EDF Scheduler Implementation in FreeRTOS

By:

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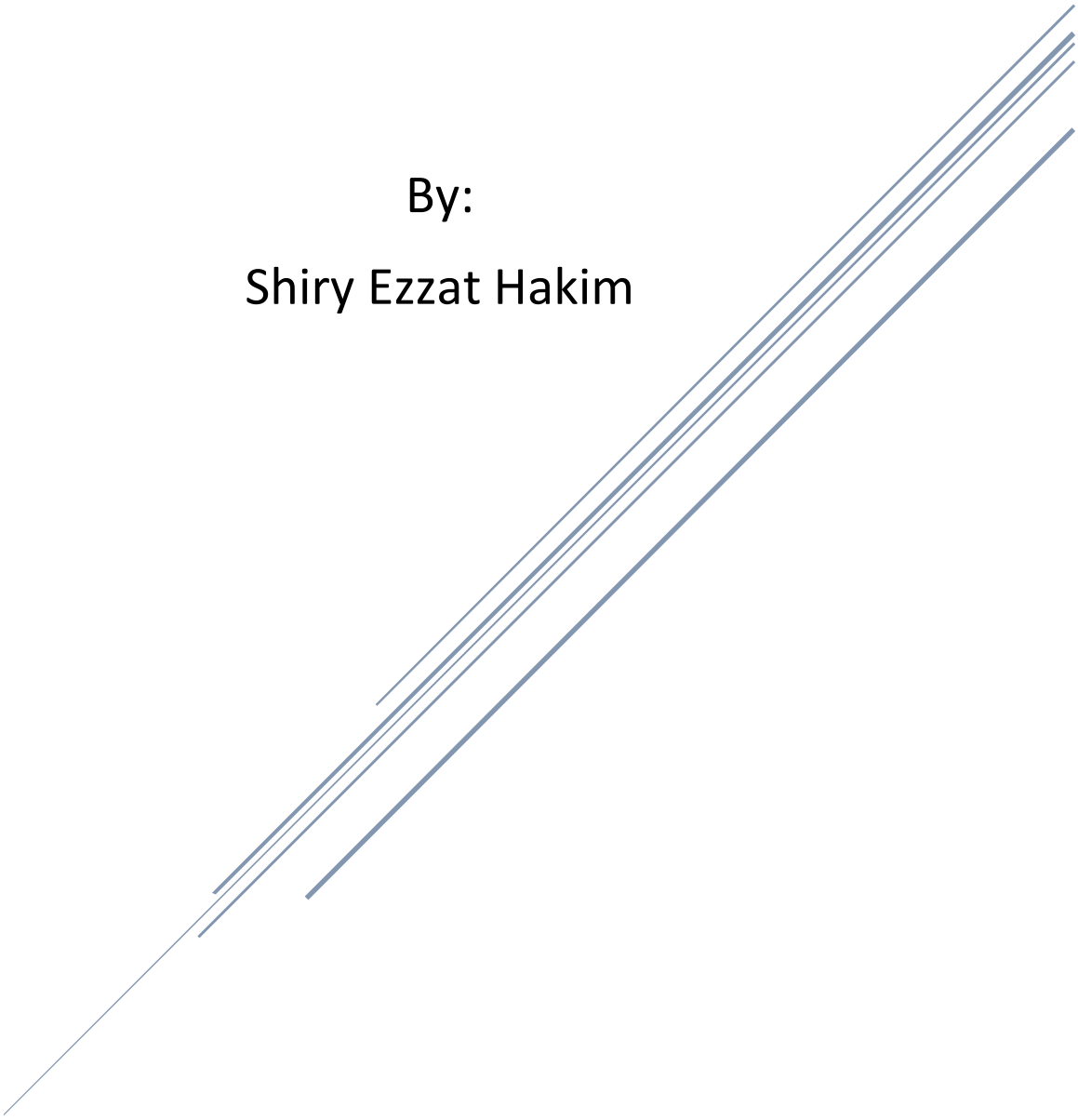


Tasks:

Task 1: ""Button_1_Monitor"", {Periodicity: 50, Deadline: 50}

Task 2: ""Button_2_Monitor"", {Periodicity: 50, Deadline: 50}

Task 3: ""Periodic_Transmitter"", {Periodicity: 100, Deadline: 100}

Task 4: ""Uart_Receiver"", {Periodicity: 20, Deadline: 20}

Task 5: ""Load_1_Simulation"", {Periodicity: 10, Deadline: 10}, Execution time: 5ms

