

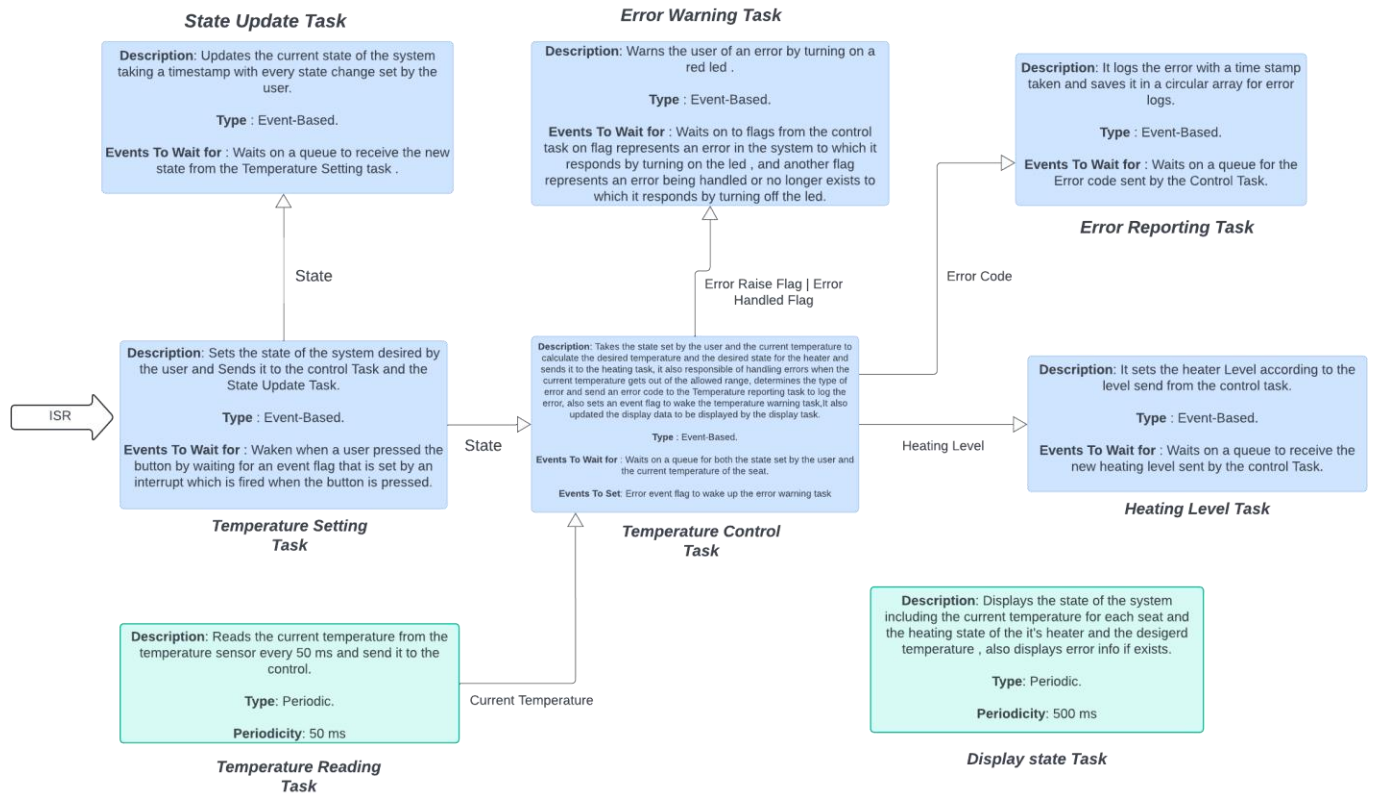
Seat Heater Control System



Prepared by:

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Tasks Block Diagram:



There are two tasks of each implementation (e.g. Temp setting task for driver seat , Temp setting task for Passenger seat) , except the display task and the Error reporting task there is only one of each as the handles both seats .

Shared resources:

Almost no shared resources all communication are handled with queues since each set of tasks handles its own seat, using the seat parameters given to it upon creation.

Only two structs are shared between the display tasks and the control tasks and no protection is needed since the control writes to it and the display reads the data every 500ms.

