Designing a real-time system

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This document is mainly a design for a simple system based on free RTOS.

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System description:

Designing a healthcare system using free RTOS, The system mainly consists of set of components (tasks) each one will be described individually below:

Task 1: Periodically read commands from the touch LCD via UART which configured to baud rate (speed) of 9600 bps, the execution time 2 ms.

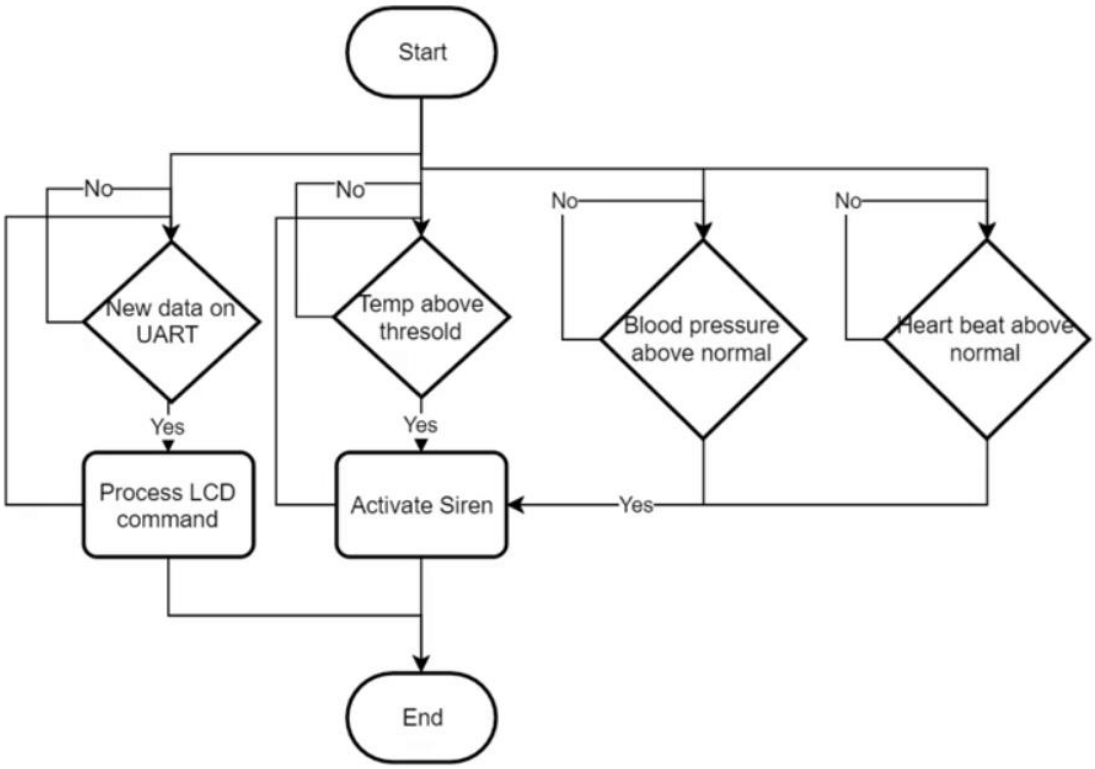
Task 2: Periodically read blood pressure sensor which has refresh rate every 25ms, the execution time 3 ms.

Task 3: Periodically read heart beat sensor which has new data every 100ms, the execution time 1.5 ms.

Task 4: Periodically receive data from the temperature sensor which has new data every 10ms, the execution time 2.5 ms.

Task 5: Based on the readings from other tasks the system will decide to activate or deactivate the alert siren, execution time is 1 ms.

