System Verification

MUSTAFA ALI

Tasks:

- Note: all tasks execution time is calculated from the actual implemented tasks using GPIOs and the logic analyzer

Task Name	Periodicity / Deadline (MS)	Execution Time (MS)
Button_1_Monitor	50	0.0012
Button_2_Monitor	50	0.0012
Periodic Transmitter	100	0.00547
UART Receiver	20	0.00327
Load_1	10	5
Load_2	100	12

Methods of Verification:

- **1- Using Analytical Method:**
  - 1.1. System Hyper period:
    - It's the Least Common Multiple of all task periods
    - H = LCM (50, 50,100, 20, 10, 100) = 100
  - 1.2. CPU Load
    - U = (E1 + E2 + E3 + E4 + E5 + E6) / H
    - where E is the Execution time and H is the Hyper period.
    - U = (0.0012*2 + 0.0012*2 + 0.00547 + 0.00327*5 + 5*10 + 12) / 100
      = 0.6202662=(62.0266%)

- 1.3. System stimulability check using URM and Time Demand Analysis Techniques:
  - $\sum ci\ /pi \leq n(2\ \hat{}\ (1/n) - 1)$;sigma from i=1 to n
  - $L.\ H.\ S = \sum ci\ /pi$ = 0.0012/50 + 0.0012/50 + 0.00547 /100 +1 0.00327/20 + 5/10 + 12/100 = 0.62026
  - $R.\ H.\ S = n\ (2\hat{}(1/n) - 1)$ = 0.7348
  - $L.\ H.\ S \leq R.\ H.\ S$ so, the system is schedulable.

2- Time Demand Analysis:

a- Sort the tasks making the highest priority at the first:

Task Name	Periodicity / Deadline(MS)	Execution Time (MS)
1- Load 1	20	5
2-UART Receiver	20	0.00327
3-Button_1_Monitor	50	0.0012
4-Button_2_Monitor	50	0.0012
5- Periodic Transmitter	100	0.00547
6-Load 2 Simulation	100	12

b- Choose the critical instant 0 then :

$W1\ (10) = 5 + 0 = 5 < deadline$

$w2\ (20) = 0.00327 + 5 * 20/10 = 10.0032 < deadline$

$w3\ (50) = 0.0012 + 0.00327 * 50/20 + 5 * 50/10 = 25.0093 < deadline$

$W4\ (50) = 0.0012 + 0.0012 * 50/50 + 0.00327 * 50/20 + 5 * 50/10$

$= 25.01 < deadline$

$w5\ (100) = 0.00547 + 0.0012 * 100/50 + 0.0012 * 100/50 + 0.00327 * 100/20 + 5 * 100/10 = 50.0266 < deadline$

$w6\ (100) = 12 + 0.00547 * 100/100 + 0.0012 * 100/50 + 0.0012 * 100/50 + 0.00327 * 100/20 + 5 * 100/10 = 62.02 < deadline$

As all Tasks are less Than the deadline. So, the system is schedulable.

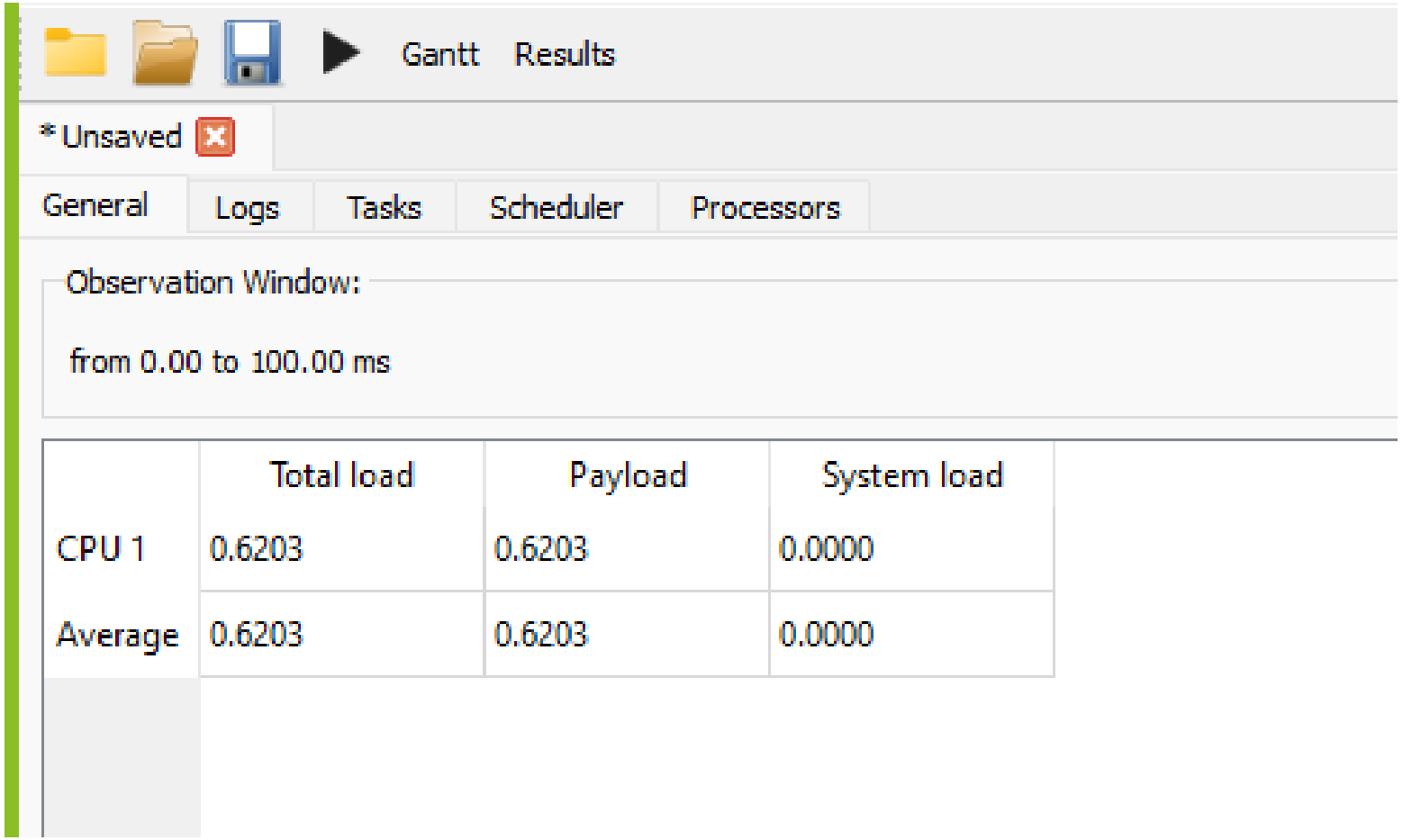
3- Using SIMSO offline simulator:

Used Scheduler: Fixed priority rate monotonic. Tasks Simulated:

General | Scheduler | Processors | Tasks

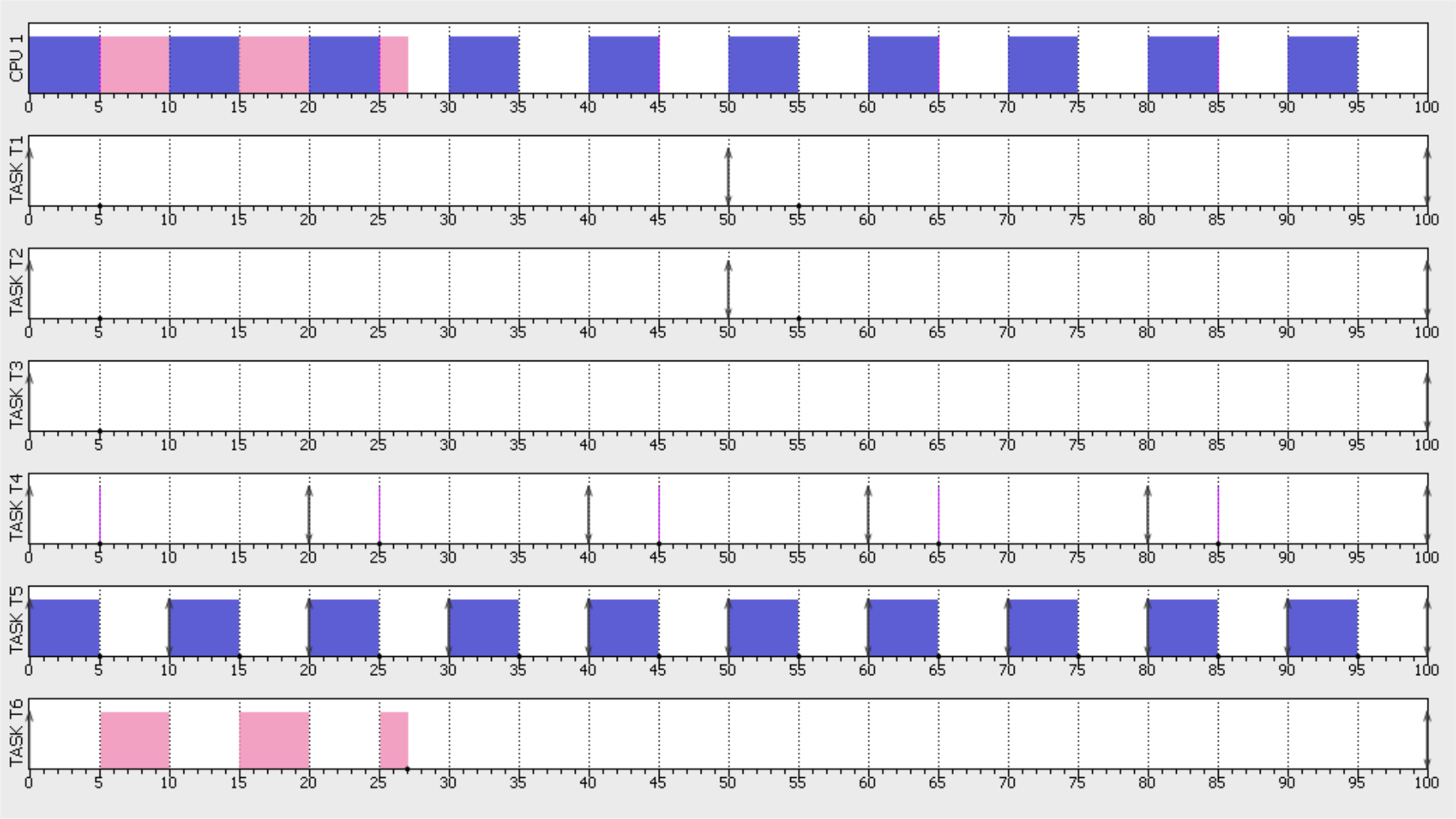
id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)
1	TASK T1	Periodic	No	0	50	-	50	0.0012
2	TASK T2	Periodic	No	0	50	-	50	0.0012
3	TASK T3	Periodic	No	0	100	-	100	0.00547
4	TASK T4	Periodic	No	0	20	-	20	0.00327
5	TASK T5	Periodic	No	0	10	-	10	5
6	TASK T6	Periodic	No	0	100	-	100	12

- For The CPU load the is the same as the analytical mode



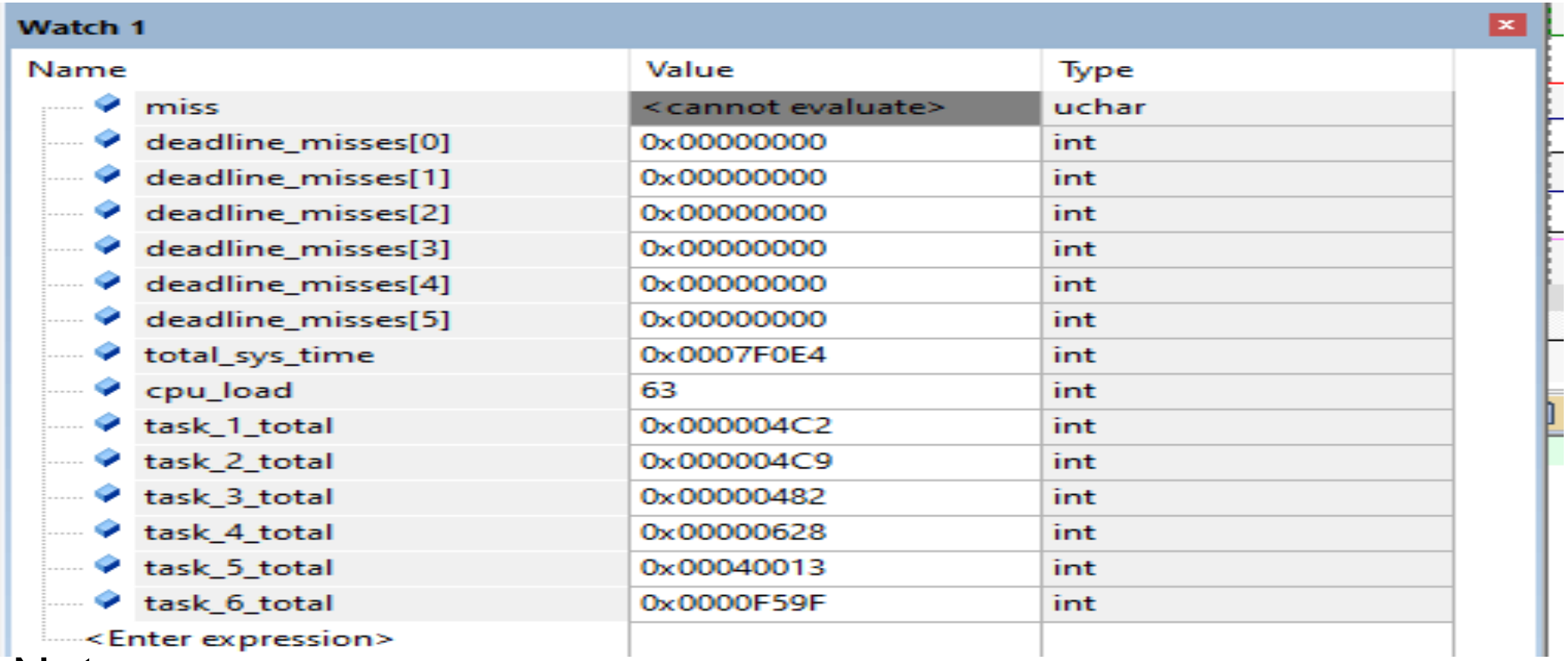
	Total load	Payload	System load
CPU 1	0.6203	0.6203	0.0000
Average	0.6203	0.6203	0.0000

Gantt chart over the Hyper period:



4- Using Keil Simulator at Runtime:

- 1- Calculate the CPU usage time using timer 1 and trace macros:



Note:

1- The CPU load is the same as the calculated analytically and the obtained using SIMSO offline simulator.

2- None of The Tasks Miss the Deadline

2. Using trace macros and GPIOs, plot the execution of all tasks, tick, and the idle task on the logic analyzer: