

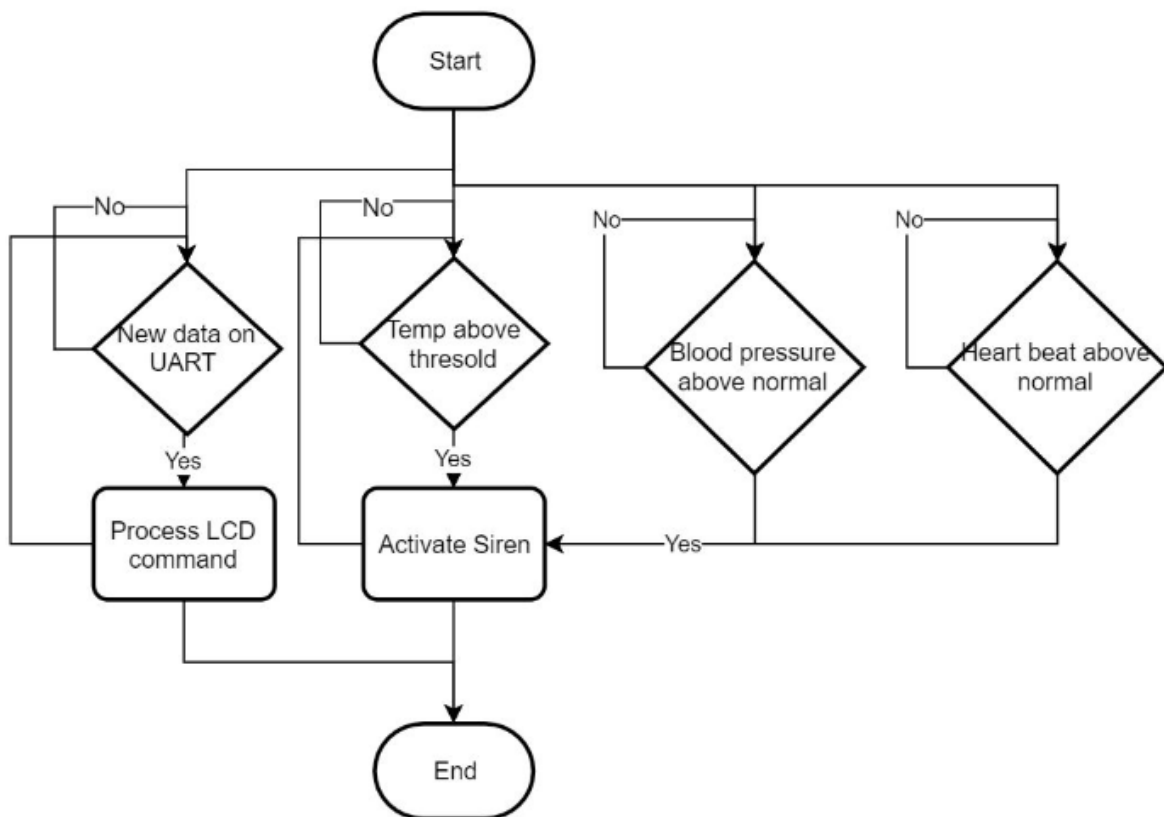
Free RTOS MasterClass

Week3 Task

Designing a Real Time System

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System Flowchart:



Hand Analysis:

I decided to implement the system into 5 tasks. The total information of all the tasks are given in the table provided next

Task Number	Task Name	Periodicity (P)	Execution time (e)	Deadline (D)	Priority (Pr)
1	Display Task (LCD and UART)	100ms	2ms	100ms	0
2	Blood Pressure Sensor Task	25ms	3ms	25ms	0
3	Heart Beat Detector Task	50ms	1.5ms	50ms	0
4	Temperature Sensor Task	10ms	2.5ms	10ms	0
5	Alert Siren Task	10ms	1ms	10ms	0

From the previous Table we can conclude the following:

Total Execution Time = 2 + 3 + 1.5 + 2.5 + 1 = 10ms

Hyperperiod = LCM {100, 25, 50, 10, 10} = 100ms

CPU Load = $\frac{2+(3*4)+(1.5*2)+(2.5*10)+(1*10)}{100} = 52\%$

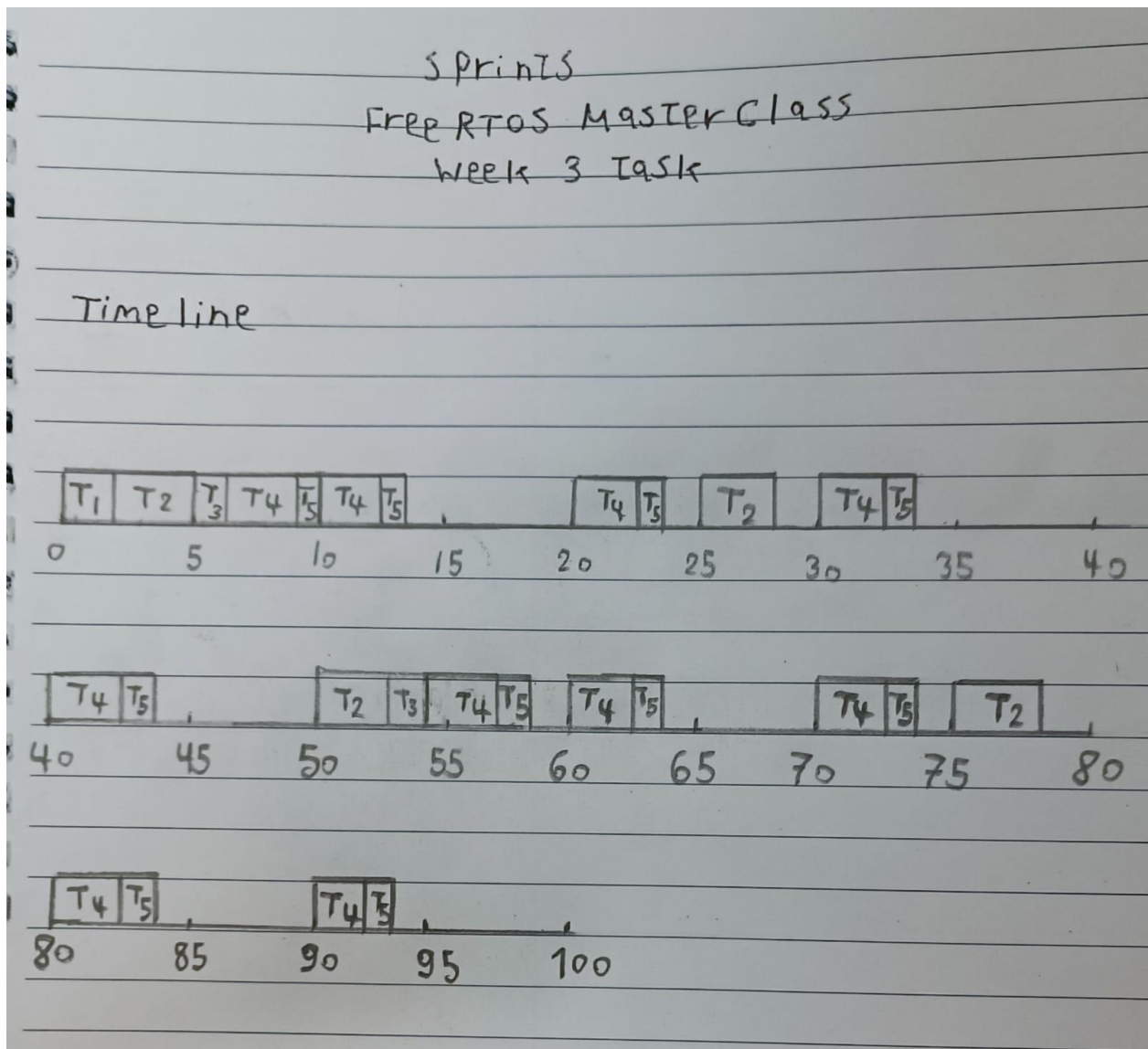
Then I set the system tick as follows:

Systick Time = 5ms

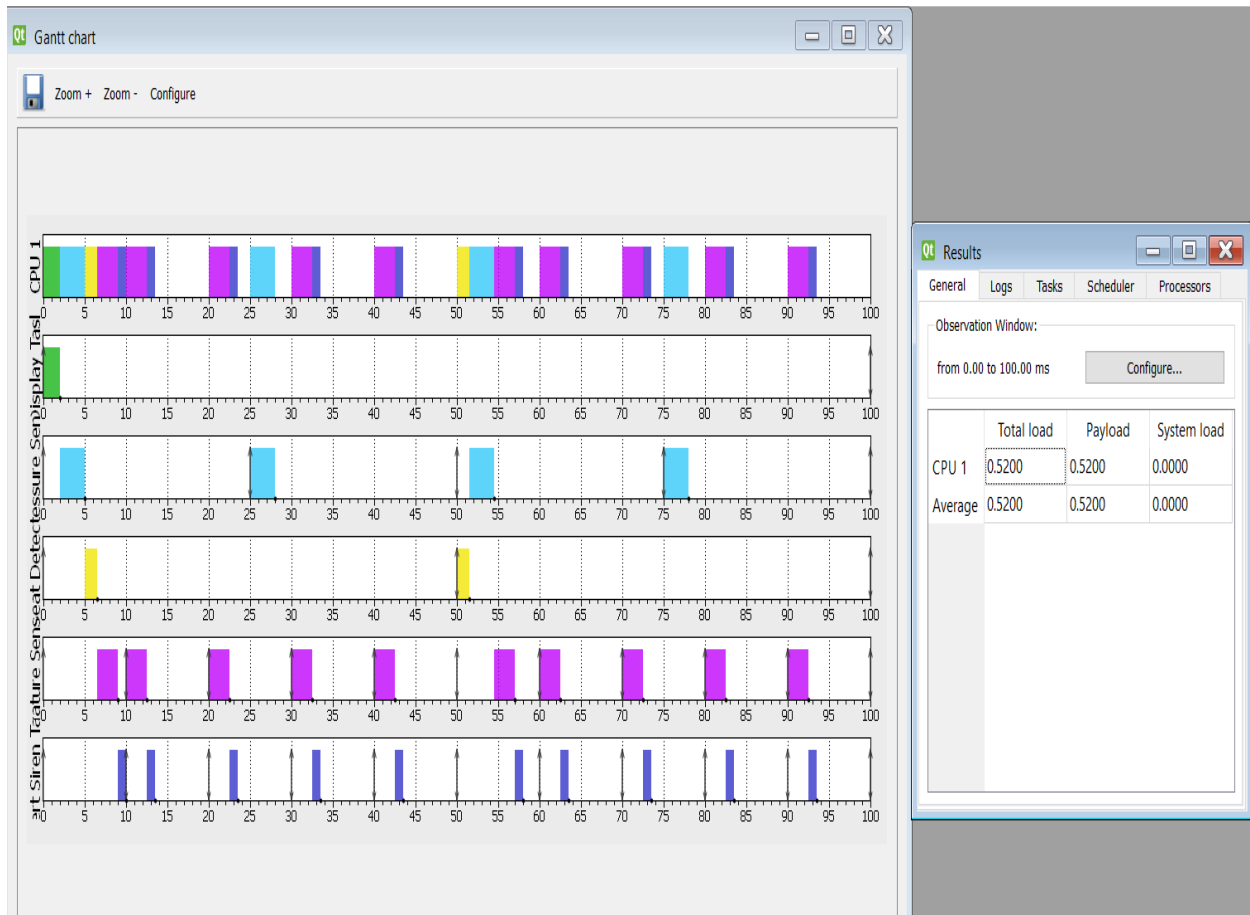
Notes:

- There were no requirements on Deadline of Tasks so I set the deadline of each task to be the same as their periodicity
- I choose the SysTick Time to be equal to 5ms so all the tasks can be performed within their deadline
- All the tasks are given the same priority as the system is non preemptive
- The scheduling technique used is Fixed Priority Scheduling

Timeline:



Simulation using Simso:



Comments:

- The system is schedulable as no task misses its deadline.
- The simulation results agree with the hand analysis done before.
- The System is considered healthy as the CPU load is reasonable (52 %).
- The Heart Beat Detector Task periodicity was chosen this way because it is considered a safety critical task.
- The Siren Alert Task periodicity was chosen this way so it can keep up with any updates provided by any of the other tasks.