Scheduling using EDF (Project 2)

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The tasks that need to be implemented are the following according to the description:

Task	Button1	Button2	Trans_Uart	Receiv_Uart	1st load	2nd load
Periodicity	50 ms	50 ms	100 ms	20 ms	10 ms	100 ms
Deadline	50 ms	50 ms	100 ms	20 ms	10 ms	100 ms
Exec Time	30 us	30 us	90 us	145 us	5 ms	12 ms

- **Calculate the system hyperperiod:**
  The hyperperiod must be the largest among all tasks = 100 ms

- **Calculate the CPU load:**
  The cpu could be calculated as the total exec time / hyperperiod give..
  However the total execution time is = sum of exec time of each task * the number that it occurs in one hyperperiod:

  Thus :

  $$cpu\ load = \frac{2(30) + 2(30) + 1(90) + 5(145) + 10(5) + 1(12.5)}{100}$$

  $$= 0.63435 = 63.3\%$$

- **Check system schedulability using URM and time demand analysis techniques (Assuming the given set of tasks are scheduled using a fixed priority rate -monotonic scheduler):**
  1. Using URM:
     NB: The system will be schedulable if and only if it doesn't miss its deadline.

     Total utilization U = 0.634
     Which is less than $n\left(2^{\frac{1}{n}} - 1\right) = 6\left(2^{\frac{1}{6}} - 1\right) = 0.73477$
     Thus the system is schedulable where $U < n\left(2^{\frac{1}{n}} - 1\right)$

2. Using Time Demand:
   NB: The system will be scheduable if and only if the time provided is greater than the time required for each task

   Task 1 (Button1 Monitor):

   $$W = 30u + \left(\frac{50}{50}\right) * 30u + \left(\frac{50}{20}\right) * 145u = 26m$$

   26 is less than 50 thus deadline not violated

   Task 2 (Button2 Monitor):

   $$W = \left(\frac{50}{10}\right) * 5m + 30u + \left(\frac{50}{50}\right) * 30u + \left(\frac{50}{20}\right) * 145u = 25.3m$$

   25.3 is less than 50 thus deadline not violated

   Task 3 (UART receive):

   $$W = 140u + \left(\frac{20}{10}\right) * 5m = 10.1m$$

   10.1 is less than 20 thus deadline not violated

   Task 4 (UART transmit):

   $$W = 90 + \left(\frac{100}{50}\right) * 30u + \left(\frac{100}{50}\right) * 30u + \left(\frac{100}{20}\right) * 145u + \left(\frac{100}{10}\right) * 5m = 50.91m$$

   50.91 is less than 100 thus deadline not violated

   Task 5 (First Load):
   $$W = 5m$$

   5 is less than 10 thus deadline not violated

   Task 6 (Second Load):

   $$W = 12.5 + \left(\frac{100}{50}\right) * 30 + \left(\frac{100}{50}\right) * 30 + \left(\frac{100}{20}\right) * 145u + \left(\frac{100}{10}\right) * 5m + 90u = 63.5$$

   63.5 is less than 100 thus deadline not violated

Since none of the task violated the deadline , the overall system is scheduable.

- **Using simulators to calculate the real execution time :**
  1. **Using Sismo simulation tool:**

