Automotive door control system design

egFWD – Embedded Systems

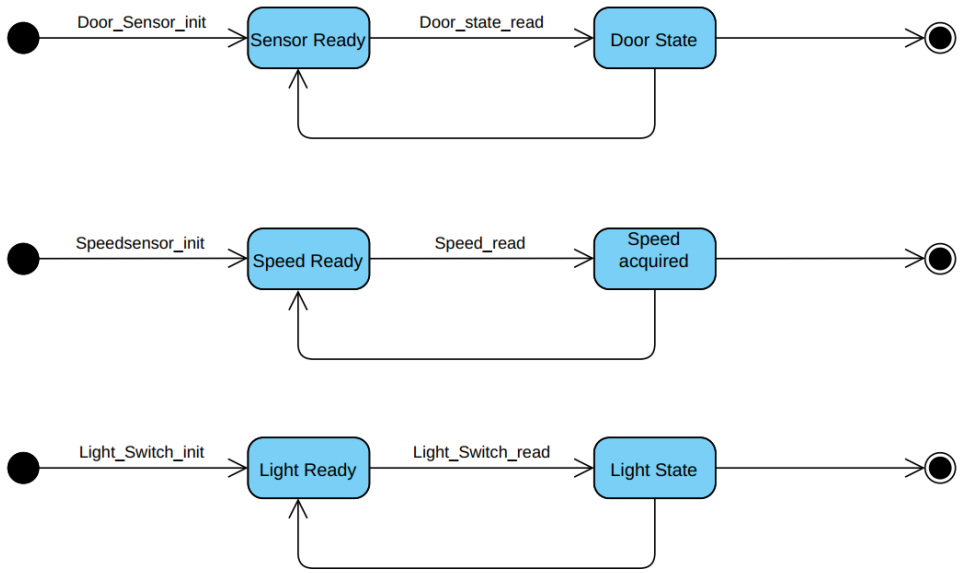
Advanced Track

By: Mohamed Elsayed

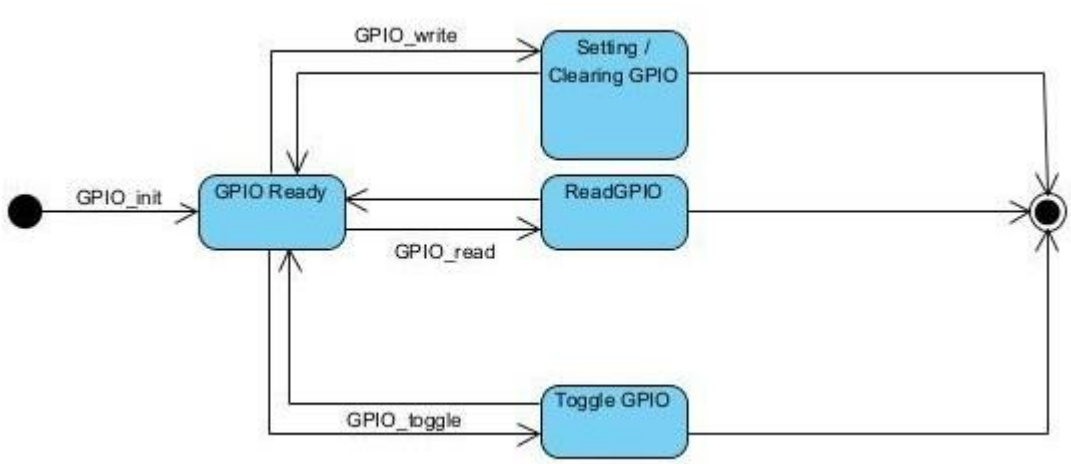
3- Dynamic design analysis

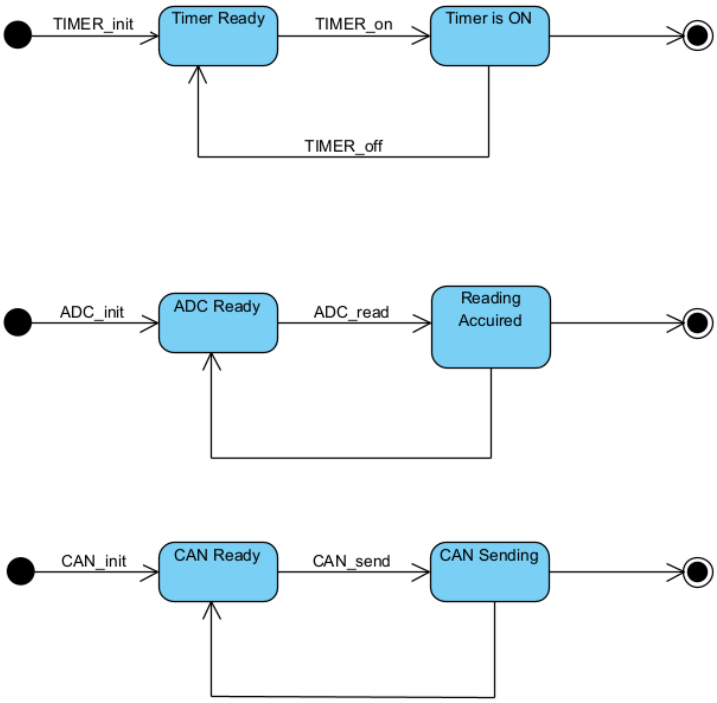
ECU 1:

ECUAL's State Machines

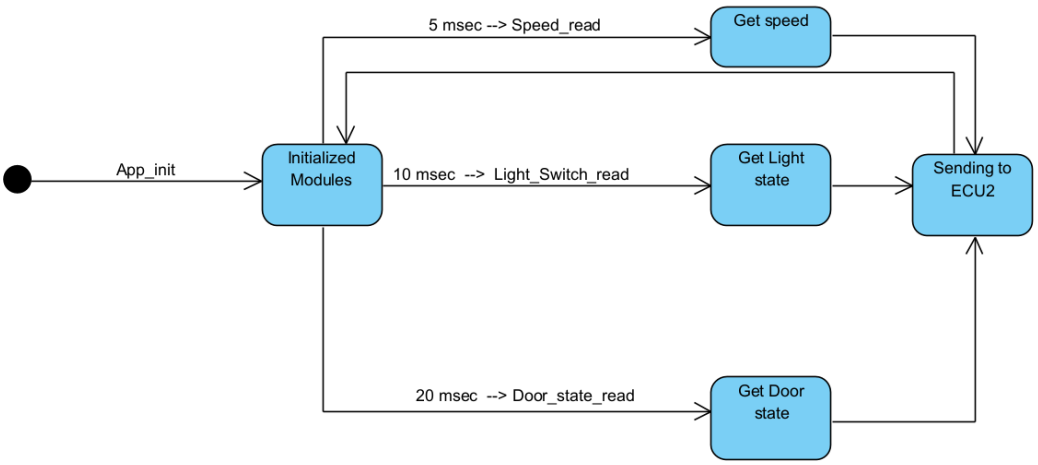


MCAL's State Machines

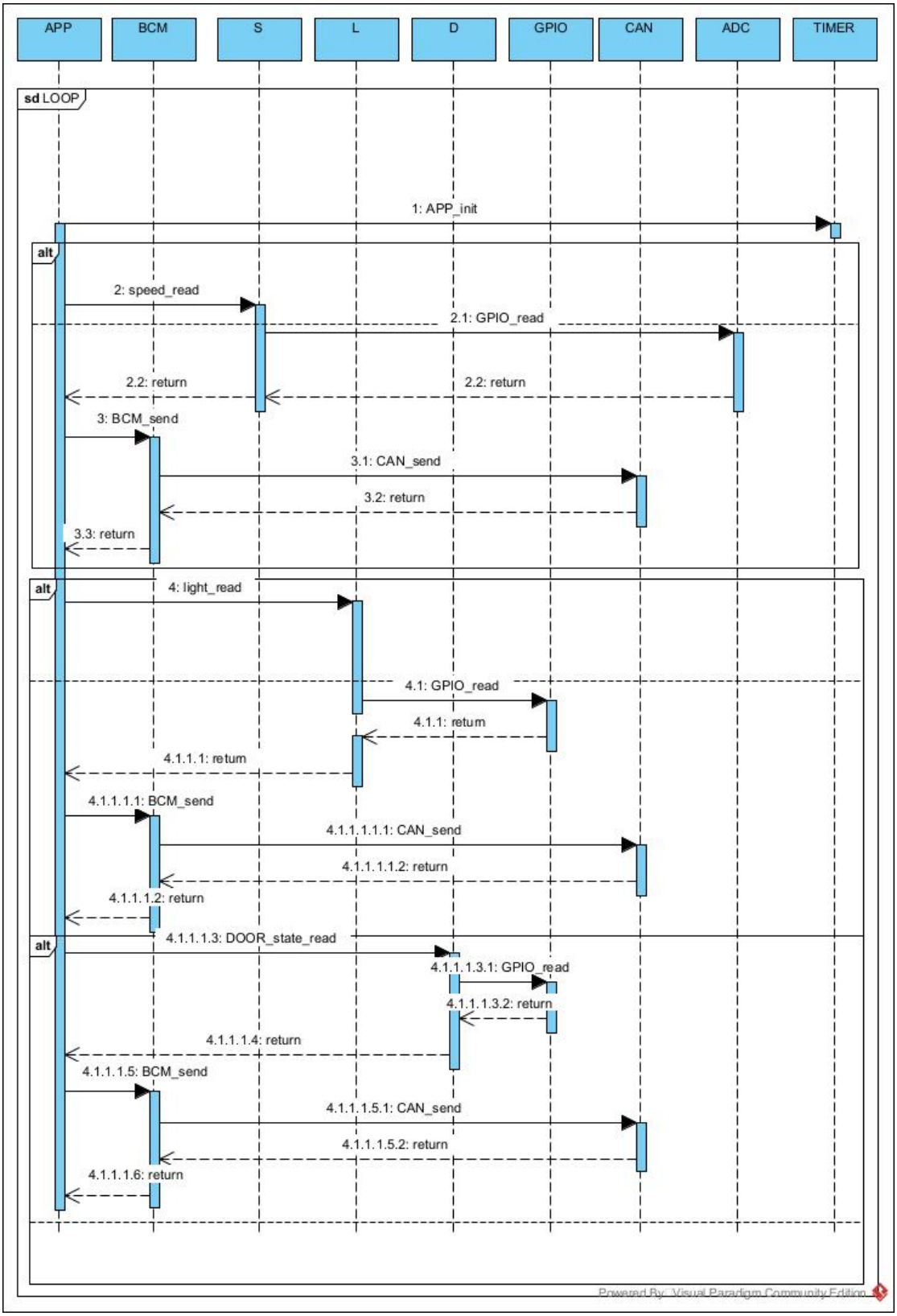




ECU1 operation



Sequence Diagram



ECU 1: CPU LOAD

Assuming : Tick time=1ms , Task periodecities :5,10,20,
Execution time :1, 2, 4 ms

$\boldsymbol{HyperPeriod} = \boldsymbol{LCM}(Periodicities) = \boldsymbol{LCM}(5,10,20)$
$\boldsymbol{HyperPeriod} = 20$

CPU Load Calculations

CPU LOAD =Total Time*100/ HyperPeriod

$$\textbf{CPU LOAD} = \frac{\text{Total Time}}{\text{HyperPeriod}} * 100$$

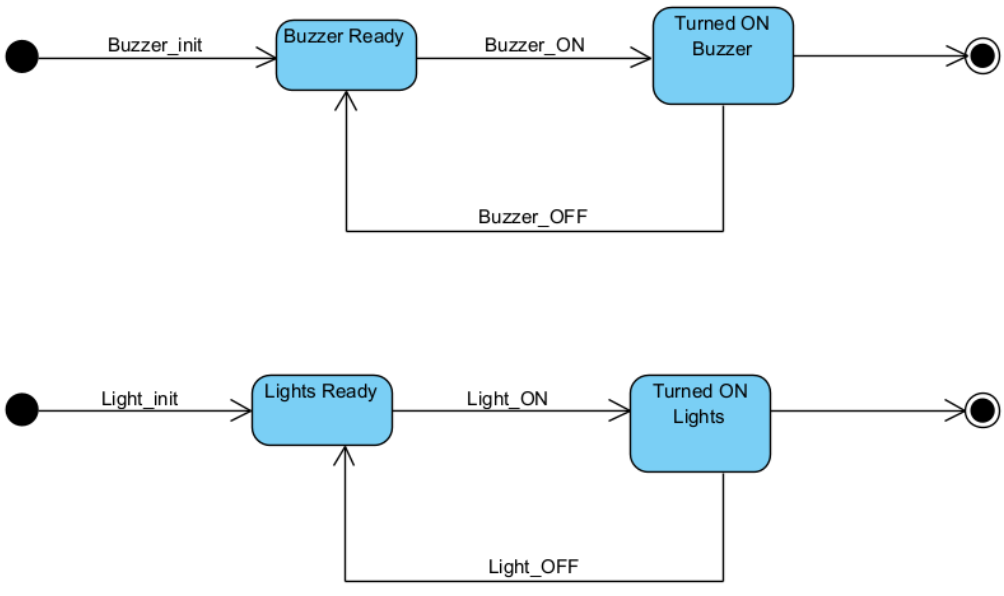
$$\boldsymbol{Total\ Time} = \sum_{i=1}^{6} \text{ExecutionTime}_i * \text{Num of Calls In HyperPeriod}_i$$

$\boldsymbol{Total\ Time} = 1 * 4 + 2 * 2 + 4 = 12$

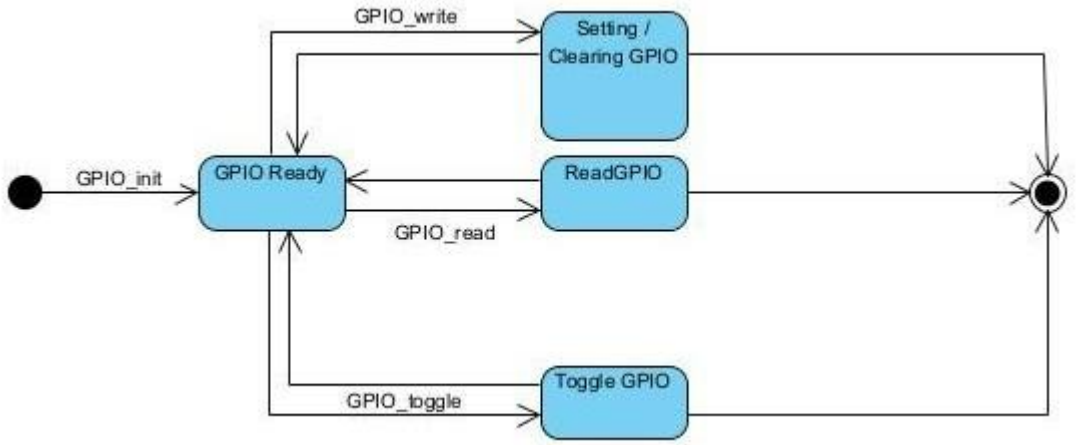
$\boldsymbol{U} = \textbf{CPU LOAD} = 12*20\ /100 = 60\%$

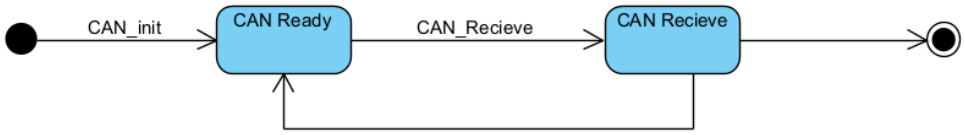
ECU 1:

ECUAL's State Machines

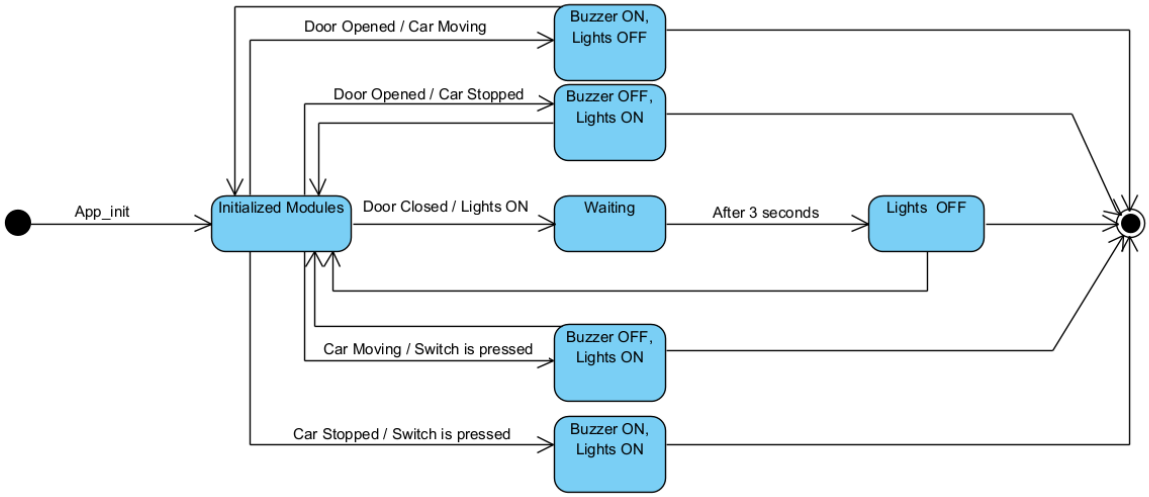


MCAL's State Machines

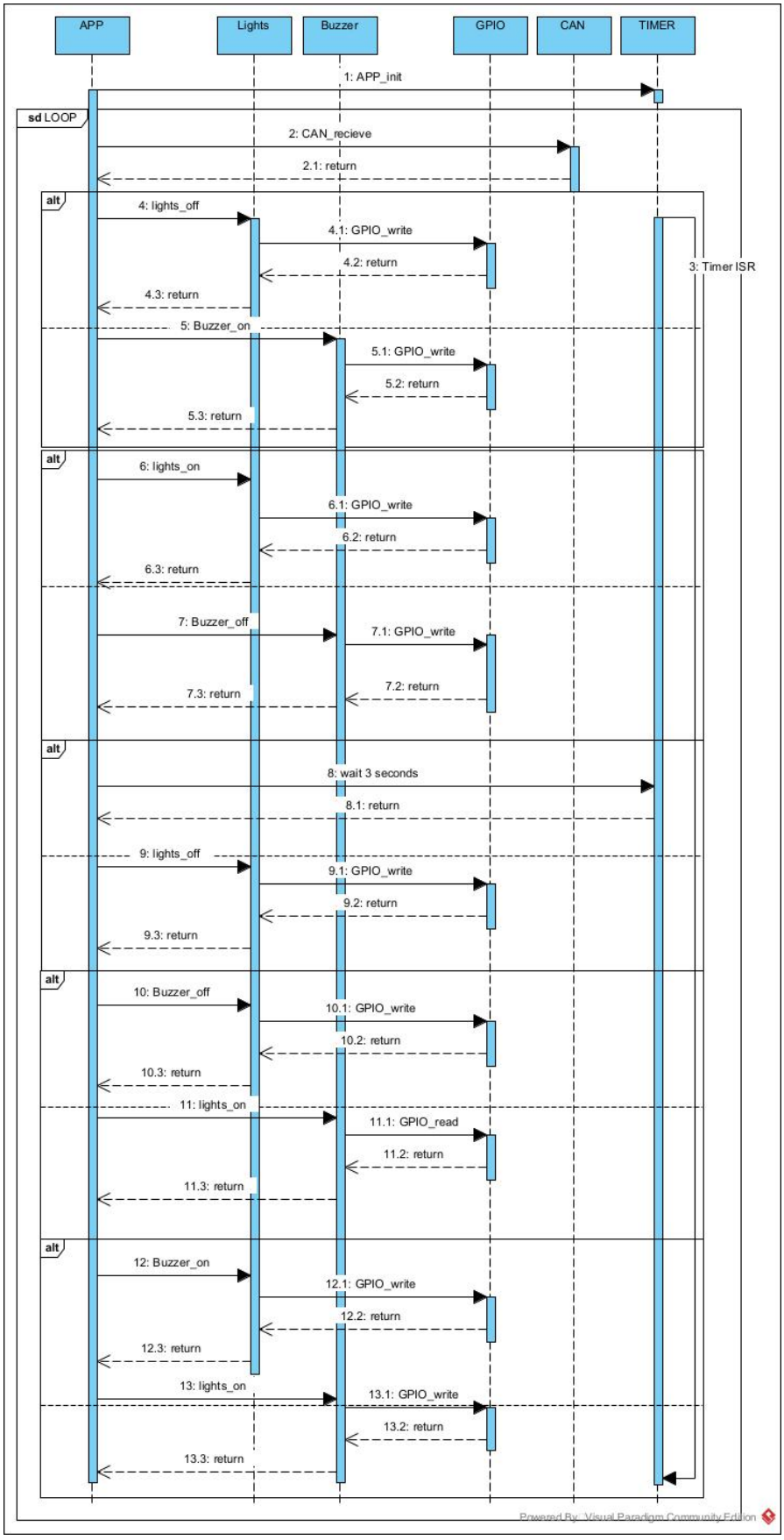




ECU2 operation



Sequence Diagram



ECU 1: CPU LOAD

Assuming : Tick time=1ms , Task periodecities :5,10,
Execution time : 2, 3 ms

$\boldsymbol{HyperPeriod} = \boldsymbol{LCM}(Periodicities) = \boldsymbol{LCM}(5,10)$
$\boldsymbol{HyperPeriod} = 10$

CPU Load Calculations

CPU LOAD =Total Time*100/ HyperPeriod

$$\textbf{CPU LOAD} = \frac{\text{Total Time}}{\text{HyperPeriod}} * 100$$

$$\boldsymbol{Total\ Time} = \sum_{i=1}^{6} \text{ExecutionTime}_i * \text{Num of Calls In HyperPeriod}_i$$

$\boldsymbol{Total\ Time} = 2 * 2 + 3 = 7$

$\boldsymbol{U}$ = **CPU LOAD** = 7*10 /100 = 70%