Task 6: ""Load_2_Simulation"", {Periodicity: 100, Deadline: 100}, Execution time: 12ms

1. Using analytical methods calculate the following for the given set of tasks:

- Hyperperiod = 100ms
- CPU load = (0.015/50) + (0.015/50) + (0.015/20) + (0.15/100) + (5/10) + (12/100) = 62.3%
- Check system schedulability using URM and time demand analysis techniques:

URM:

$$U = \sum_{i=1}^{n} \frac{C_i}{P_i} \leq n(2^{\frac{1}{n}} - 1)$$

U = Total Utilization
C = Execution time
P = Periodicity
N = Number of tasks

L.H.S (U) = CPU load = 0.62285
R.H.S (URM) = n ($2^{\frac{1}{n}}$ -1) = 6 ($2^{\frac{1}{6}}$ -1) = 0.73477

Since, U < URM
Therefore, The system is Schedulable.

Time Demand Analysis:

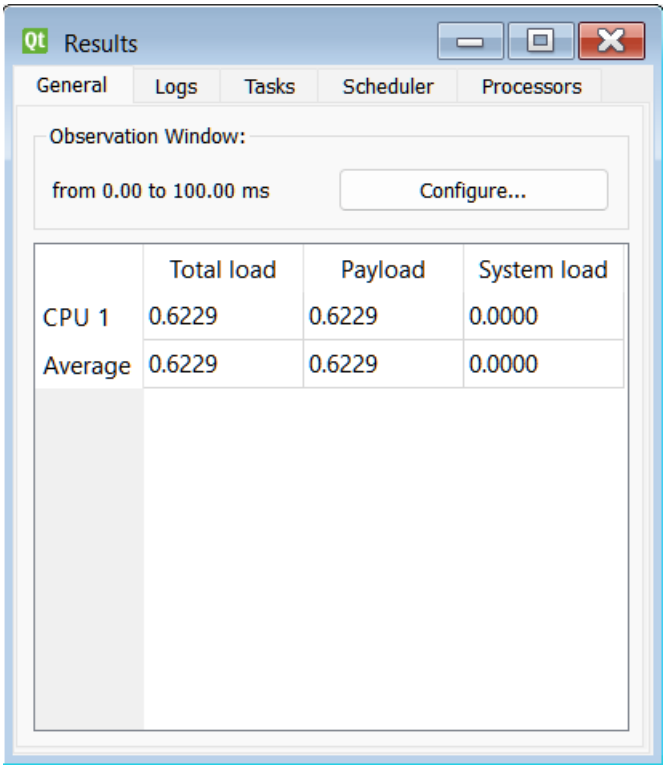
$$w_i(t) = e_i + \sum_{k=1}^{i-1} \left\lceil \frac{t}{p_k} \right\rceil e_k \quad for\ 0 < t \le p_i$$

