HEALTH CARE SYSTEM DESIGN

RTOS

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Overview

This is a simple design for a Healthcare system using RTOS (real-time operating system) with the following Requirements.

1. A touch LCD is an input that controls the system and gives commands. Every LCD command is represented in 4 bytes. LCD is connected to the microcontroller through UART with a speed of 9600 bps [Bit per second]. (Reading 4 bytes and processing the command takes 2 ms)
2. Blood pressure sensor with new data every 25ms. (Reading the sensor and processing its data takes 3 ms)
3. Heartbeat detector with new data every 100ms. (Reading the sensor and processing its data takes 1.5 ms)
4. Temperature sensor with new data every 10ms. (Reading the sensor and processing its data takes 2.5 ms)
5. Alert siren. (Activate or deactivate the siren takes 1 ms)

Goals

1. determine how many tasks are needed the system.
2. determine the specification of each task (Deadline - periodicity - priority)
3. decide the systick rate
4. calculate
   - hyperperiod
   - CPU load
5. Draw the timeline manually the expected schedulablility of the system
6. Model the system in Simso

Deliverables

Tasks

The system consists of five task
(LCD, Blood pressure, Heartbeat Reading, Temperature reading) and driven task by event

Tasks parameters

Task_ID	Priority	Periodicity	Deadline
T1_LCD	4	100	100
T2_BLOOD	2	25	25
T3_HEART	3	100	50
T4_TEMP	1	10	10
T5_ALERT	0	10	10

Table 1 Tasks parameters

Description of table

1. The task with Higher number has higher priority.
2. Give alert task the lowest priority because it is driven task by other tasks and don't make starvation in the system.

system tick rate

-To determine the systick rate we must calculate the **TotalExecutionTime**.

TotalExecutionTime = (2+3+1.5+2.5+1) = 10ms

Decide **TotalExecutionTime** is 10ms.

Calculations

Hyperperiod

Hyperperiod = LCM (all tasks periodicity)
=LCM (100,25,10) = 100

CPU load

Task_ID	Execution time	Periodicity	Busy time=(E*(H/P))
T1_LCD	2	100	2*(100/100) = 2
T2_BLOOD	3	25	3*(100/25) = 12
T3_HEART	1.5	100	1.5 *(100/100) = 1.5
T4_TEMP	2.5	10	2.5*(100/10) = 25
T5_ALERT	1	10	1*(100/10) = 10
Total busy time			50.5

Table 2 Tasks busy time

CPU Load = (Total busy time / Hyperperiod)
= (50.5/ 100) *100 = 50.5%

Timeline and Schedulability

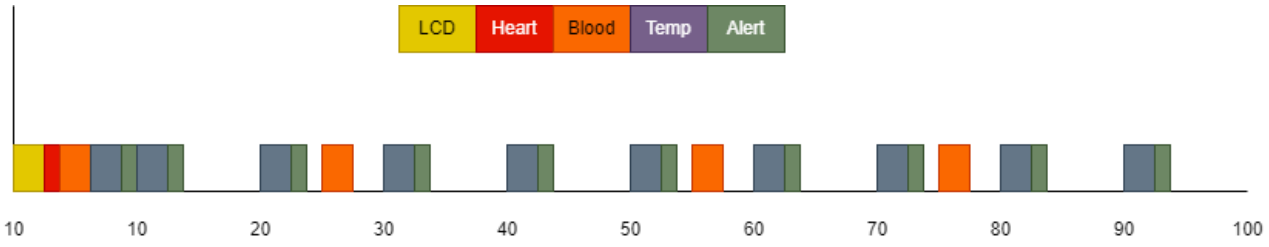

Figure 1 Manual timeline schedule

Simso output

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	periority
1	T1_LCD	Periodic	Yes	0	100.0	-	100.0	2.0		4
2	T2_BLOOD	Periodic	Yes	0	25.0	-	25.0	3.0		2
3	T3_HEART	Periodic	Yes	0	100.0	-	100.0	1.5		3
4	T4_TEMP	Periodic	Yes	0	10	-	10	2.5		1
5	T5_ALERT	Periodic	Yes	0	10	-	10	1.0		0

Figure 2 Simso tasks properties

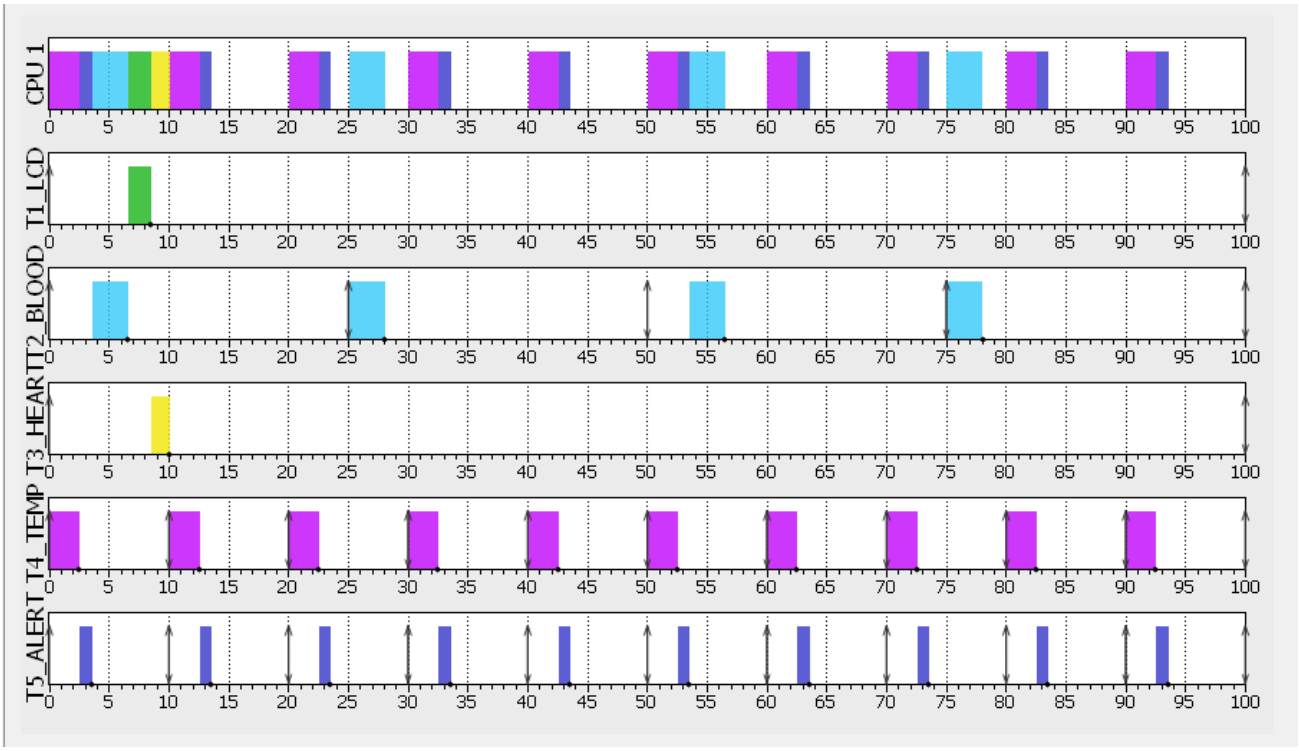

Figure 3 Simso system results