HealthCare System Using RTOS

V 1.0

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Table of Content

Overview

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

• 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)

• Blood pressure sensor with new data every 25ms.

(Reading the sensor and processing its data takes 3 ms)

• Heartbeat detector with new data every 100ms.

(Reading the sensor and processing its data takes 1.5 ms)

• Temperature sensor with new data every 10ms.

(Reading the sensor and processing its data takes 2.5 ms)

• Alert siren. (Activate or Deactivate the siren takes 1 ms)

Goals

• Decide how many tasks are needed.

• Decide the task parameters (Priority - Periodicity - Deadline).

• Decide the system tick rate.

• Calculate :

1. Hyperperiod
2. CPU load.

• Draw the timeline manually and analyze system schedulability.

• Model the system in Simso and verify that your design is schedulable.

Deliverables

Tasks

The system will mainly contain ***five tasks***. Four periodic tasks (LCD, Blood Pressure Reading, Heartbeat Reading, Temperature Reading) and one event task (Alert siren).

We will assume that the event task (Alert siren) will be periodic too but the logic of this task is based on event wait using (OR Logic) which means if any event occurs from the three tasks (Blood Pressure, Heartbeat, Temperature sensor) it will execute.

- T1 (LCD)
- T2 (Blood pressure sensor)
- T3 (Heartbeat detector)
- T4 (Temperature sensor)
- T5 (Alert siren)

Tasks Parameters

Task Number	Priority	Periodicity	Deadline
T1	0	100	100
T2	3	25	25
T3	2	50	50
T4	4	10	10
T5	1	10	10

Notes

- The **Higher** Priority Number indicates **Higher** Priority.
- T1 (LCD) takes the least priority due to the importance of other tasks.
- The logic inside T5 (Alert Siren) is executed only if the event occurs.

System Tick Rate

Since the execution time is given for each task we can simply calculate ***TotalExecutionTime.***

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

Therefore the Tickrate must be a number greater than ***TotalExecutionTime*** but in our system, ***we will choose 10ms too***.

Calculations

Hyperperiod

Since Hyperperiod ***(H)*** is equal to ***LCM(PI)*** where PI is all task periodicities.

Therefore ***H*** = ***100ms.***

CPU Load

CPU load can also be used in the design phase to decide whether to add new features to the system or not. It can be calculated wing following techniques:

- U = 100% - (Percentage of time that is spent in idle task)
- U = R/C

U = Utilization, ***R*** = Requirements which in simple terms is the BUSY TIME

C = Capacity which in simple terms is BUSY TIME + IDLE TIME ***(Hyperperiod).***

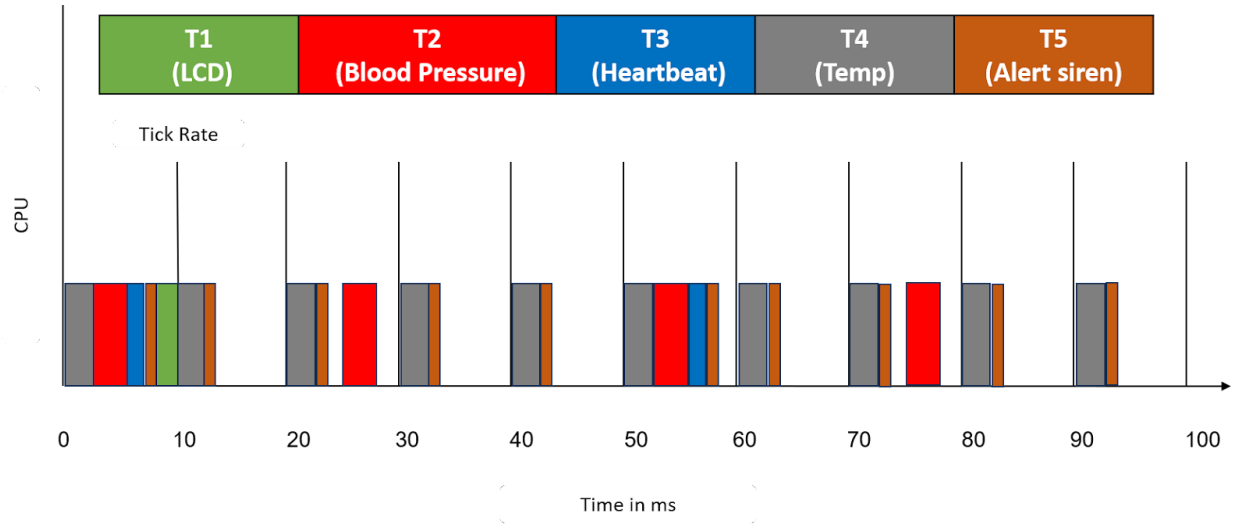
Since Requirements ***(R) = Execution time During Hyperperiod***

(E) = (2+3*4+1.5*2+2.5*10+1*10) = 52ms

(H) = 100ms

Therefore ***(U) = (52)/(100) = 52 %.***

Timeline and System Schedulability



Hyper period (H) = 100ms
Tick Rate = 10ms
CPU Load (U) = 52 %

Simso Output