Real-Time Operating System Project

Implementing EDF Scheduler Report

And verifying the system implementation

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Verifies system implementation with the EDF (Earliest Deadline First) scheduler using:

1.using analytical methods:

A- System Hyperperiod:

Task	Periodicity
Button 1 Monitor	50
Button 2 Monitor	50
Periodic Transmitter	100
UART Transmitter	20
Load 1 Simulation	10
Load 2 Simulation	100

$Hyperperiod$ = Least Common Multiplier of all tasks periodicities
$Hyperperiod = LCM$ (50, 50, 100, 20, 10, 100)
$Hyperperiod$ = 100

B- CPU Load:

Task	Execution Time	Occurrence During Hyperperiod
Button 1 Monitor	29 us	2
Button 2 Monitor	29 us	2
Periodic Transmitter	93 us	1
UART Transmitter	30 us	5
Load 1 Simulation	5 ms	10
Load 2 Simulation	12 ms	1

Utilization = Total Execution Time During Hyperperiod / Hyperperiod

$U = [(29u*2)+(29u*2)+(93u*1)+(30u*5)+(5^{m}*10)+(12^{m}*1) / 100m] * 100\% = 62\%$

C- System Schedulability:

- Using Rate Monotonic Utilization Bound

$$U \leq n[\, 2\,\hat{}\,(1/n) - 1]$$

U = 0.623 && Urm = 0.734

Therefore U < Urm --> The system is feasible (Schedulable).

- Using Time Demand Analysis

$$Wi(t) = ei + \sum_{k=0}^{i-1} \left[\frac{t}{Pk}\right]ek$$

In our case, critical instant = 100ms

Task	Periodicity	Execution Time
Button 1 Monitor	50	29 us
Button 2 Monitor	50	29 us
Periodic Transmitter	100	93 us
UART Transmitter	20	30 us
Load 1 Simulation	10	5 ms
Load 2 Simulation	100	12 ms

For Task 1: Button 1 Monitor (E: 29us, P: 50ms, Provided Time=50ms)
w_3 (50) = 29µ + (50/10) $5m$ + (50/20) 30µ = 25. 059 ms , w (50) = 25. 059 < 50
Therefore, Button 1 Monitor task is schedulable

For Task 2: Button 2 Monitor (E: 29us, P: 50ms, Provided Time=50ms)
w_4 (50) = 29µ + (50/10) $5m$ + (50/20) 30µ + (50/50)29µ = 25. 087 ms w (50) = 25. 087 < 50
Therefore, Button 2 Monitor task is schedulable

For Task 5: Periodic Transmitter (E: 93 us , P: 100ms, Provided Time=100ms)

$w_5(100) = 93\mu + (100/10)\ 5m + (100/20)\ 30\mu + (100/50)29\mu + (100/50)29\mu = 50.359\ ms\ w(100)$
$= 50.359 < 100$

<u>Therefore,</u> Periodic Transmitter task is schedulable.

For <u>Task</u> <u>4:</u> UART Receiver (E: 30us, P: 20ms, Provided Time=20ms)
$w_2(20) = 30\mu + (20/10)\ 5m = 10.03\ ms,\ w(20) = 10.03 < 20$

Therefore, UART Receiver task is schedulable.

For <u>Task</u> <u>3:</u> Load 1 Simulation (E: 5ms, P: 10ms, Provided Time=10ms)
$w_1(10) = 5m + 0 = 5,\ w(10) = 5 < 10$

Therefore, Load 1 Simulation task is schedulable.

