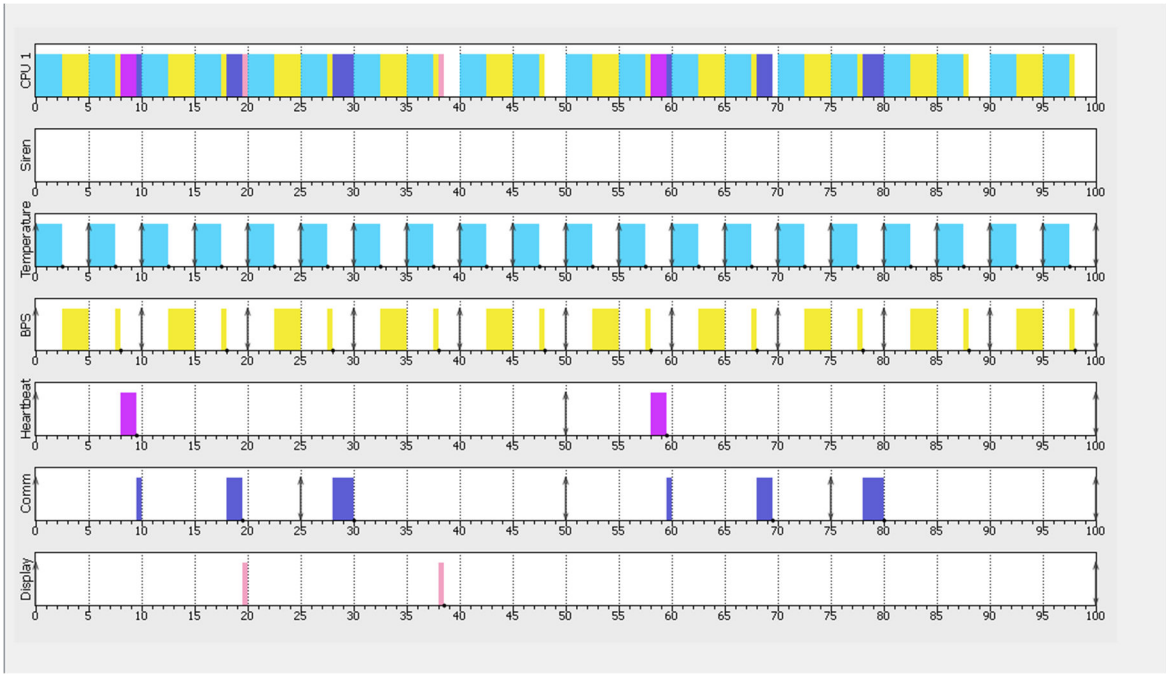
$$= \boldsymbol{92\%\ \ (+ 1n\%)_{siren\ task}}$$

Notes:

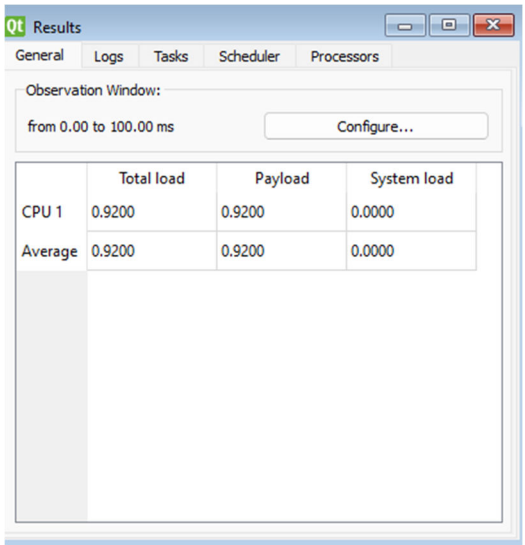
The assistance of the SimSo model is necessary for predicting system schedulability, given the periodicity of the temperature sensor task (5ms) and its execution time (2.5ms). Manual handling of this task would overcrowd the timeline and complicate visualization. However, excluding this particular task, it becomes evident that the system is schedulable. By employing appropriate prioritization decisions, the system can effectively accommodate the temperature sensor task without compromising the deadlines of other tasks.

SimSo Model

SimSo Results



CPU Load



Response Time / deadlines assurance

Response time:

Task	min	avg	max	std dev
Siren				
Temperature	2.500	2.500	2.500	0.000
BPS	8.000	8.000	8.000	0.000
Heartbeat	9.500	9.500	9.500	0.000
Comm	5.000	12.250	19.500	7.250
Display	38.500	38.500	38.500	0.000