System flow chart:



Tasks in details:

Task	Type	Periodicity	Execution time	Deadline	priority
Touch LCD	Periodic	100	2	100	1
Blood pressure	Periodic	10	3	10	2
Heart beat	Periodic	50	1.5	50	3
Temp. sensor	Periodic	5	2.5	5	4
Alert siren	Event based	--	1	100	5

System calculations:

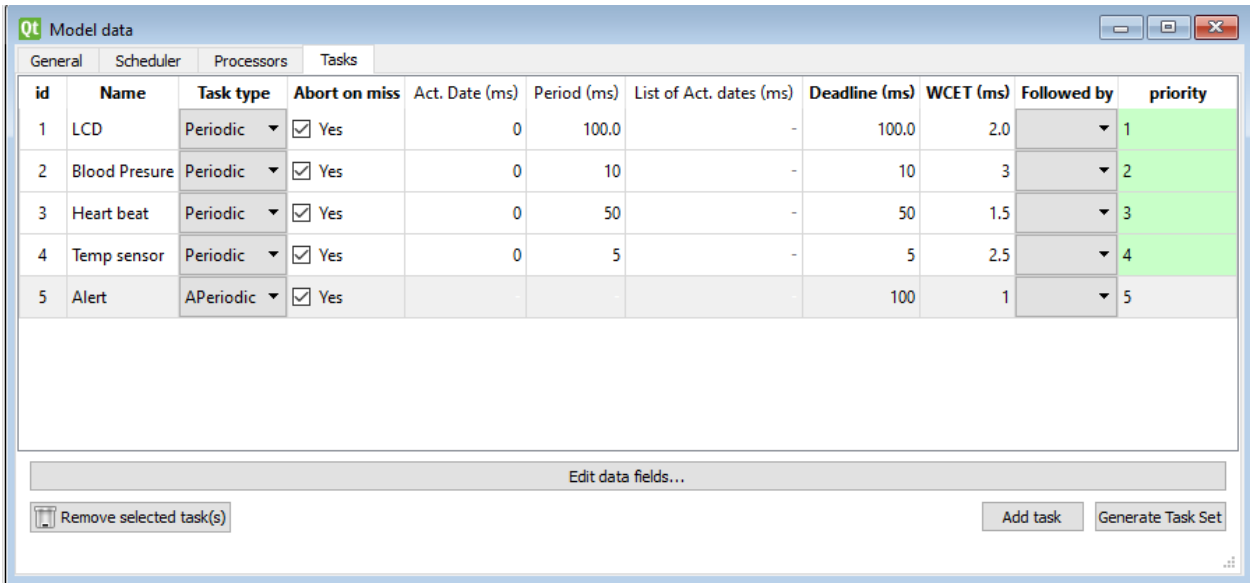
1- Hyper period (LCM) = 100 msec.
2- CPU load = [(2*1) + (3*10) + (1.5*2) + (2.5*20)] / 100 = 0.85 (85%)

Comment: 1- The CPU load is suitable as it's 85% with the ability to add the event based task (alert siren) without failures.

2- The periodicities of each task follows Nequest equation (sampling rate >= 2*F).

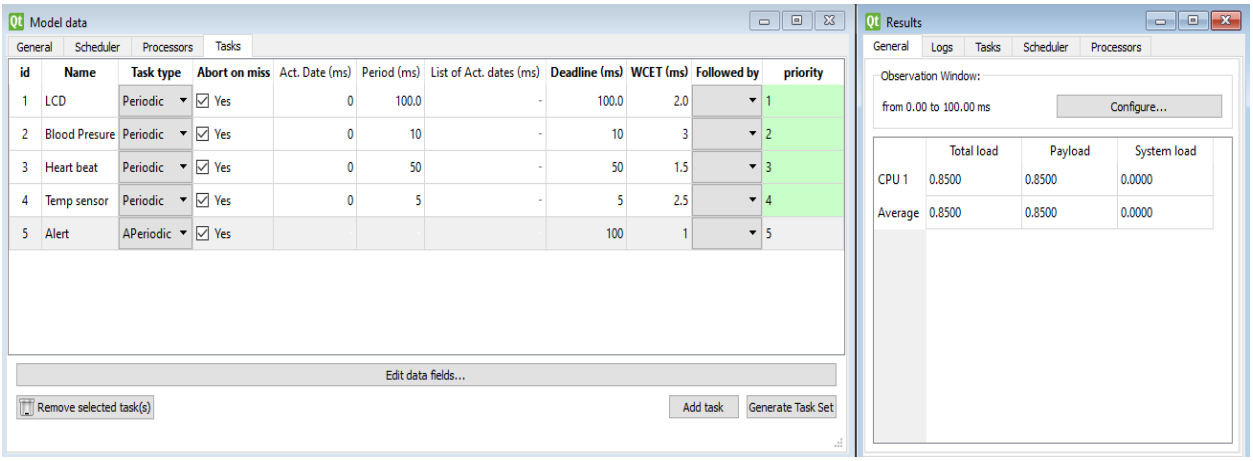
SimSO Figures:

1- Adding tasks



id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by	priority
1	LCD	Periodic	Yes	0	100.0	-	100.0	2.0		1
2	Blood Presure	Periodic	Yes	0	10	-	10	3		2
3	Heart beat	Periodic	Yes	0	50	-	50	1.5		3
4	Temp sensor	Periodic	Yes	0	5	-	5	2.5		4
5	Alert	APeriodic	Yes				100	1		5

2- CPU load



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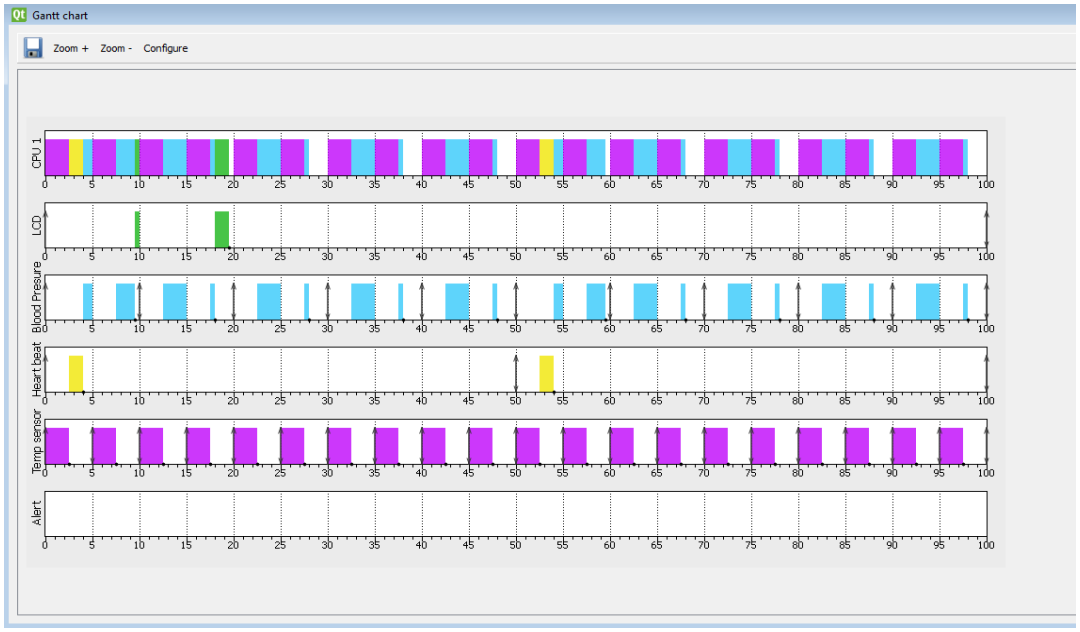
2	Blood Presure	Periodic	Yes	0	10	-	10	3		2
3	Heart beat	Periodic	Yes	0	50	-	50	1.5		3
4	Temp sensor	Periodic	Yes	0	5	-	5	2.5		4
5	Alert	APeriodic	Yes				100	1		5

	Total load	Payload	System load
CPU 1	0.8500	0.8500	0.0000
Average	0.8500	0.8500	0.0000

3- Time line



Comment: Simso shows that tasks are schedulable and also the calculated CPU_load is similar to the manual calculated CPU_load.