Model data

General | Scheduler | Processors | **Tasks**

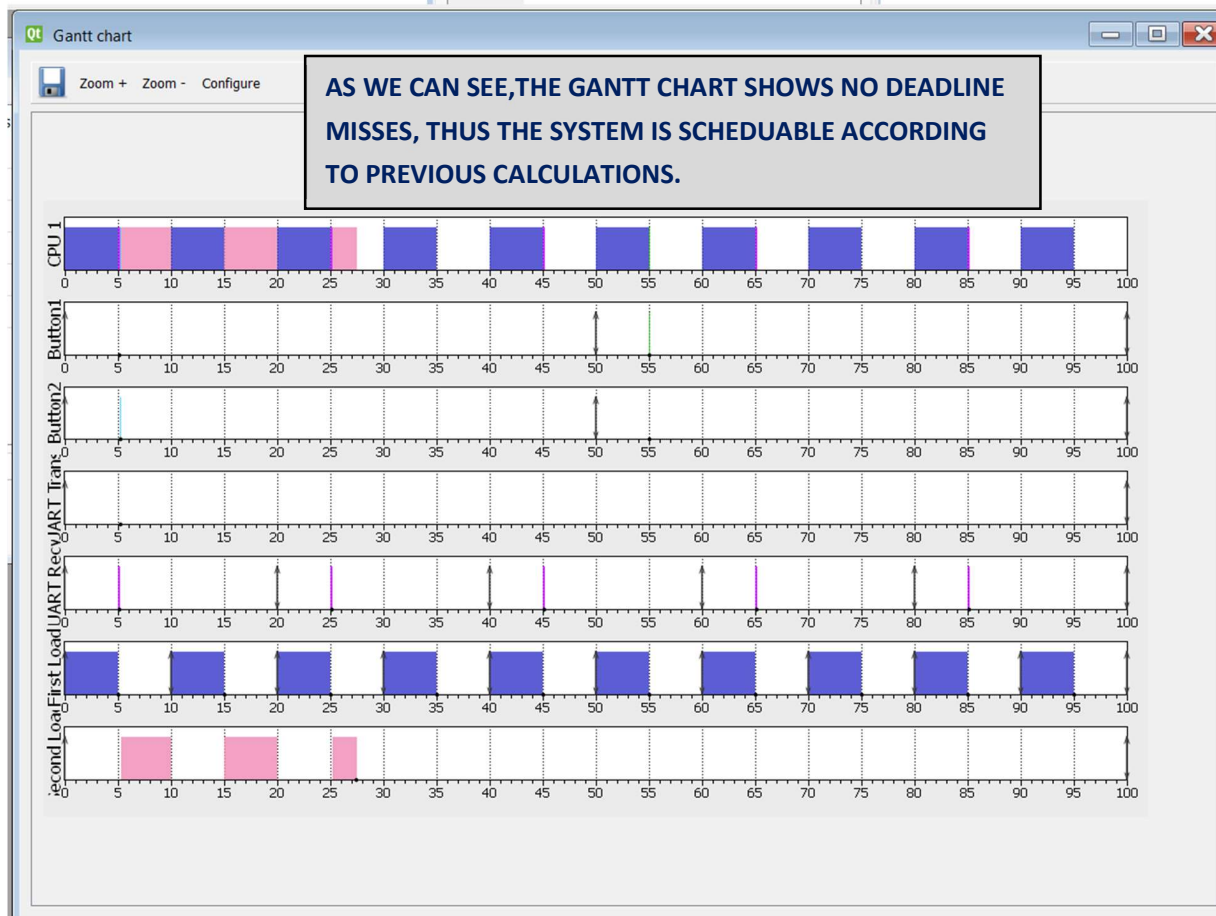| id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by
1	Button1	Periodic	☐ No	0	50	-	50	0.03	
2	Button2	Periodic	☐ No	0	50	-	50	0.03	
3	UART Trans	Periodic	☐ No	0	100	-	100	0.09	
4	UART Recv	Periodic	☐ No	0	20	-	20	0.145	
5	First Load	Periodic	☐ No	0	10	-	10	5	
6	Second Load	Periodic	☐ No	0	100	-	100	12	

