EGFWD: ADVANCED EMBEDDED SYSTEMS

RTOS Project Report

Prepared By:

Eng. Ahmed Mostafa Rizk

BSc. Electronics and Communication Engineering

Ain Shams University

FEBRUARY 22, 2023

SPRINTS EGFWD

Advanced Embedded Systems Track

1-Hyperperiod

The hyperperiod is basically the LCM of the periodicity of all tasks.

In our case:-

Hyperperiod(H)=LCM(10,20,50,100)=100ms

2-CPU Load

We assume that the execution time for the first 4 tasks to be zeroes as they were all around 2-6 microseconds. In this case, the CPU load is as follows:

$$CPU\ Load = \frac{E5 + E6}{H} = \frac{(5 * 10) + (12 * 1)}{100} = 0.62(62\%)$$

3-Schedulability

3.1 URM

$$U = \sum_{i=1}^{n} \frac{C_i}{P_i}$$

$$(where\ C\ is\ Execution\ Time\ and\ P\ is\ Periodicity)$$

$$U = \left(\frac{1\mu}{50}\right)_1 + \left(\frac{1\mu}{50}\right)_2 + \left(\frac{6\mu}{100}\right)_3 + \left(\frac{20\mu}{20m}\right)_4 + \left(\frac{5}{10}\right)_5 + \left(\frac{12}{100}\right)_6 = 0.62$$

$$URM = n\left(2^{\frac{1}{n}} - 1\right) = 6\left(2^{\frac{1}{6}} - 1\right) = 0.73$$

$$U < URM$$

(so, the system is guaranteed schedulable)

3.2 Time Demand Analysis

$$Worst\ case(W)_{task} = (Execution\ time)_{task} + \sum\left(\frac{Current\ Tick}{(Period)_{Higher\ Priority\ Tasks}} * (Execution\ time)_{Higher\ Priority\ Tasks}\right)$$

$$If\ W < Deadline_{task}, then\ it\ is\ schedulable.$$

Let's start with task 5:-

W_5=5ms directly

(because it is the highest priority task)

5ms<10ms(deadline)

Task 5 is schedulable.

As for task 4 (Priority 2):-

$$W_4 = (20\mu)_4 + \left(\frac{20}{10} * 5\right)_5 \approx 10ms$$

10ms<20ms

Task 4 is schedulable.

As for tasks 1 & 2 (assuming 1 runs first):-

$$W_1 = (1\mu)_1 + \left(\frac{50}{20} * 20\mu\right)_4 + \left(\frac{50}{10} * 5\right)_5 \approx 25ms$$

$$W_2 = (1\mu)_2 + \left(\frac{50}{50} * 1\mu\right)_1 + \left(\frac{50}{20} * 20\mu\right)_4 + \left(\frac{50}{10} * 5\right)_5 \approx 25ms$$

25ms<50ms

Tasks 1 & 2 are schedulable.

As for task 6:-

$$W_6 = (12m)_6 + \left(\frac{100}{50} * 1\mu\right)_2 + \left(\frac{100}{50} * 1\mu\right)_1 + \left(\frac{100}{20} * 20\mu\right)_4 + \left(\frac{100}{10} * 5\right)_5 \approx 62ms$$

62ms<100ms

Task 5 is schedulable.

And finally, task 3 (in case 6 runs first/worst case):-

$$W_3 = (6\mu)_3 + \left(\frac{100}{100} * 12m\right)_6 + \left(\frac{100}{50} * 1\mu\right)_2 + \left(\frac{100}{50} * 1\mu\right)_1 + \left(\frac{100}{20} * 20\mu\right)_4 + \left(\frac{100}{10} * 5\right)_5 \approx 62ms$$

62ms<100ms

Task 3 is schedulable.