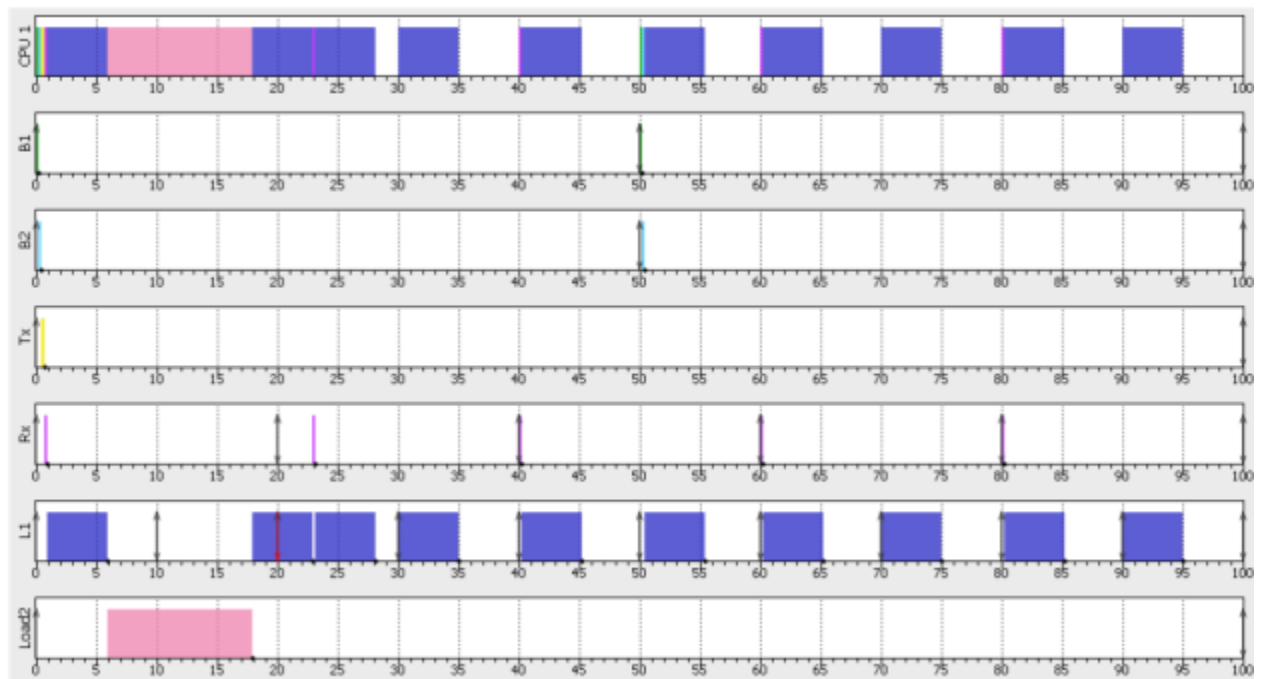**For <u>Task</u> <u>6</u> :** Load 2 Simulation (E: 12ms , P: 100ms, Provided Time=100ms)
$w_6(100) = 12m + (100/10)5m + (100/20)30\mu + (100/50)29\mu + (100/50)29\mu + (100/100)93\mu$
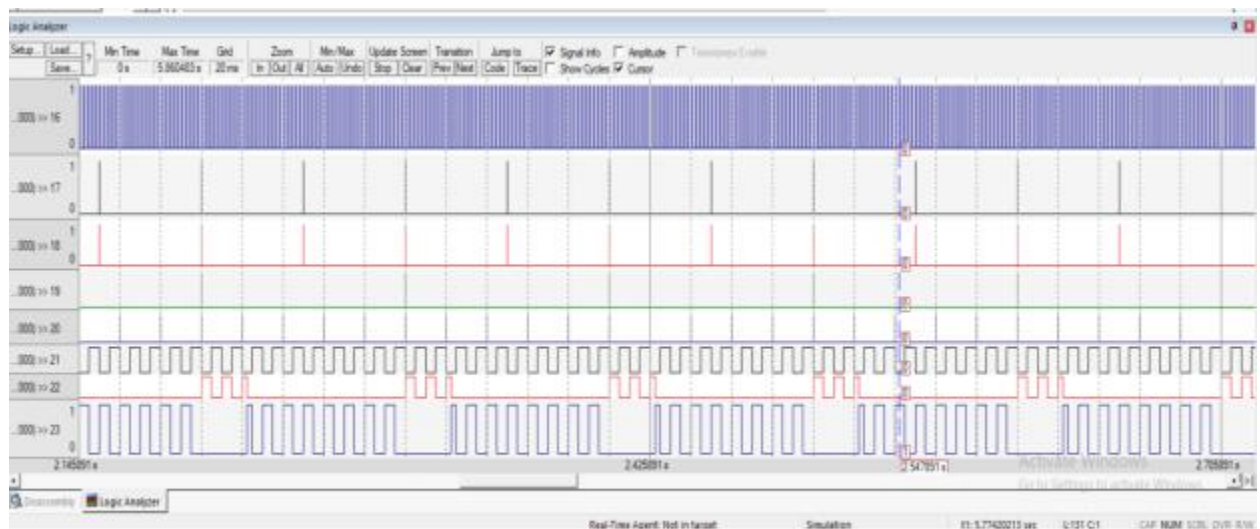$w(100) = 62.452 < 100$

Therefore, Load 2 Simulation Task is schedulable.

((<u>System</u> <u>is</u> <u>Schedulable</u>))

2. SIMSO Offline Simulator

3. Kiel Simulator

Watch 1

Name	Value	Type
L1_inTime	0x0013570F	uint
L2_inTime	0x0013526B	uint
Rx_inTime	0x00135713	uint
Tx_inTime	0x00134DBD	uint
cpu_load	63	uint
total_exeTime	0x000C37D2	uint
T1TC	0x001357C0	ulong
<Enter expression>		