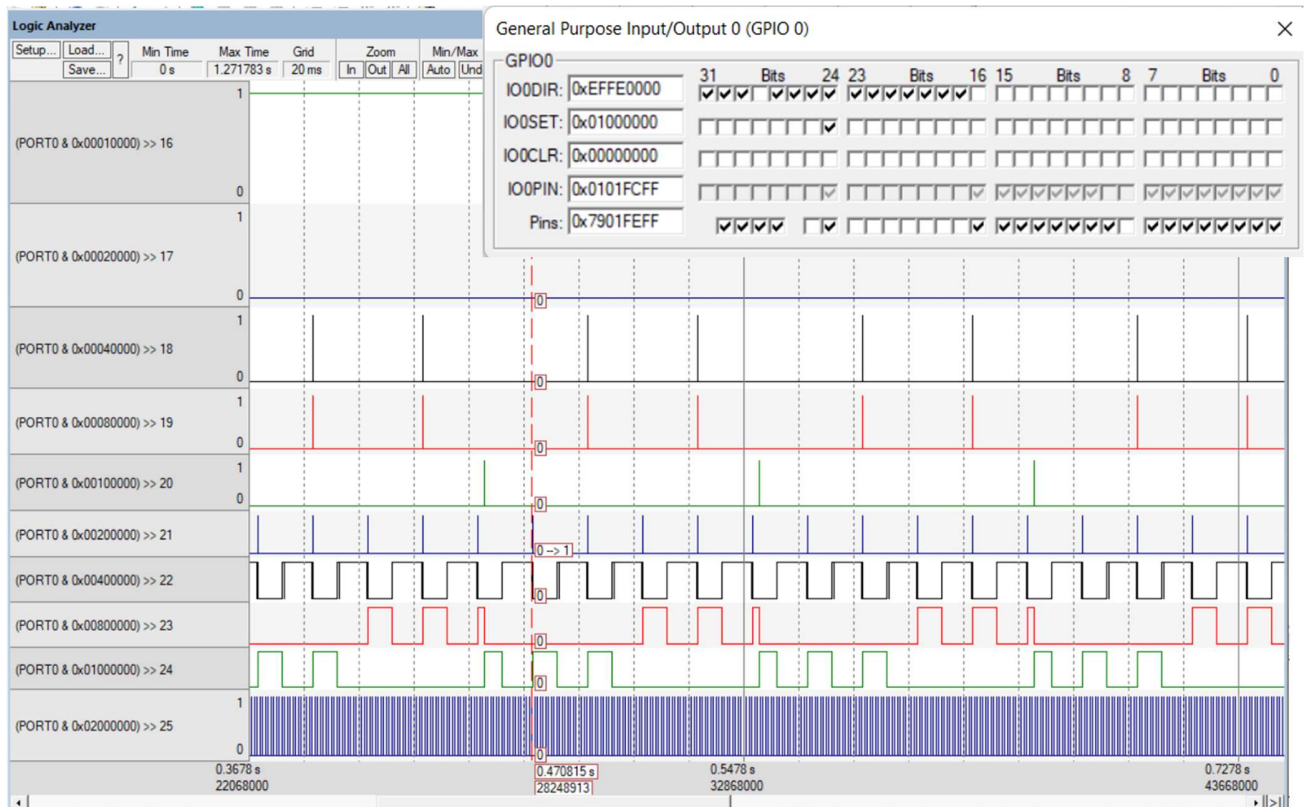Remove selected task(s)   Add task   Generate Task Set

Results
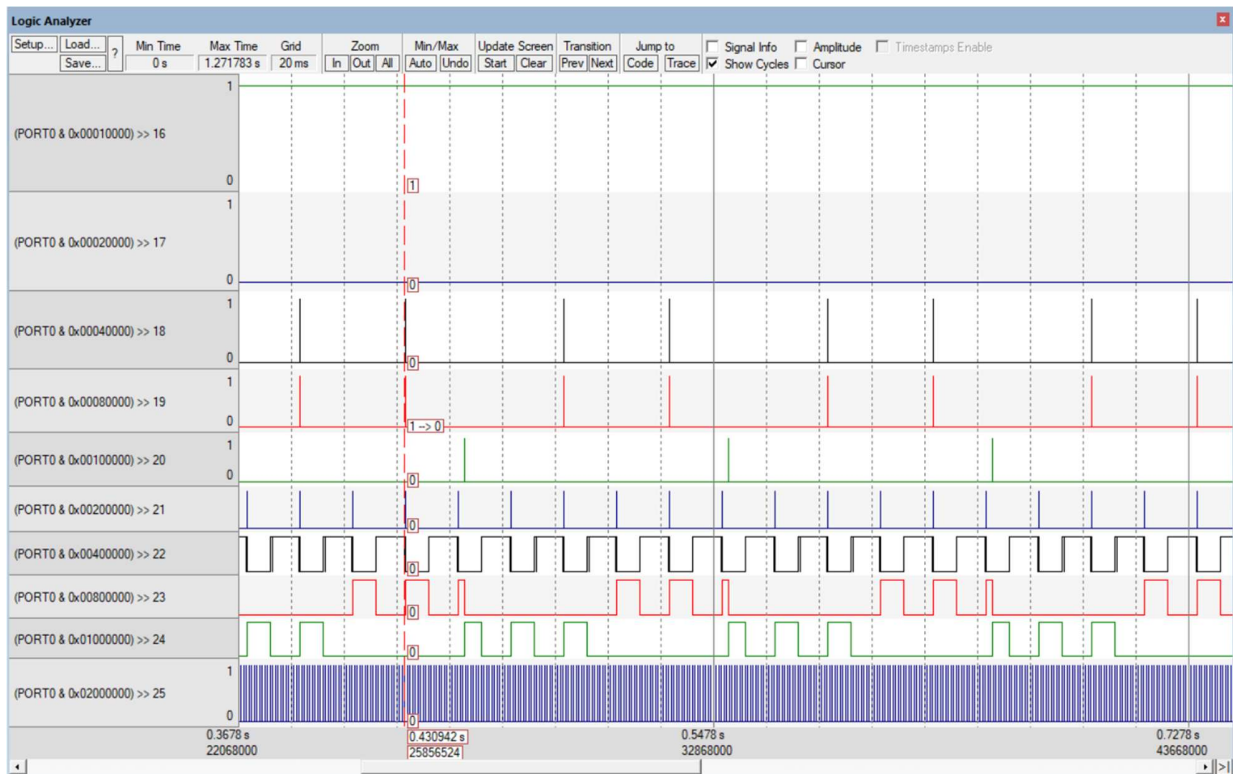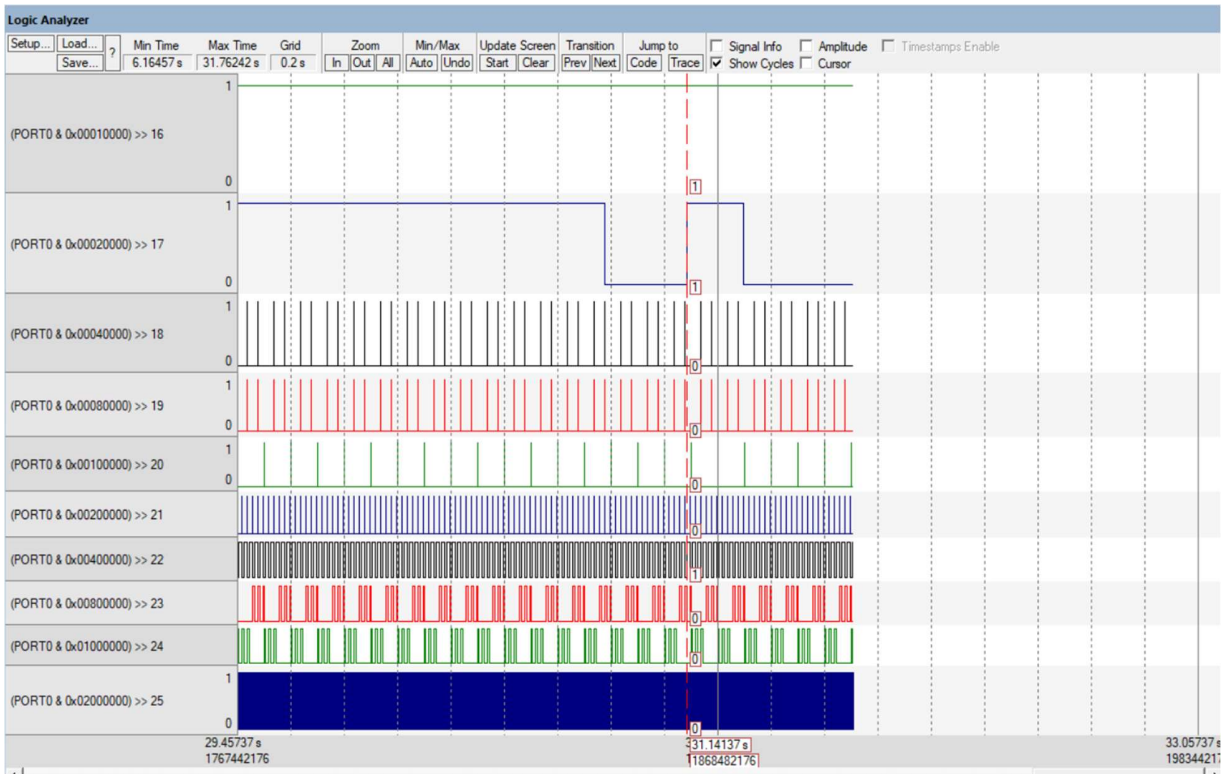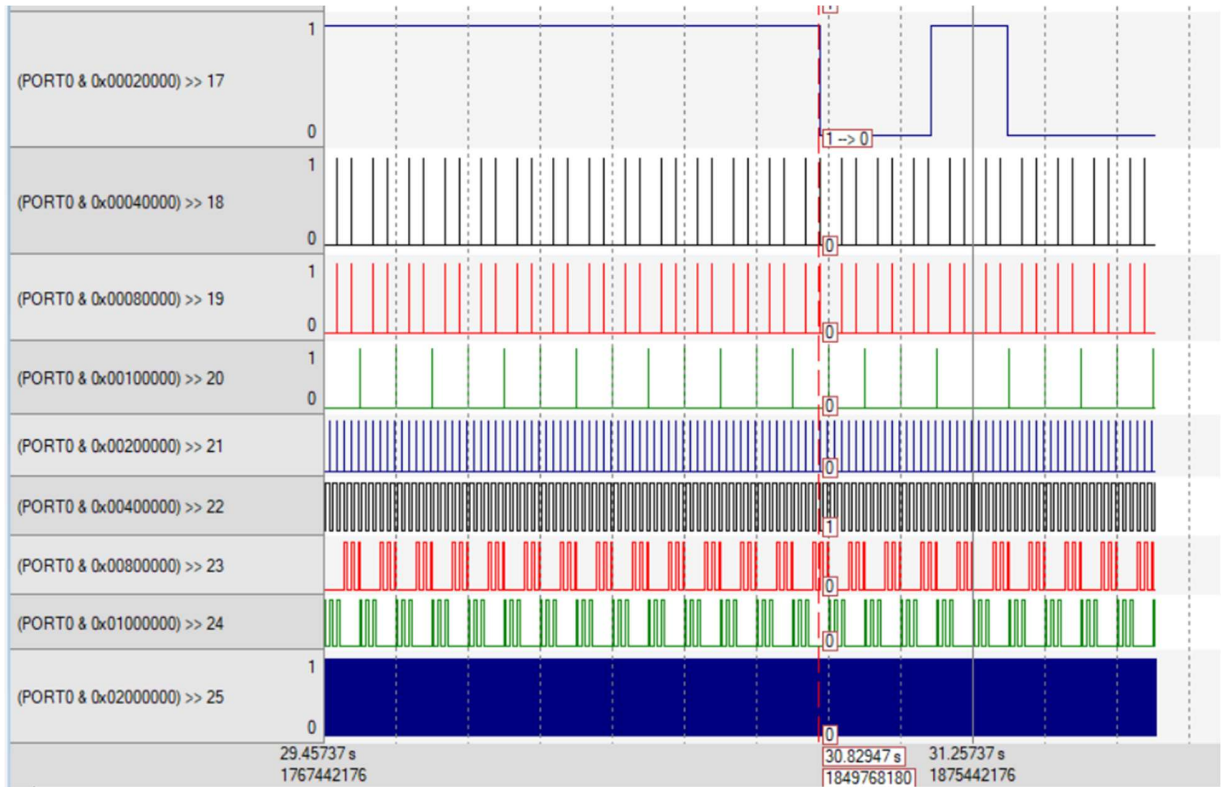
General | Logs | Tasks | Scheduler | Processors

Observation Window:

from 0.00 to 100.00 ms   Configure...

	Total load	Payload	System load
CPU 1	0.6293	0.6293	0.0000
Average	0.6293	0.6293	0.0000

Gantt chart

Zoom + Zoom - Configure

AS WE CAN SEE,THE GANTT CHART SHOWS NO DEADLINE MISSES, THUS THE SYSTEM IS SCHEDUABLE ACCORDING TO PREVIOUS CALCULATIONS.

2. Using Keil simulation tool:

The ports used are :

port0 pin 16 → status of button 1 (variable)

port0 pin 17→ status of button 2 (variable)

port0 pin 18 → button1_monitor

port0 pin 19 → button2_monitor

port0 pin 20 → UART_Transmitter

port0 pin 21 → UART_Receiver

port0 pin 22 → Load_1

port0 pin 23 → Load2

port0 pin 24 → Idle task (default)

port0 pin 25 → Systick