EDF Scheduler Implementation with FreeRTOS

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Contents

1. Analytical Calculations

Hyperperiod:

Task	Periodicity
Btn1	50
Btn2	50
Tx	100
Rx	20
Ld1	10
Ld2	100

Hyperperiod = LCM (50,50,100,20,10,100)

Hyperperiod = 100 ms

CPU Load

Task	Periodicity	Execution Time	Occurrence Over Hyperperiod	Deadline
Btn1	50	24.3 us	2	50
Btn2	50	24.3us	2	50
Tx	100	90.1 us	1	100
Rx	20	28 us	5	20
Ld1	10	5 ms	10	10
Ld2	100	12 ms	1	100

Utilization = Total Execution Time over Hyperperiod/Hyperperiod

$$U = \frac{(24.3\ us * 2) + (24.3\ us * 2) + 90.1\ us + (28\ us * 5) + (5\ m * 10) + 12\ ms}{100\ ms} \times 100\% = 62.32\%$$

System Schedulability

Rate Monotonic:

$$U \leq n(2^{\frac{1}{n}} - 1)$$

U=62.32%

n = 6

$$\therefore U_{rm} = 6 * \left(2^{\frac{1}{6}} - 1\right) = 0.7347$$

$$\therefore U < U_{rm}$$

Then, System is schedulable.

Time Demand Analysis

$$W_i = e_i + \sum_{k=1}^{i-1} \left\lceil \frac{t}{p_k} \right\rceil e_k$$

Where,
w: worst response time
e: execution time
t: time instance
P: periodicity
i: task number

also, the Worst case is 100 ms

Load 1 Simulation :(E: 5ms, P: 10ms, Deadline=10ms)
$w_1(10) = 5m + 0 = 5,\ w\ (10) = 5 < 10$
<div align="center">Therefore, Load 1 simulation is <u>*schedulable*</u></div>

Uart Receiver: (E: 28us, P: 20ms, Deadline=20ms)
$w_2(20) = = 28\ \mu\ + (20/10)\ 5m = 10.\ 028\ ms,\ w\ (20) = 10.\ 028 < 20$
<div align="center">Therefore, Uart Receiver is <u>*schedulable*</u></div>

Button 1 Monitor (E: 24.3us, P: 50ms, Deadline=50ms)
$w_3(50) = = 24.3\ \mu\ + (50/10)\ 5m + (50/20)\ 30\ \mu\ = 25.\ 099\ ms,\ w\ (50) = 25.\ 099 < 50$
<div align="center">Therefore, Button 1 Monitor is <u>*schedulable*</u></div>

Button 2 Monitor: (E: 24.3us, P: 50ms, Deadline=50ms)

$w_4(50) = 24.3\,\mu + (50/10)\ 5m + (50/20)\ 30\,\mu + (50/50)29\,\mu = 25.\ 128\ ms$

$w\ (50) = 25.\ 128 < 50$

Therefore, Button 2 Monitor is *schedulable*

Periodic Transmitter :(E: 90.1 us, P: 100ms, Deadline=100ms)

$w_5(100) = 90.1\,\mu + (100/10)\ 5m + (100/20)\ 30\,\mu + (100/50)29\,\mu + (100/50)29\,\mu = 50.\ 356\ ms$

$w\ (100) = 50.\ 356 < 100$

Therefore, Periodic Transmitter is *schedulable*

Load 2 Simulation: (E: 12ms, P: 100ms, Deadline=100ms)

