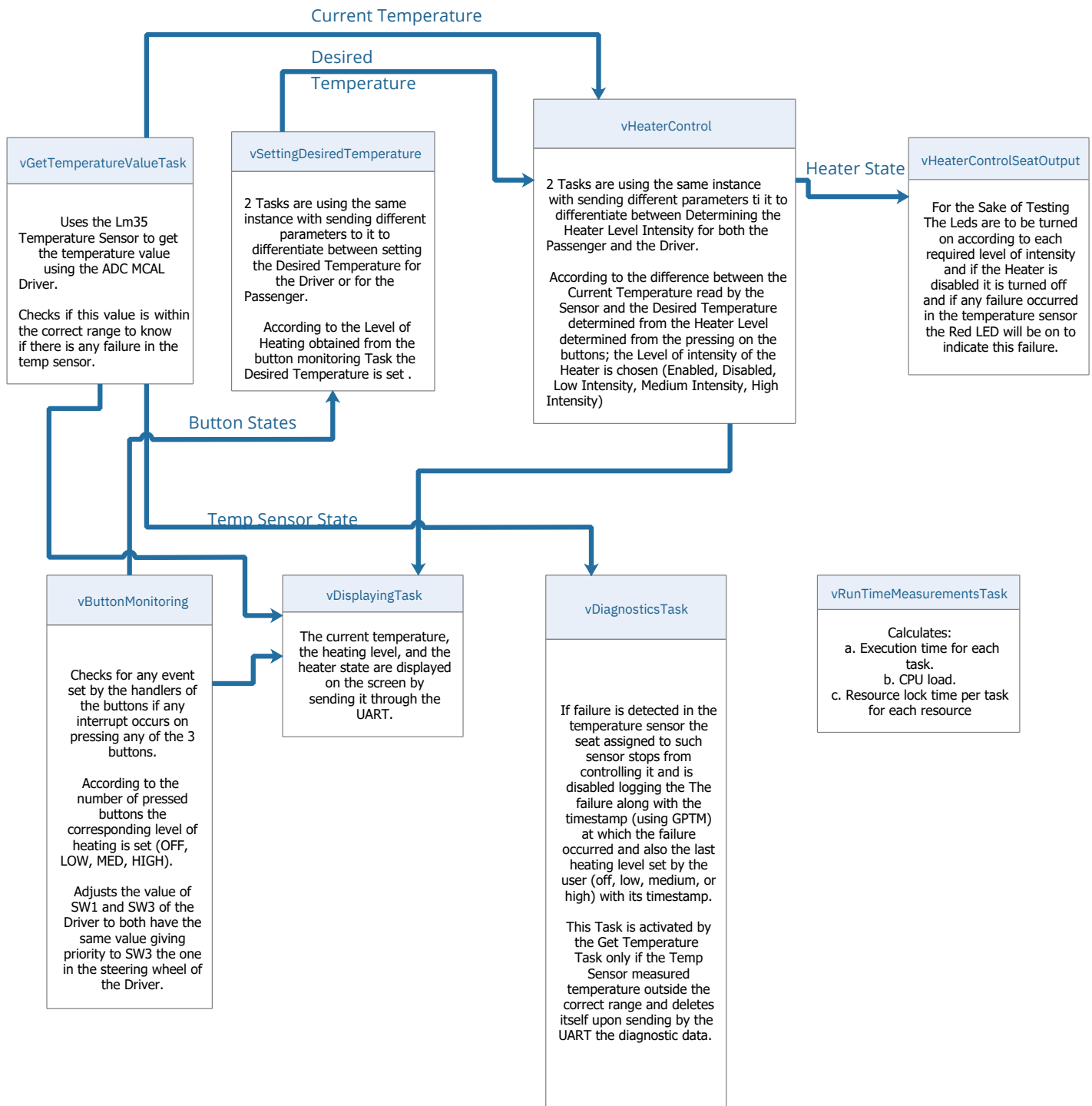# RTOS FINAL PROJECT

Esraa Khaled Mostafa

1. Diagrams for the design of the system containing all the details of the tasks.

Current Temperature

Desired Temperature

vGetTemperatureValueTask

Uses the Lm35 Temperature Sensor to get the temperature value using the ADC MCAL Driver.

Checks if this value is within the correct range to know if there is any failure in the temp sensor.

vSettingDesiredTemperature

2 Tasks are using the same instance with sending different parameters to it to differentiate between setting the Desired Temperature for the Driver or for the Passenger.

According to the Level of Heating obtained from the button monitoring Task the Desired Temperature is set .

vHeaterControl

2 Tasks are using the same instance with sending different parameters ti it to differentiate between Determining the Heater Level Intensity for both the Passenger and the Driver.

According to the difference between the Current Temperature read by the Sensor and the Desired Temperature determined from the Heater Level determined from the pressing on the buttons; The Level of intensity of the Heater is chosen (Enabled, Disabled, Low Intensity, Medium Intensity, High Intensity)

Heater State

vHeaterControlSeatOutput

For the Sake of Testing The Leds are to be turned on according to each required level of intensity and if the Heater is disabled it is turned off and if any failure occurred in the temperature sensor the Red LED will be on to indicate this failure.

Button States

Temp Sensor State

vButtonMonitoring

Checks for any event set by the handlers of the buttons if any interrupt occurs on pressing any of the 3 buttons.

According to the number of pressed buttons the corresponding level of heating is set (OFF, LOW, MED, HIGH).

Adjusts the value of SW1 and SW3 of the Driver to both have the same value giving priority to SW3 the one in the steering wheel of the Driver.

vDisplayingTask

The current temperature, the heating Level, and the heater state are displayed on the screen by sending it through the UART.

vDiagnosticsTask

If failure is detected in the temperature sensor the seat assigned to such sensor stops from controlling it and is disabled logging the The failure along with the timestamp (using GPTM) at which the failure occurred and also the last heating level set by the user (off, low, medium, or high) with its timestamp.

This Task is activated by the Get Temperature Task only if the Temp Sensor measured temperature outside the correct range and deletes itself upon sending by the UART the diagnostic data.

vRunTimeMeasurementsTask

Calculates:
a. Execution time for each task.
b. CPU load.
c. Resource lock time per task for each resource

2. Screenshots for the output of the system (UART messages).

```
Terminal ×
COM3 ×

Current Temperature = 22
Driver Heater Level = OFF
Passenger Heater Level = OFF
Driver Heater State = DISABLED
Passenger Heater State = DISABLED


Current Temperature = 18
Driver Heater Level = LOW
Passenger Heater Level = OFF
Driver Heater State = MED_INTENSITY
Passenger Heater State = DISABLED
```

```
Terminal ×
COM3 ×

Current Temperature = 18
Driver Heater Level = LOW
Passenger Heater Level = MED
Driver Heater State = MED_INTENSITY
Passenger Heater State = LOW_INTENSITY
```

```
Terminal ×
COM3 ×

Current Temperature = 31
Driver Heater Level = MED
Passenger Heater Level = OFF
Driver Heater State = DISABLED
Passenger Heater State = HIGH_INTENSITY
```

```
Terminal ×
COM3 ×

Temperature Sensor Failure recorded at: 6074208
Driver Heater Level before Failure = MED at: 5510701
Passenger Heater Level before Failure = LOW at: 6035602
```
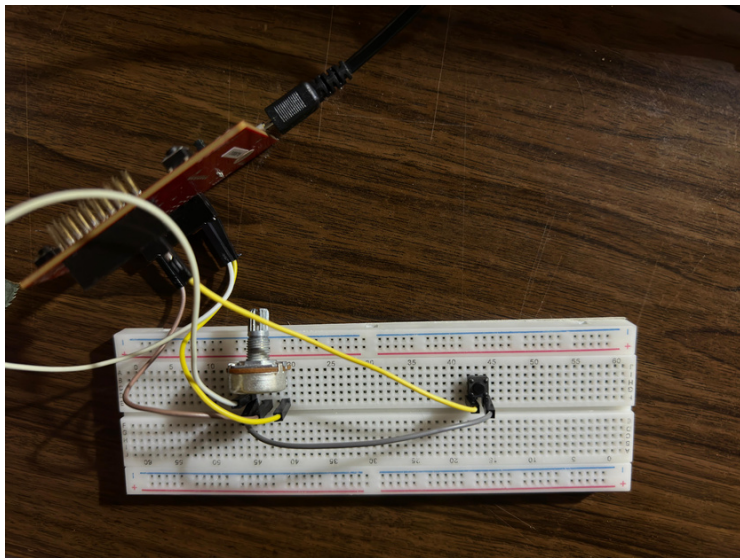
Setup for Testing Potentiometer and Extra Button Connected to PB2
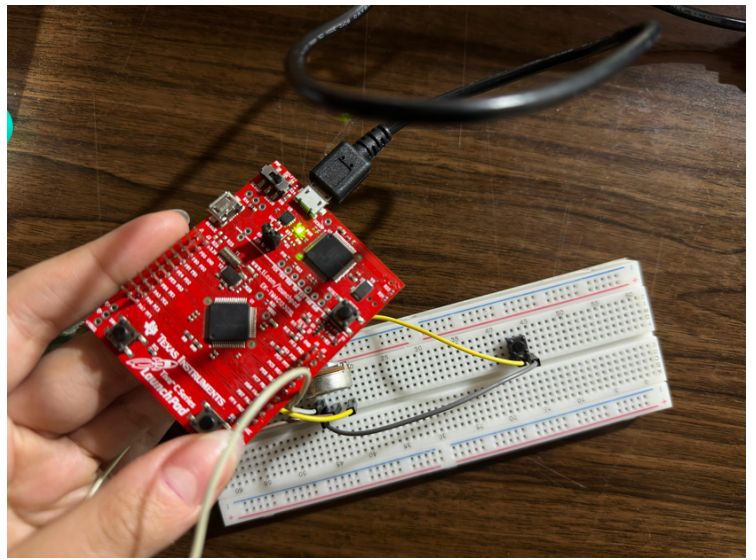
OFF
Heater Level is Disabled
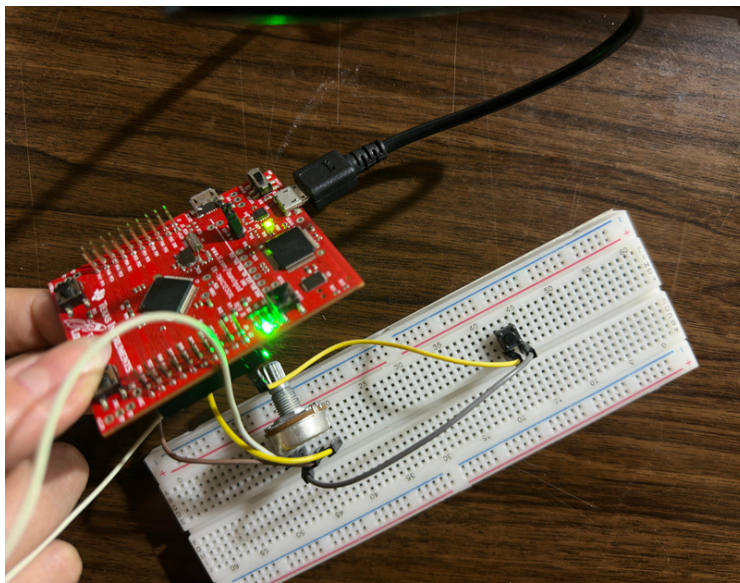
LOW Intensity
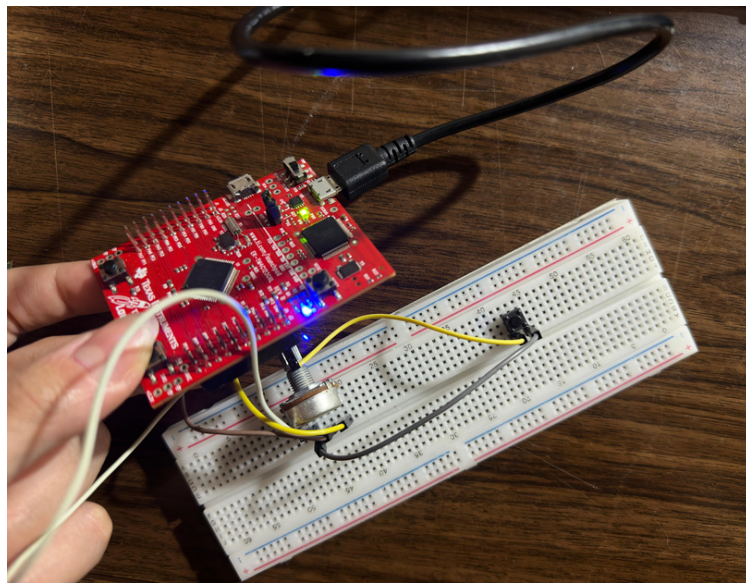
MEDIUM Intensity
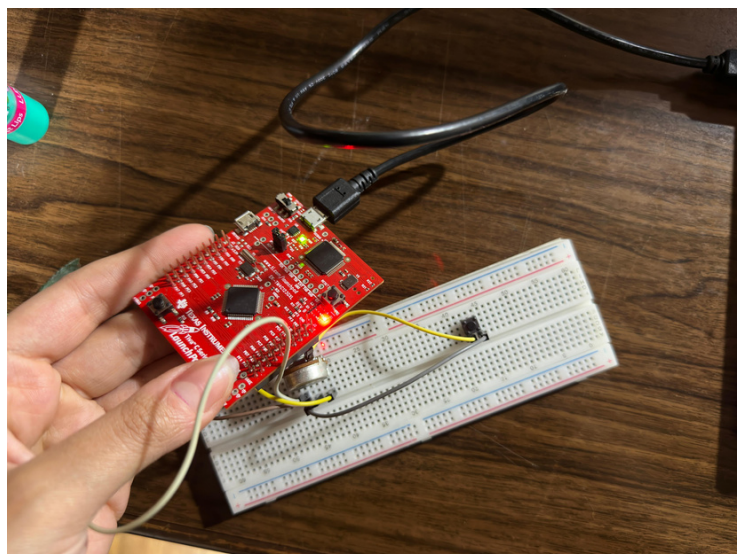
HIGH Intensity
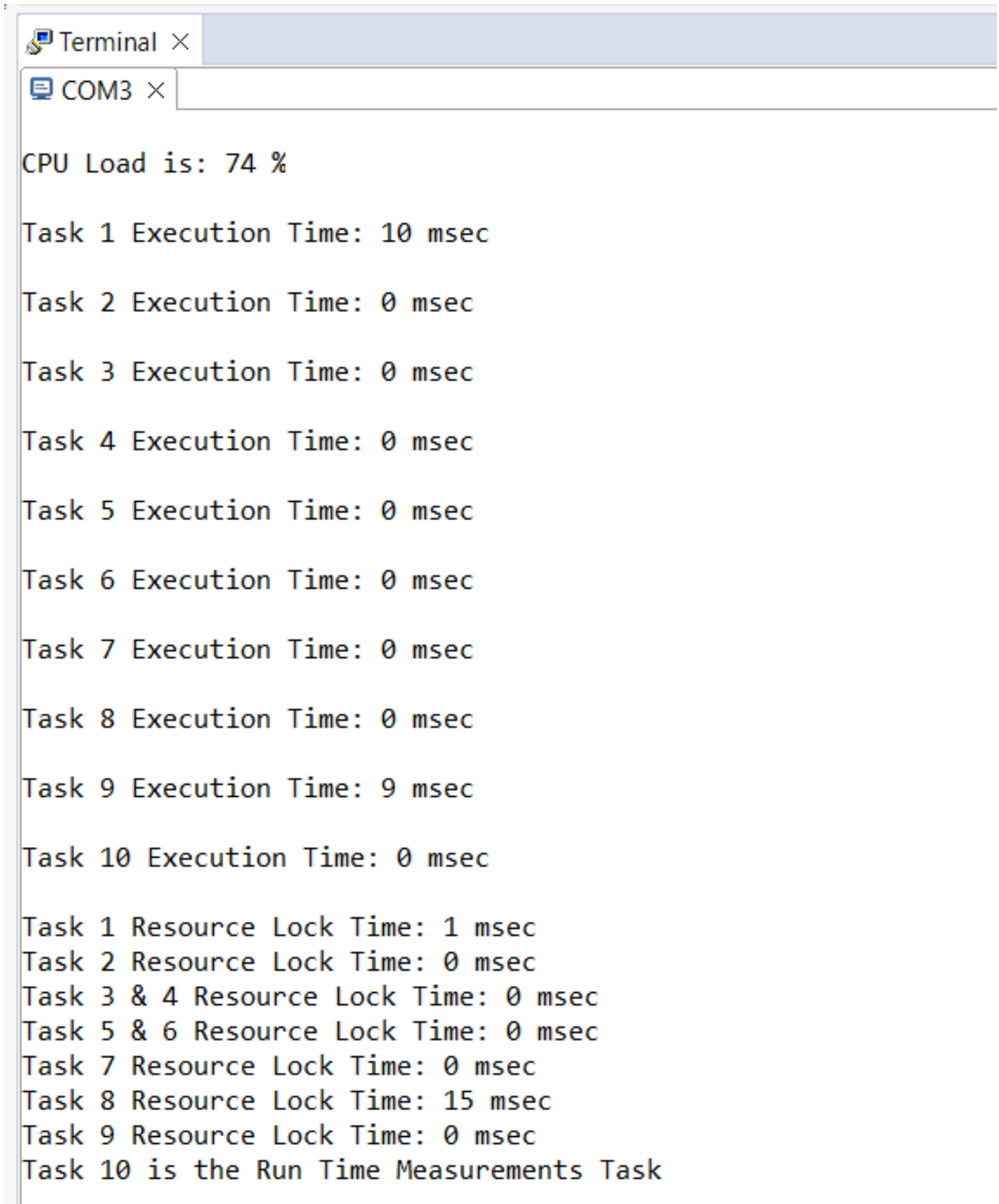RED Led is always ON if Temperature Sensor Fails

3. Simulation results using Simso.

RTOS_FinalProjectSimso.xml ❌

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	vGetTemperatureValueTask	Periodic ▼	☑ Yes	0.0	20.0		20.0	2	▼	3
2	vButtonMonitoring	Periodic ▼	☑ Yes	0.0	10.0	-	10.0	3	▼	4
3	vSettingDesiredTemperatureDriver	Periodic ▼	☑ Yes	0.0	20.0	-	20.0	2	▼	2
4	vSettingDesiredTemperaturePassenger	Periodic ▼	☑ Yes	0.0	20.0	-	20.0	2	▼	2
5	vHeaterControlDriver	Periodic ▼	☑ Yes	0.0	30.0	-	30.0	4	▼	2
6	vHeaterControlPassenger	Periodic ▼	☑ Yes	0.0	30.0	-	30.0	4	▼	2
7	vHeaterControlSeatOutput	Periodic ▼	☑ Yes	0.0	30.0	-	30.0	3	▼	2
8	vDisplayingTask	Periodic ▼	☑ Yes	0.0	3000.0	-	3000.0	4	▼	2
9	vDiagnosticsTask	Periodic ▼	☑ Yes	0.0	3000.0	-	3000.0	3	▼	2
10	vRunTimeMeasurementsTask	Periodic ▼	☑ Yes	0.0	5000.0	-	5000.0	5	▼	1

RTOS_FinalProjectSimso.xml ❌

General   Logs   Tasks   Scheduler   Processors

Observation Window:

from 0.00 to 50.00 ms

	Total load	Payload	System load
CPU 1	0.7600	0.7600	0.0000
Average	0.7600	0.7600	0.0000
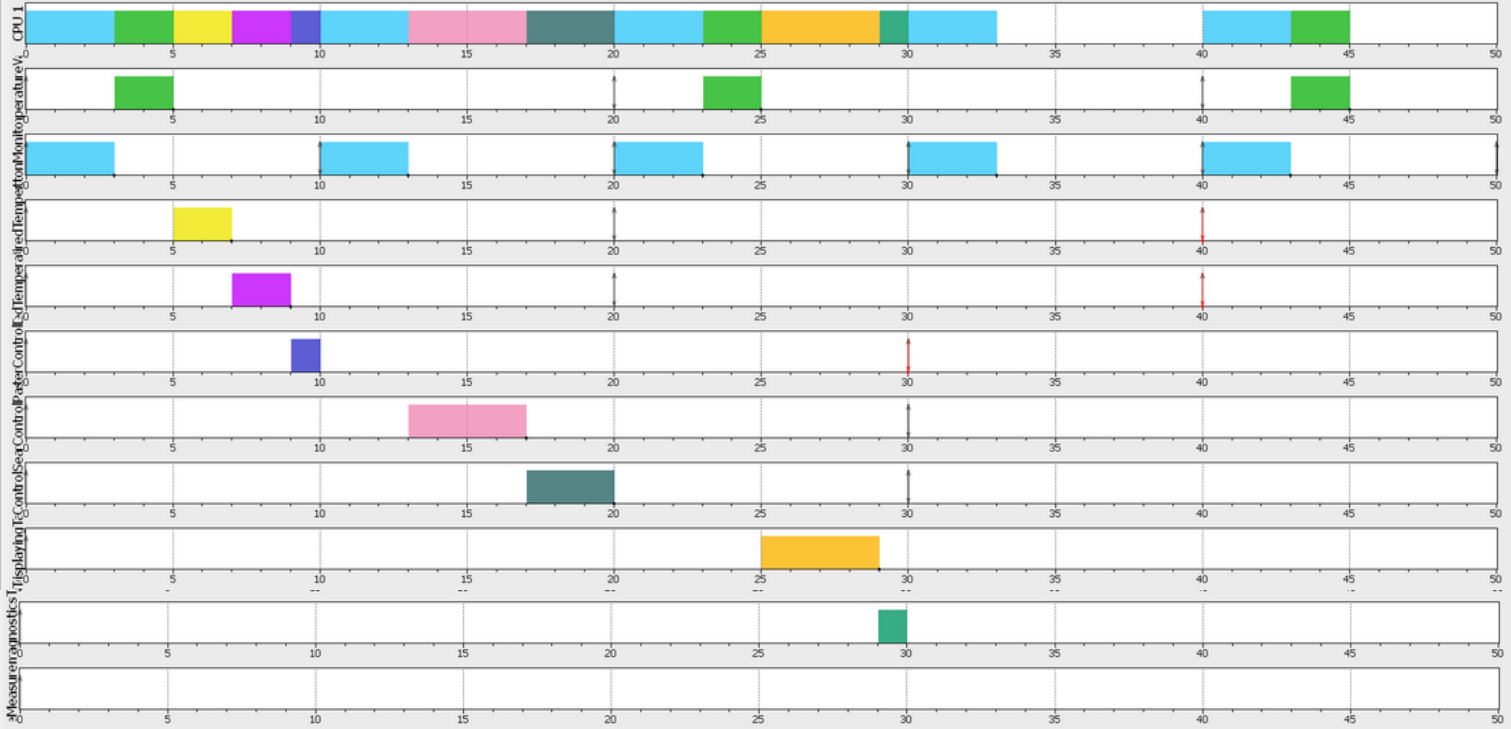
4. Run time measurements results.

```
Terminal ✕

COM3 ✕

CPU Load is: 74 %

Task 1 Execution Time: 10 msec

Task 2 Execution Time: 0 msec

Task 3 Execution Time: 0 msec

Task 4 Execution Time: 0 msec

Task 5 Execution Time: 0 msec

Task 6 Execution Time: 0 msec

Task 7 Execution Time: 0 msec

Task 8 Execution Time: 0 msec

Task 9 Execution Time: 9 msec

Task 10 Execution Time: 0 msec

Task 1 Resource Lock Time: 1 msec
Task 2 Resource Lock Time: 0 msec
Task 3 & 4 Resource Lock Time: 0 msec
Task 5 & 6 Resource Lock Time: 0 msec
Task 7 Resource Lock Time: 0 msec
Task 8 Resource Lock Time: 15 msec
Task 9 Resource Lock Time: 0 msec
Task 10 is the Run Time Measurements Task
```