RTM Calculations:

- Temp Setting Task = 0.1ms
- Temp Reading Task = 0.1ms
- Heating Task = 0.1 ms
- Control Task = 0.1ms
- Display task = 30.5ms
- Error warning Task = 0.1ms
- State update task = 0.1ms
- Error reporting task = 0.1ms
- CPU Load = 8-9% (depending on the state and current functionality).

Resource lock Time for per task for each resource:

- **Set_read_to_ctrl_seat1(queue set 1)** = 49ms.
- **Set_reat_to_ctrl_seat2(queue set 2)** = 49ms.
- **Ctrl_to_heat_seat1 (queue 3)** = 50ms.
- **Ctrl_to_heat_seat1 (queue 4)** = 50ms.
- **Ctrl_to_error (queue 5):** depends on error event, minimum blocking time estimated when error occurred is 50 ms.
- **Set_to_state_seat1(queue 6):** depends on the event of pressing the button, minimum blocking time on pressing a button is 139ms
- **Set_to_state_seat2 (queue 7):** depends on the event of pressing the button, minimum blocking time on pressing a button is 149ms

```
/*-----  
block time for queue 1 is : 49 ms  
block time for queue 2 is : 49 ms  
block time for queue 3 is : 50 ms  
block time for queue 4 is : 50 ms  
block time for queue 5 is : 49 ms  
block time for queue 6 is : 139 ms  
block time for queue 7 is : 4615 ms  
| ***** |
```

SimSo Results :

Tasks defined:

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	Display	Periodic	<input type="checkbox"/> No	0.0	500.0	-	500.0	31.0		3
2	Temp Reading 1	Periodic	<input type="checkbox"/> No	0.0	50.0	-	50.0	1.0	Control 1 (6)	3
3	Temp Reading 2	Periodic	<input type="checkbox"/> No	0.0	50.0	-	50.0	1.0	Control 2 (7)	3
4	Temp Set 1	Periodic	<input type="checkbox"/> No	0.0	1000.0	-	1000.0	1.0	State update 1 (13)	4
5	Temp set 2	Periodic	<input type="checkbox"/> No	0.0	1000.0	-	1000.0	1.0	State update 2 (14)	4
6	Control 1	APeriodic	<input type="checkbox"/> No	-	-	-	50.0	1.0	Heating 1 (8)	2
7	Control 2	APeriodic	<input type="checkbox"/> No	-	-	-	50.0	1.0	Heating 2 (9)	2
8	Heating 1	APeriodic	<input type="checkbox"/> No	-	-	-	50.0	1.0		2
9	Heating 2	APeriodic	<input type="checkbox"/> No	-	-	-	50.0	1.0		2
10	Error warning 1	Periodic	<input type="checkbox"/> No	0.0	2500.0	-	2500.0	1.0		2
11	Error warning 2	Periodic	<input type="checkbox"/> No	0.0	2500.0	-	2500.0	1.0		2
12	Error reporting	Periodic	<input type="checkbox"/> No	0.0	2500.0	-	2500.0	5.0		2
13	State update 1	APeriodic	<input type="checkbox"/> No	-	-	-	50.0	2.0		3
14	State update 2	APeriodic	<input type="checkbox"/> No	-	-	-	50.0	2.0		3

Edit data fields...