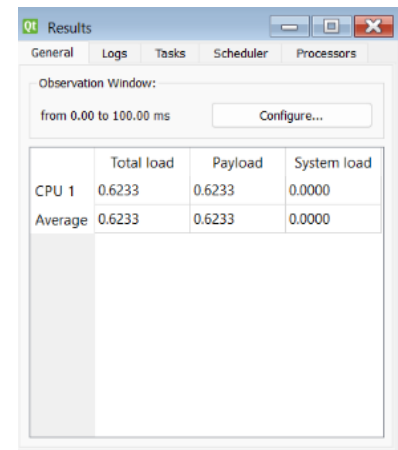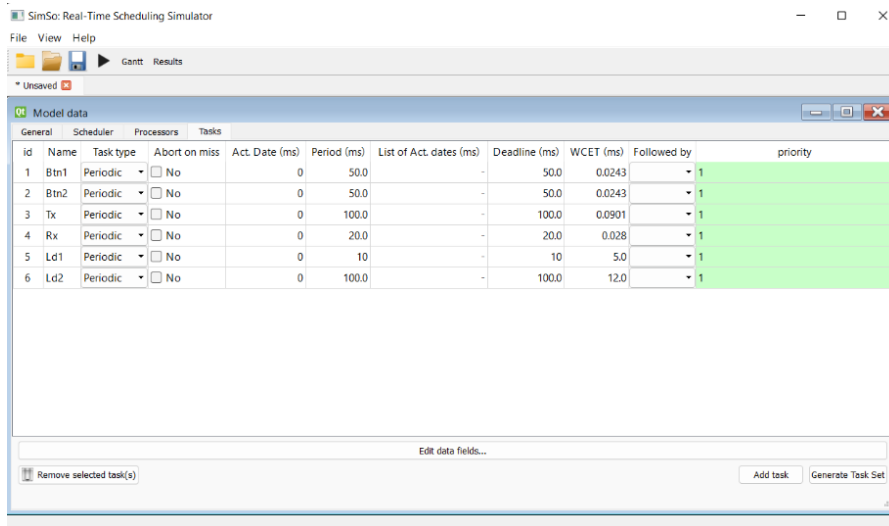$w_6(100) = 12m + (100/10)5m + (100/20)30\,\mu + (100/50)29\,\mu + (100/50)29\,\mu + (100/100)93\,\mu$

$w\ (100) = 62.\ 452 < 100$

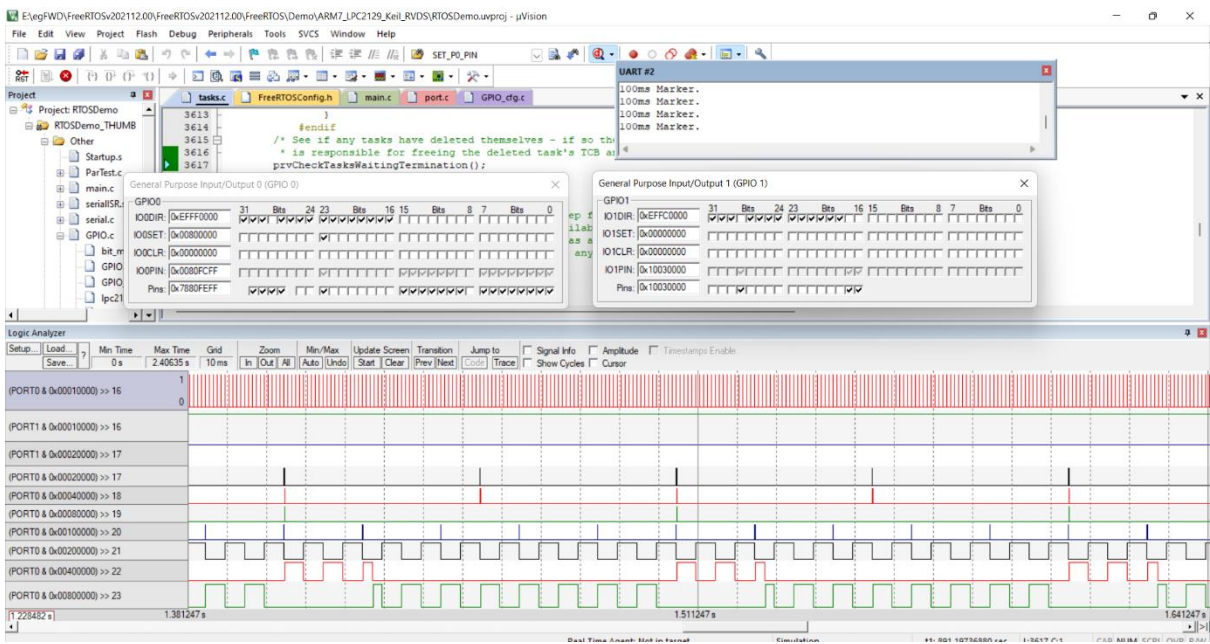Therefore, Load 2 Simulation is *schedulable*

So , System is schedulable

Screenshots

2. Simso:

3. Keil: