Tasks and System Parameters

Task1: Button1_Monitor

E	16 us
P	50 ms
D	50 ms

Task2: Button2_Monitor

E	16 us
P	50 ms
D	50 ms

Task3: Periodic_Transmitter

E	14 us
P	100ms
D	100ms

Task4: Uart_Reciever

E	22 us
P	20 ms
D	20 ms

Task5: LOAD1

E	5 ms
P	10 ms
D	10 ms

Task6: LOAD2

E	12 ms
P	100ms
D	100ms

- Hyperperiod (H) = 100 ms

- CPU Load (U)= $\frac{(E1*2)+(E2*2)+(E3*1)+(E4*5)+(E5*10)+(E6*1))}{H}$ = 62.188 %

System Schedulability

1) Rate-Monotonic Utilization Bound: -

URM = n $(2^{1/n}-1)$ = 6*$(2^{1/6}-1)$ = 0.73477

U ≤ URM, so the system is schedulable

2) Time Demand Analysis: -

$$w_i = e_i + \sum_{k=1}^{i-1} \left(\frac{t}{p_k}\right) e_k$$

w: worst response time
e: execution time
t: time instance
P: periodicity
i: task number
critical instant = 100ms

Task	Calculations	Schedulable?
LOAD 1	$w1\,(10) = 5m + 0 = 5, w1\,(10) = 5 < 10$	YES
Receiver	$w2\,(20) = 22\mu + (20/10) * 5m = 10.022,$ $w2\,(20) = 10.022 < 20$	YES
Button 1	$w3\,(50) = 16\mu + (50/10) * 5m + (50/20) * 22\mu = 25.071$ $w3\,(20) = 25.071 < 50$	YES
Button 2	$w4\,(50) = 16\mu + (50/10) * 5m + (50/20) * 22\mu + (50/50) * 16\mu = 25.087$ $w4\,(50) = 25.087 < 50$	YES
Transmitter	$w5\,(100) = 14\mu + (100/10) * 5m + (100/20) * 22\mu + (100/50) * 16\mu + (100/50) * 16\mu = 50.188, w5\,(100) = 50.188 < 100$	YES
Load 2	$w5\,(100) = 12m + (100/10) * 5m + (100/20) * 14\mu + (100/50) * 16\mu + (100/50) * 16\mu + (100/100) * 22\mu = 62.156$ $w5\,(100) = 62.156 < 100$	YES

The System is schedulable, and the results are as expected. As the analytical method results match the simulation, then the results indicate a successful implementation.

System offline simulation

System Schedulability.xml

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	Priority
1	TASK T1	Periodic	Yes	0.0	50.0	-	50.0	0.016		1
2	TASK T2	Periodic	Yes	0.0	50.0	-	50.0	0.016		1
3	TASK T3	Periodic	Yes	0.0	100.0	-	100.0	0.014		1
4	TASK T4	Periodic	Yes	0.0	20.0	-	20.0	0.022		1
5	TASK T5	Periodic	Yes	0.0	10.0	-	10.0	5.0		1
6	TASK T6	Periodic	Yes	0.0	100.0	-	100.0	12.0		1

Edit data fields...

Remove selected task(s)

Add task

Figure 1: Task set configurations

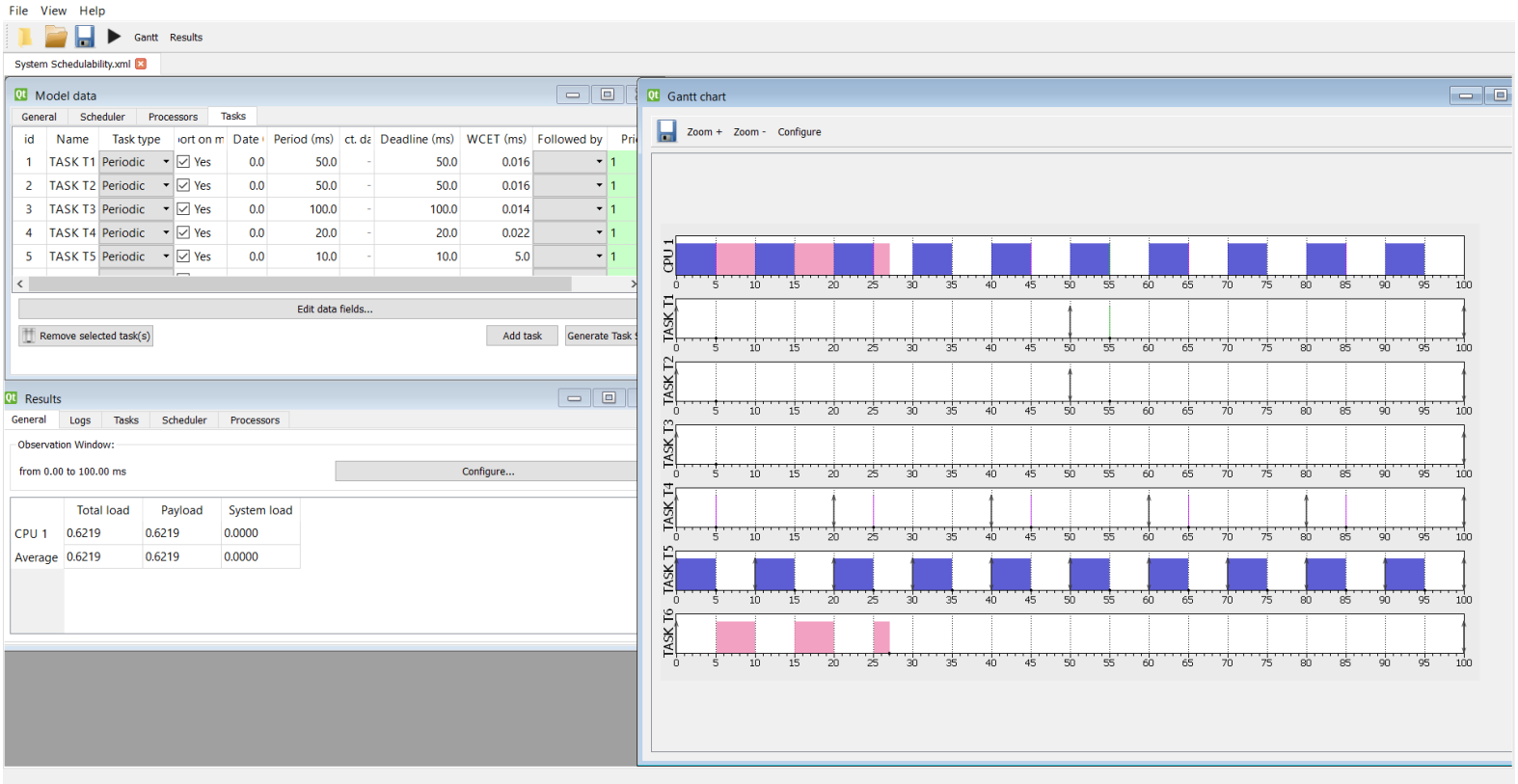

Figure 2: CPU load and system simulation using Gantt chart

Tasks Execution Plot

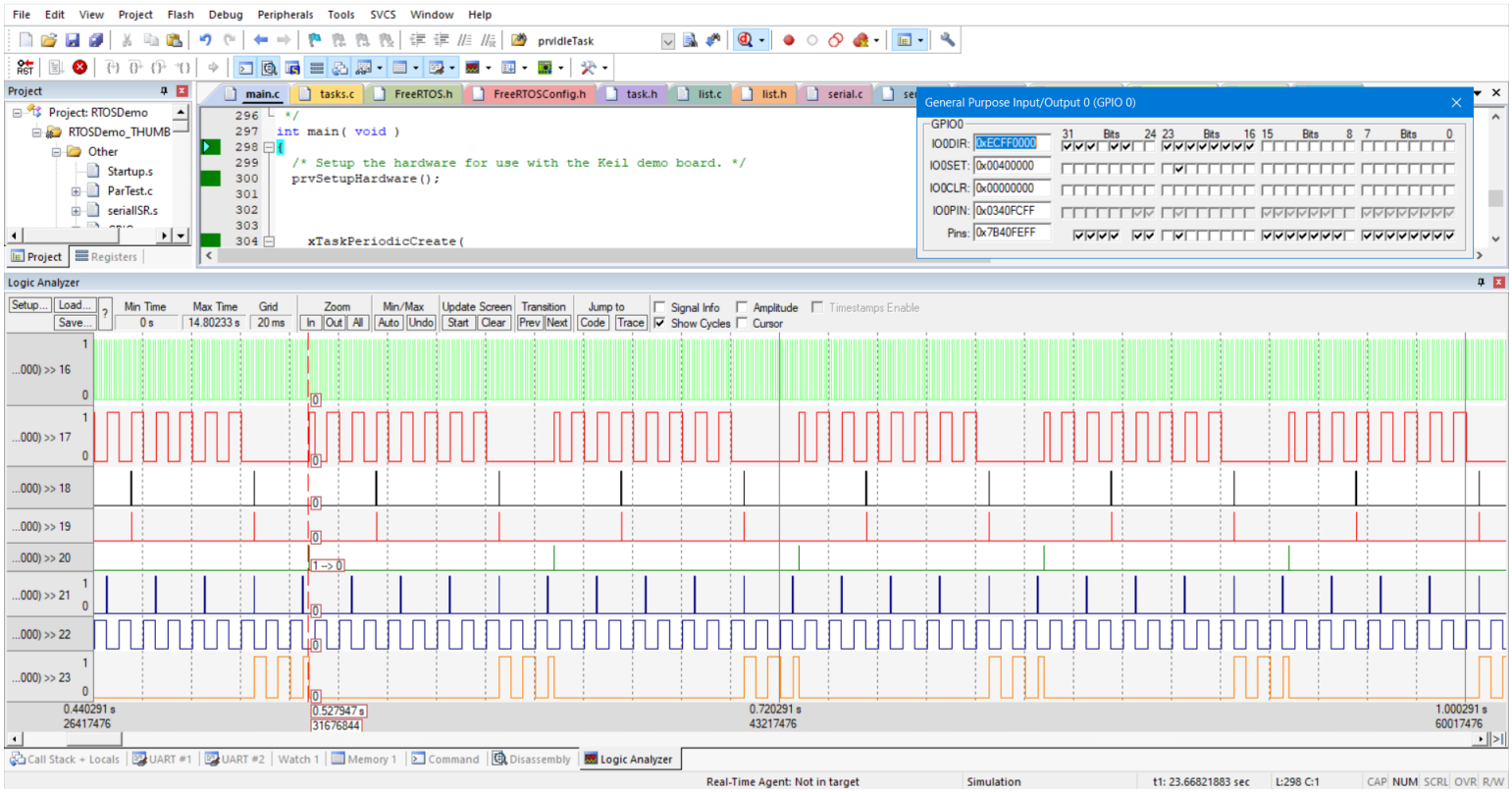

Figure 3: System real execution plot using Logic Analyzer

Task	GPIO PIN
Tick	PORT0.PIN16
Idle Task	PORT0.PIN17
Button1_Monitor	PORT0.PIN18
Button2_Monitor	PORT0.PIN19
Periodic_Transmitter	PORT0.PIN20
Uart_Receiver	PORT0.PIN21
LOAD1	PORT0.PIN22
LOAD2	PORT0.PIN23

