EDF Scheduler for FreeRTOS

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Verifying the system implementation

1. Using analytical methods:

Task name	Execution time	X number of times to come within the hyperperiod	Total execution time within the hyperperiod
Button_1_Monitor	0.0075 ms	2	0.015 ms
Button_2_Monitor	0.0075 ms	2	0.015 ms
Periodic_Transmitter	0.2 ms	1	0.2 ms
Uart_Receiver	0.3 ms	5	1.3 ms
Load_1_Simulation	5 ms	10	50 ms
Load_2_Simulation	12 ms	1	12 ms

- **Hyperperiod** = 100 ms
- **Cpu load** = ((0.015 + 0.015 + 0.2 + 1.3 + 50 +12) / 100) * 100
  = 63.73 ms
- **Schedulability using URM method**

$$\sum_{k=1}^{n} \frac{C_k}{T_k} \leq U_{RM} = n(2^{1/n} - 1)$$

0.6373 < 0.7347 = (6 * (2^(1/6) – 1))

Schedulable 

- **Schedulability using time demand analysis method**

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

Task name Arranged from the lowest period to highest	Calculation	Result	Schedulability
Load_1_Simulation	$W_{10} = 5 + 0 = 5$	5 < 10	Schedulable
Uart_Receive	$W_{20} = 0.3 + (20/10)*5 = 10.3$	10.3 < 20	Schedulable
Button_1_Monitor	$W_{50} = 0.0075 + (50/10)*5 + (50/20)*0.3 = 25.75$	25.75 < 50	Schedulable
Button_2_Monitor	$W_{50} = 0.0075 + (50/10)*5 + (50/20)*0.3 + (50/50)*0.0075 = 25.765$	25.765 < 50	Schedulable
Periodic_Transmitter	$W_{100} = 0.2 + (100/10)*5 + (100/20)*0.3 + (100/50)*0.0075 + (100/50)*0.0075 = 51.73$	51.73 < 100	Schedulable
Load_1_Simulation	$W_{100} = 12 + (100/10)*5 + (100/20)*0.3 + (100/50)*0.0075 + (100/50)*0.0075 + (100/100)*0.2 = 63.73$	63.73 < 100	Schedulable

Schedulable 

AS expected, the results indicate a successful implementation.

2. Using Simso offline simulator:

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	Priority
1	Button 1	Periodic	No	0.0	50.0	-	50.0	0.0075		1
2	Button 2	Periodic	No	0.0	50.0	-	50.0	0.0075		1
3	Transmitter	Periodic	No	0.0	100.0	-	100.0	0.2		1
4	Receiver	Periodic	No	0.0	20.0	-	20.0	0.3		1
5	Load 1	Periodic	No	0.0	10.0	-	10.0	5.0		1
6	Load 2	Periodic	No	0.0	100.0	-	100.0	12.0		1

SimSo: Real-Time Scheduling Simulator - [Results]

Qt File View Help

Gantt Results

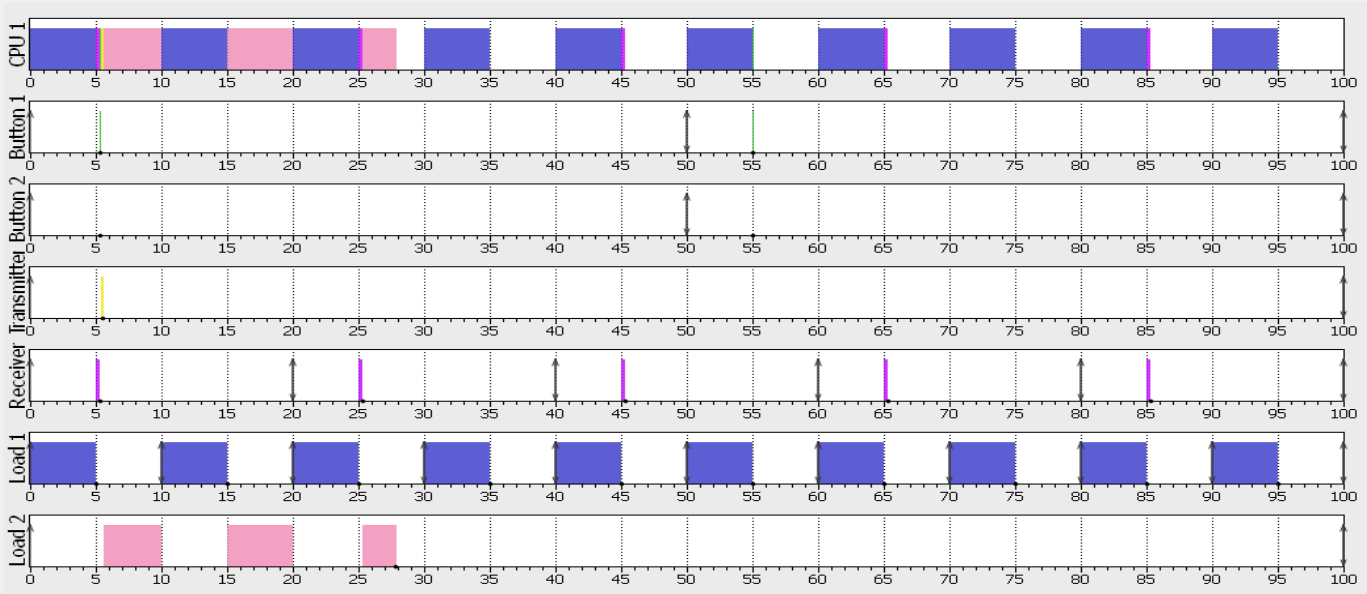
* Unsaved

General | Logs | Tasks | Scheduler | Processors

Observation Window:

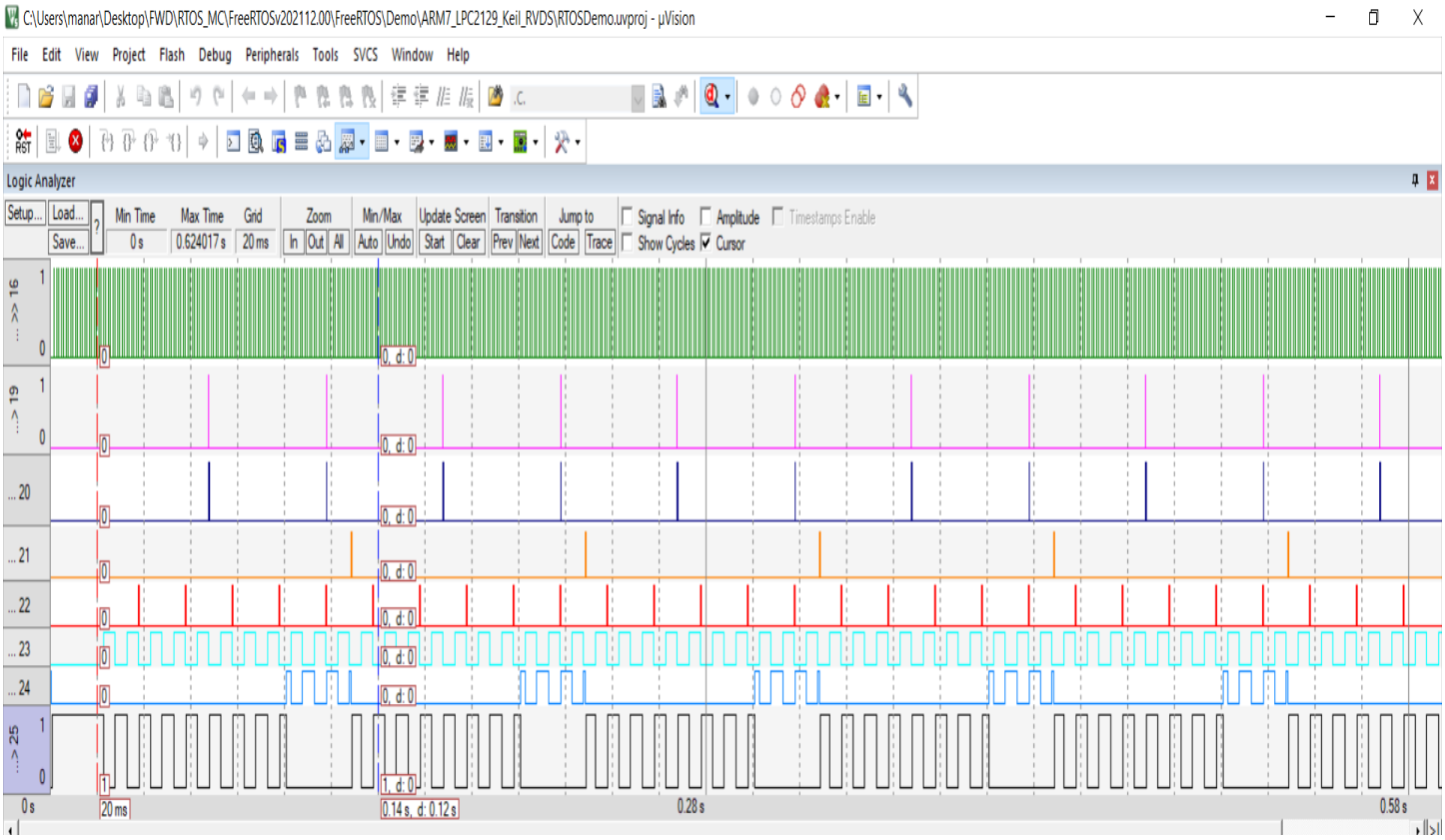
from 0.00 to 100.00 ms

	Total load	Payload	System load
CPU 1	0.6373	0.6373	0.0000
Average	0.6373	0.6373	0.0000



Schedulable 🤭

3. Using Keil simulator in run-time



Tick

Button_1_Simulator (task 1)

Button_2_Simulator (task 2)

Periodic_Transmitter (task 3)

Uart_Receiver (task 4)

Load_1_Simulation (task 5)

Load_2_Simulation (task 6)

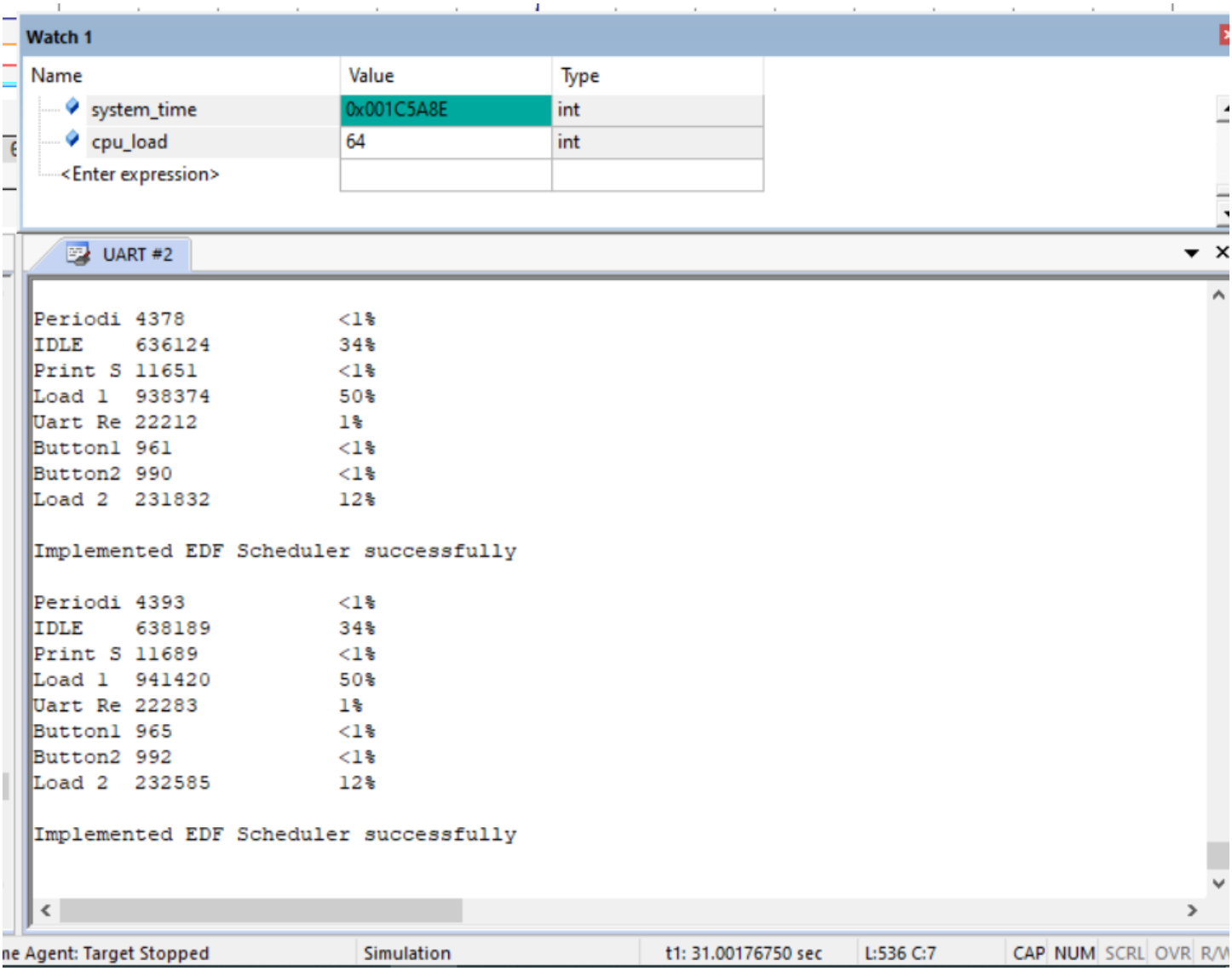
Idel_Task

Schedulable 🫠

Watch 1

Name	Value	Type
task_1_in_time	0x004EB836	int
task_1_out_time	0x004EB838	int
task_1_total_time	0x00000B9F	int
task_2_in_time	0x004EB838	int
task_2_out_time	0x004EB839	int
task_2_total_time	0x00000BCA	int
task_3_in_time	0x004EAF0A	int
task_3_out_time	0x004EAF17	int
task_3_total_time	0x00002F40	int
task_4_in_time	0x004EBA8C	int
task_4_out_time	0x004EBA9A	int
task_4_total_time		int
task_5_in_time	0x004EB706	int
task_5_out_time	0x004EB836	int
task_5_total_time	0x0027CD4C	int
task_6_in_time	0x004EAED9	int
task_6_out_time	0x004EAF09	int
task_6_total_time	0x0009BBF3	int
system_time	0x004EB95D	int
cpu_load	64	int
<Enter expression>		

- Stats summary of all tasks.



AT THE END, ALL THE RESULTS INDICATE A SUCCESSFUL IMPLEMENTATION.