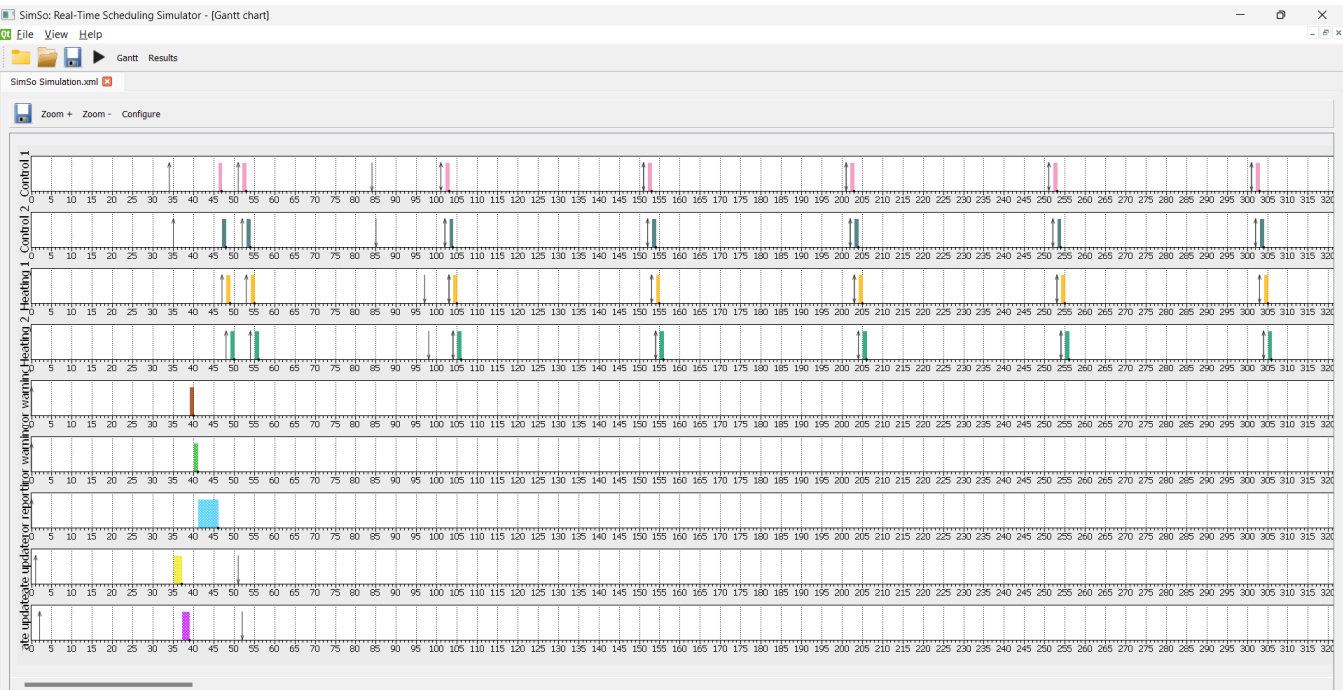
Remove selected task(s) Add task Generate Task Set

Simulation Results:

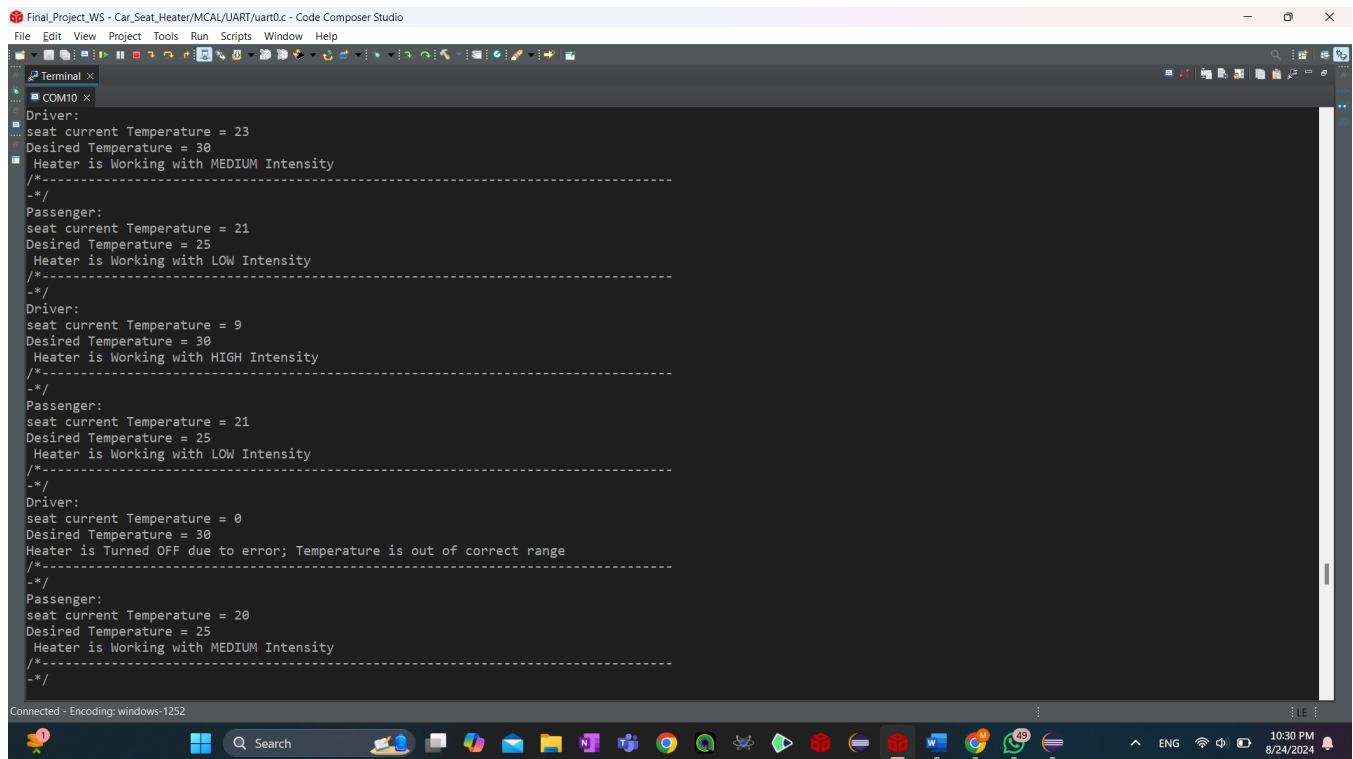
Results			
General			
Observation Window:			
from 0.00 to 5000.00 ms			
Configure...			
	Total load	Payload	System load
CPU 1	0.1908	0.1908	0.0000
Average	0.1908	0.1908	0.0000

Results					
General					
General	Display	Temp Reading 1	Temp Reading 2	Temp Set 1	Temp Set 2
Computation time:					
Task	min	avg	max	std dev	occupancy
Display	31.000	31.000	31.000	0.000	0.062
Temp Reading 1	1.000	1.000	1.000	0.000	0.020
Temp Reading 2	1.000	1.000	1.000	0.000	0.020
Temp Set 1	1.000	1.000	1.000	0.000	0.001
Temp set 2	1.000	1.000	1.000	0.000	0.001
Control 1	1.000	1.000	1.000	0.000	0.020
Control 2	1.000	1.000	1.000	0.000	0.020
Heating 1	1.000	1.000	1.000	0.000	0.020
Heating 2	1.000	1.000	1.000	0.000	0.020
Error warning 1	1.000	1.000	1.000	0.000	0.000
Error warning 2	1.000	1.000	1.000	0.000	0.000
Error reporting	5.000	5.000	5.000	0.000	0.002
State update 1	2.000	2.000	2.000	0.000	0.002
State update 2	2.000	2.000	2.000	0.000	0.002
Preemptions:					
Migrations:					
Task migrations:					
Response time:					

Gantt Chart:



Output ScreenShot:



```
Final_Project_WS - Car_Seat_Heater/MCAL/UART/uart0.c - Code Composer Studio
File Edit View Project Tools Run Scripts Window Help

Terminal x
COM10 x
Driver:
seat current Temperature = 23
Desired Temperature = 30
Heater is Working with MEDIUM Intensity
-----
*/
Passenger:
seat current Temperature = 21
Desired Temperature = 25
Heater is Working with LOW Intensity
-----
*/
Driver:
seat current Temperature = 9
Desired Temperature = 30
Heater is Working with HIGH Intensity
-----
*/
Passenger:
seat current Temperature = 21
Desired Temperature = 25
Heater is Working with LOW Intensity
-----
*/
Driver:
seat current Temperature = 0
Desired Temperature = 30
Heater is Turned OFF due to error; Temperature is out of correct range
-----
*/
Passenger:
seat current Temperature = 20
Desired Temperature = 25
Heater is Working with MEDIUM Intensity
-----
*/

Connected - Encoding: windows-1252
10:30 PM 8/24/2024
```