W = Worst response time
E = Execution time
P = Periodicity
T = Time instance

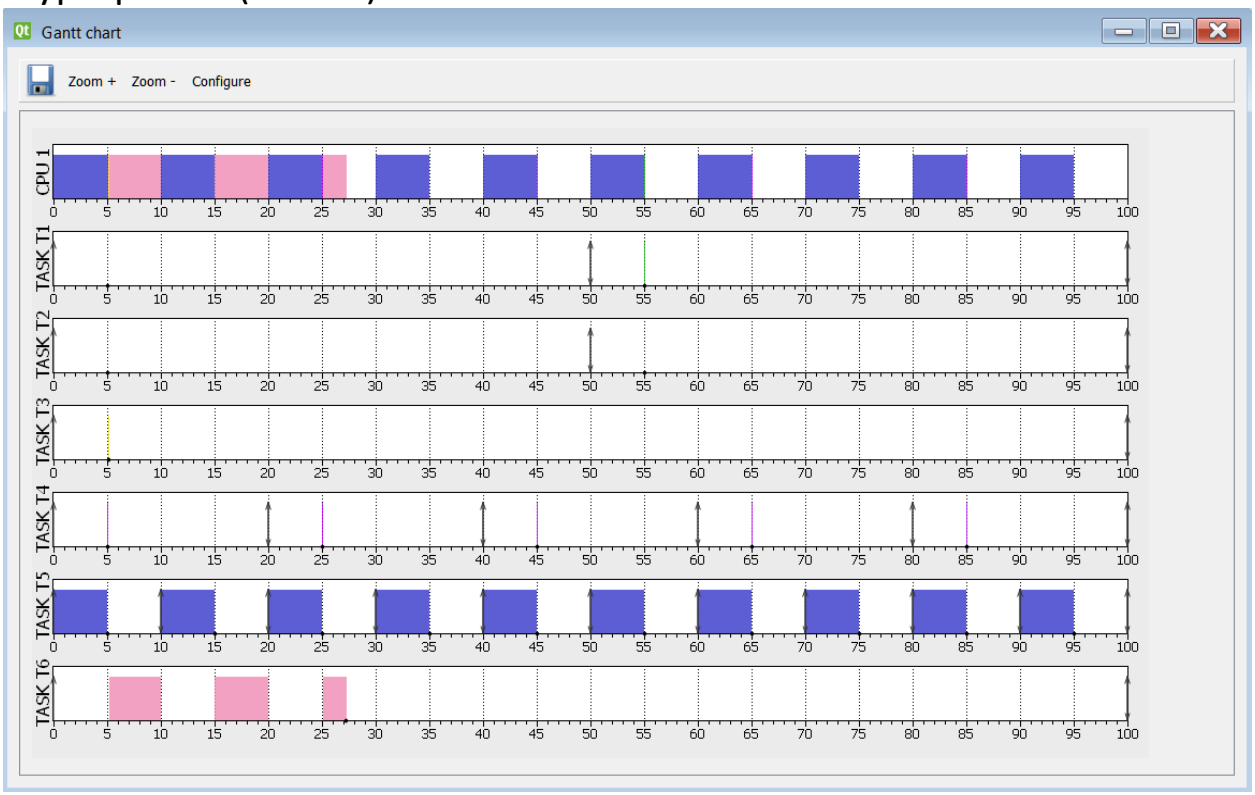
Load1:	$W_5(10) = 5 + 0 = 5$	<10
UART:	$W_4(20) = 0.015 + (20/10) * 5 = 10.015$	<20
BTN1 & BTN2:	$W_{1,2}(50) = 0.015 * 2 + (50/20) * 0.015 + (50/10) * 5 = 25.0675$	<50
Load2 & periodic:	$W_{3,6}(100) = 0.15 + 12 + (100/50)*0.015 + (100/50)*0.015 + (100/20)*0.015 + (100/10) * 5 = 62.285$	<100

Therefore, The system is Schedulable.

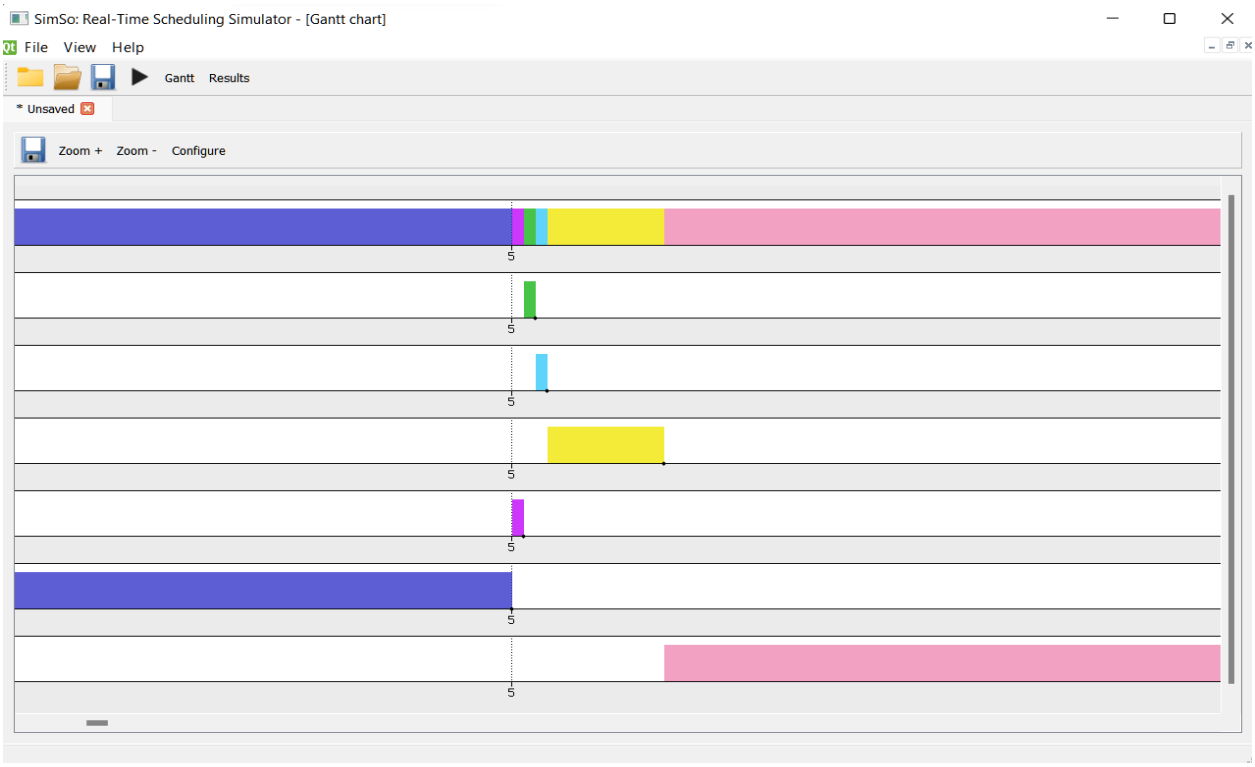
2. Using Simso offline simulator, simulate the given set of tasks assuming:



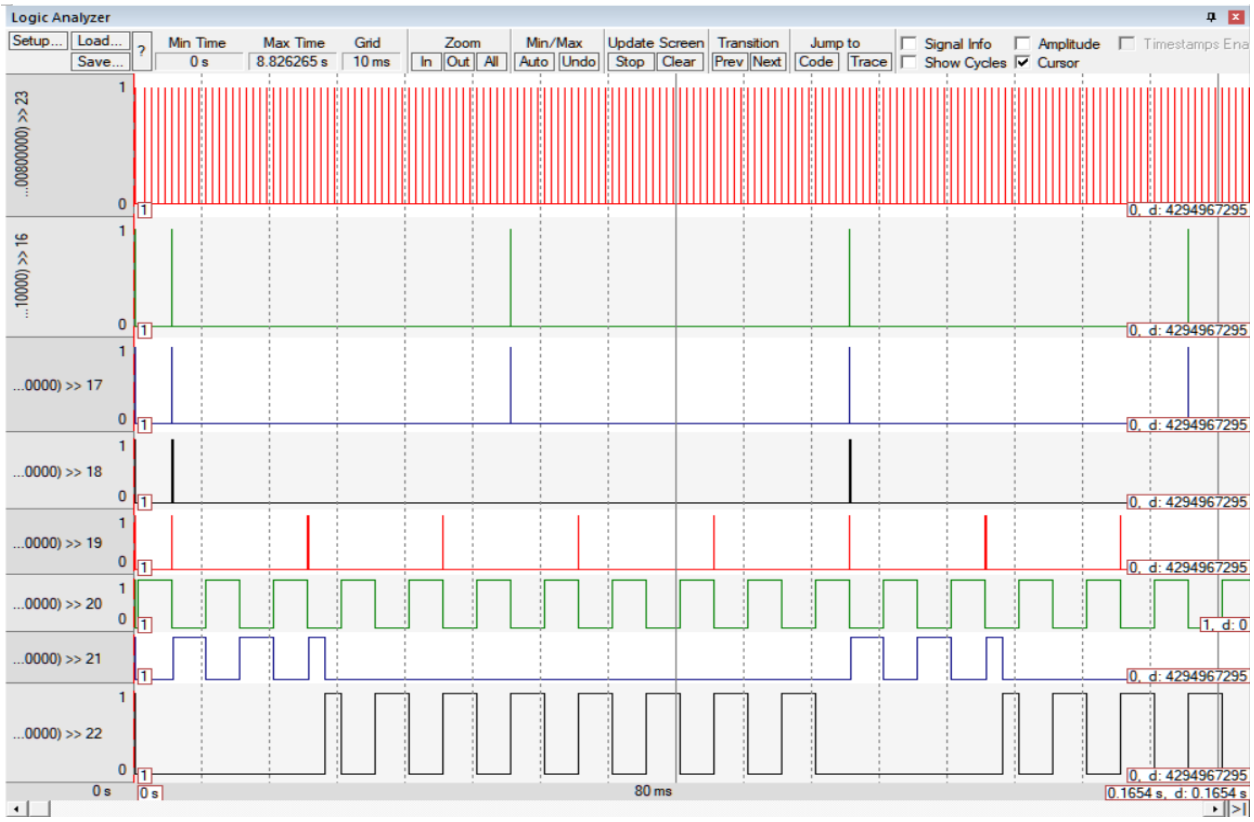
Hyperperiod (100ms):



Zoom(5ms):



Hyperperiod (100ms):



Zoom(5ms):