Table 1: GPIO Pins assigned to Tasks to plot on Logic Analyzer

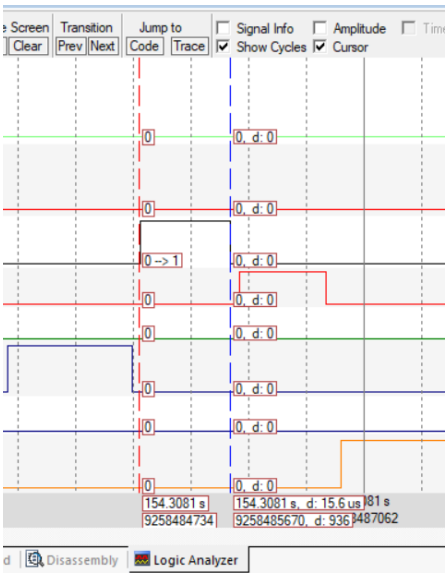

Figure 4: Task1 execution time

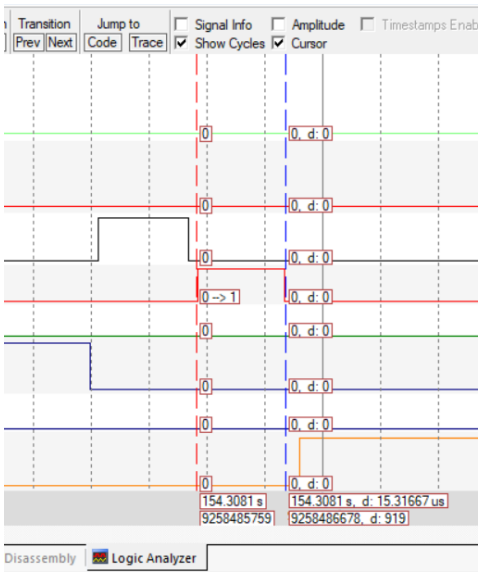

Figure 5: Task2 execution time

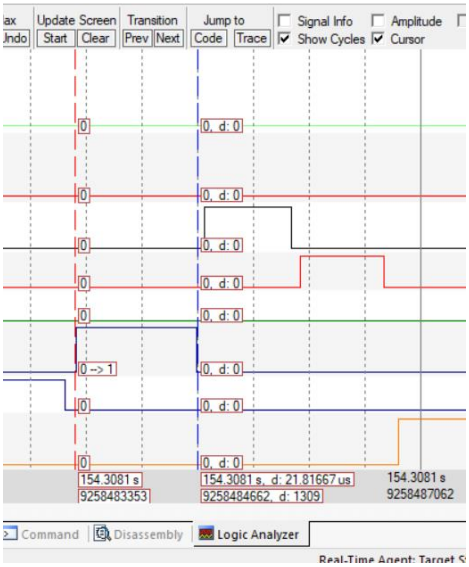

Figure 6: Task3 execution time

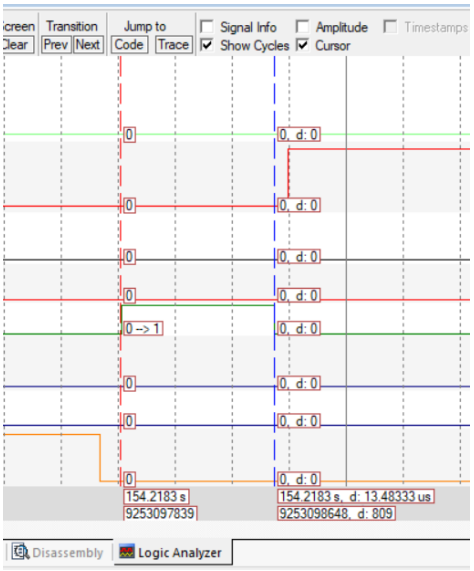

Figure 7: Task4 execution time

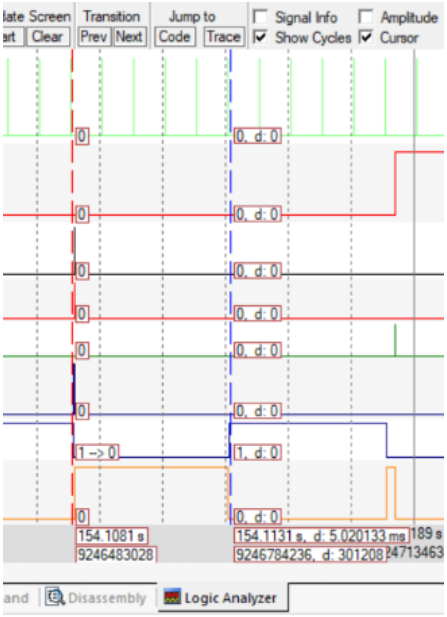

Figure 8: Task5 execution time

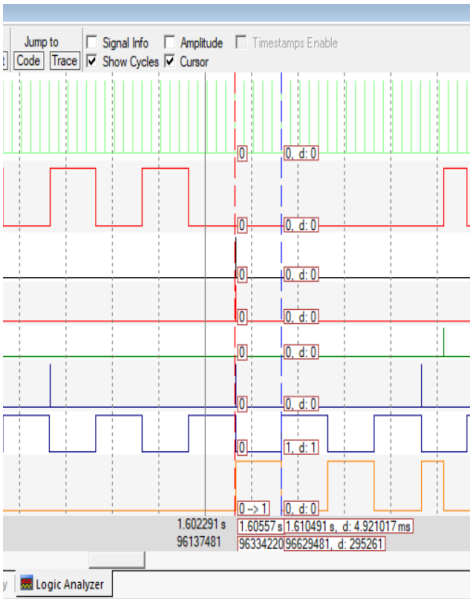

Figure 9: Task6 execution time