

Automotive door control system design

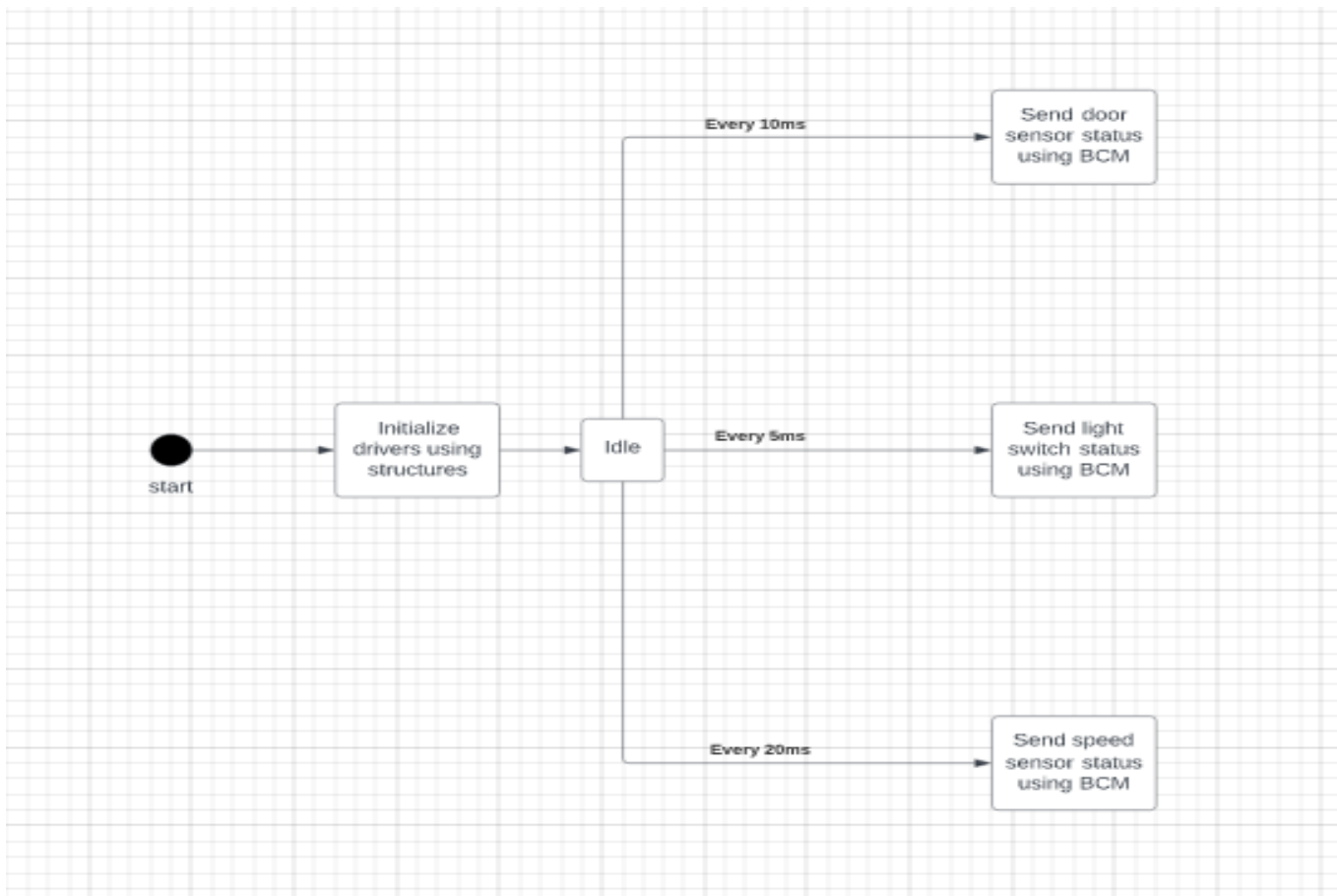
Dynamic Design Analysis

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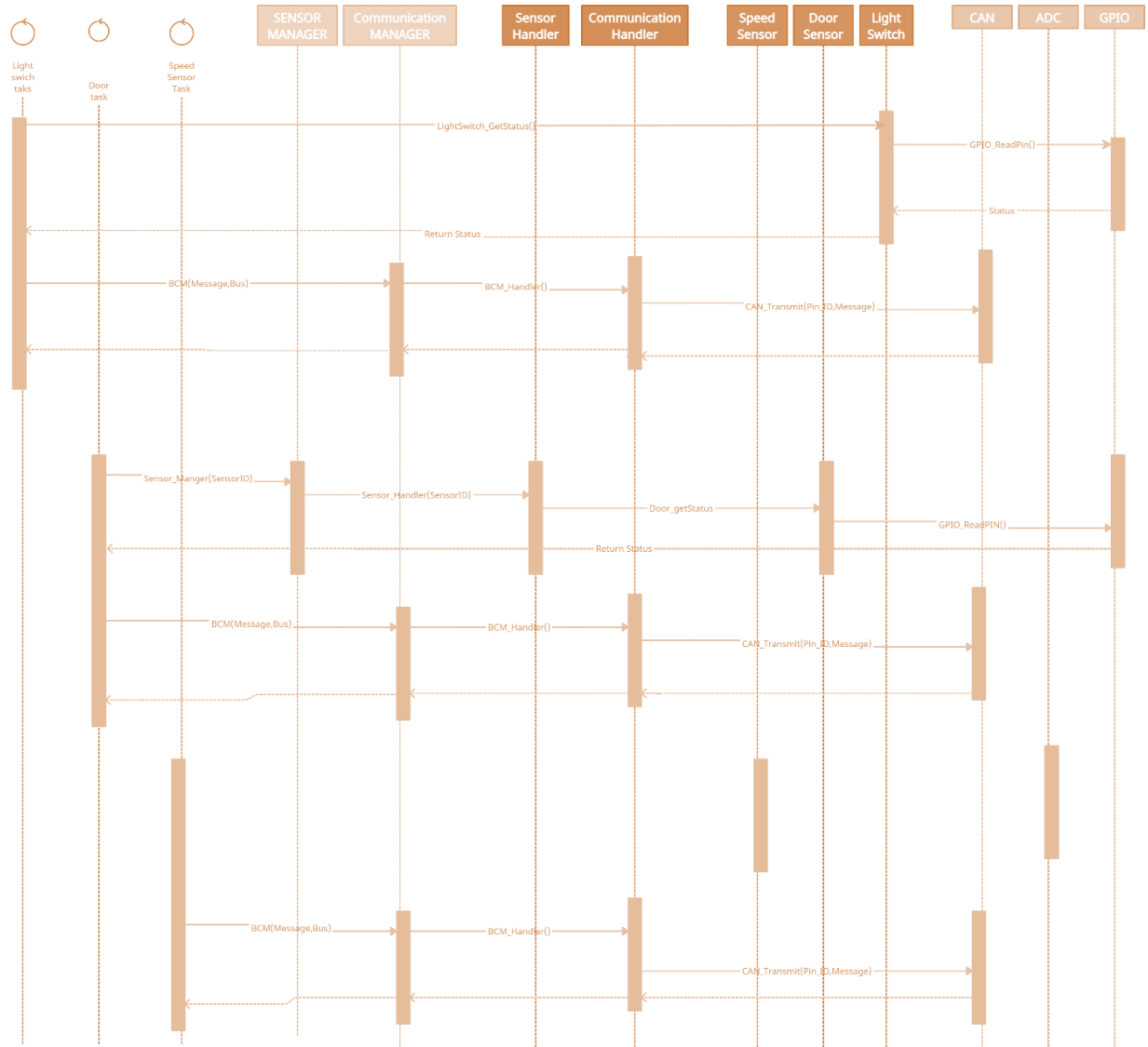
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ECU 1

1- State Machine Diagram



2- Sequence Diagram



3- CPU Load

The system contains three tasks, assume that the execution time of each task is 1.5ms.

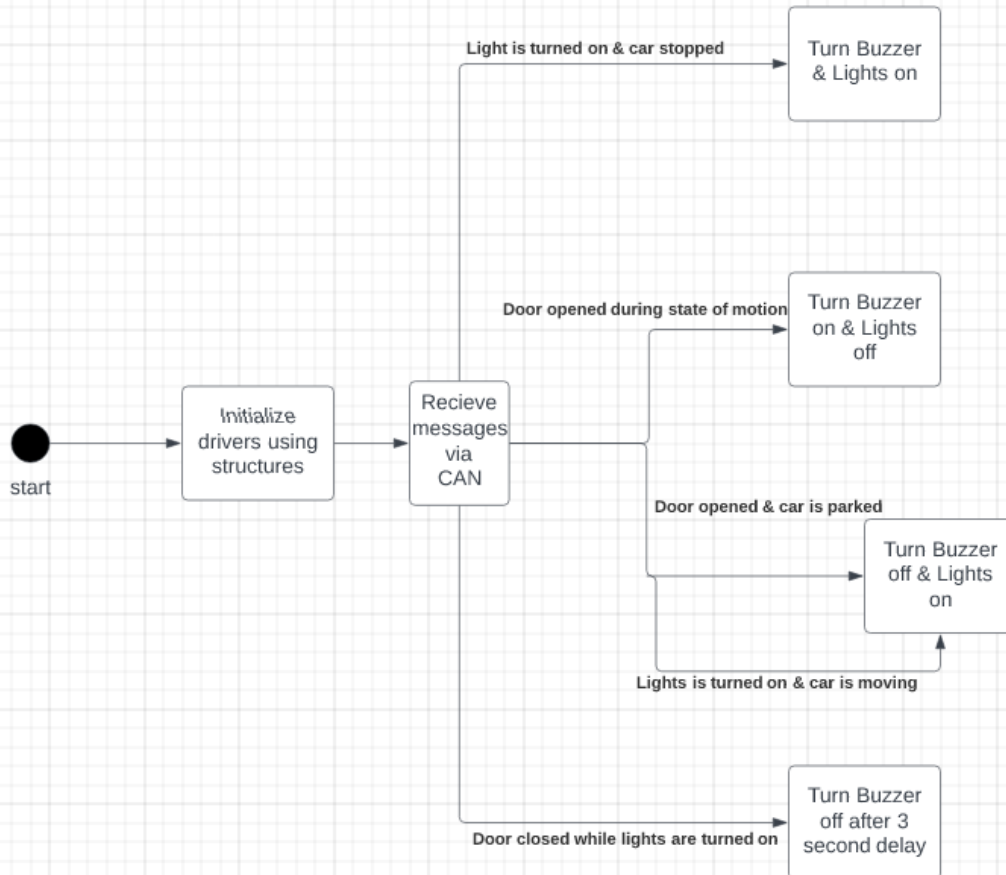
T1 {P:20, E:1.5} T2 {P:10, E:1.5} T3 {P:5, E:1.5}

Hyper period = 20

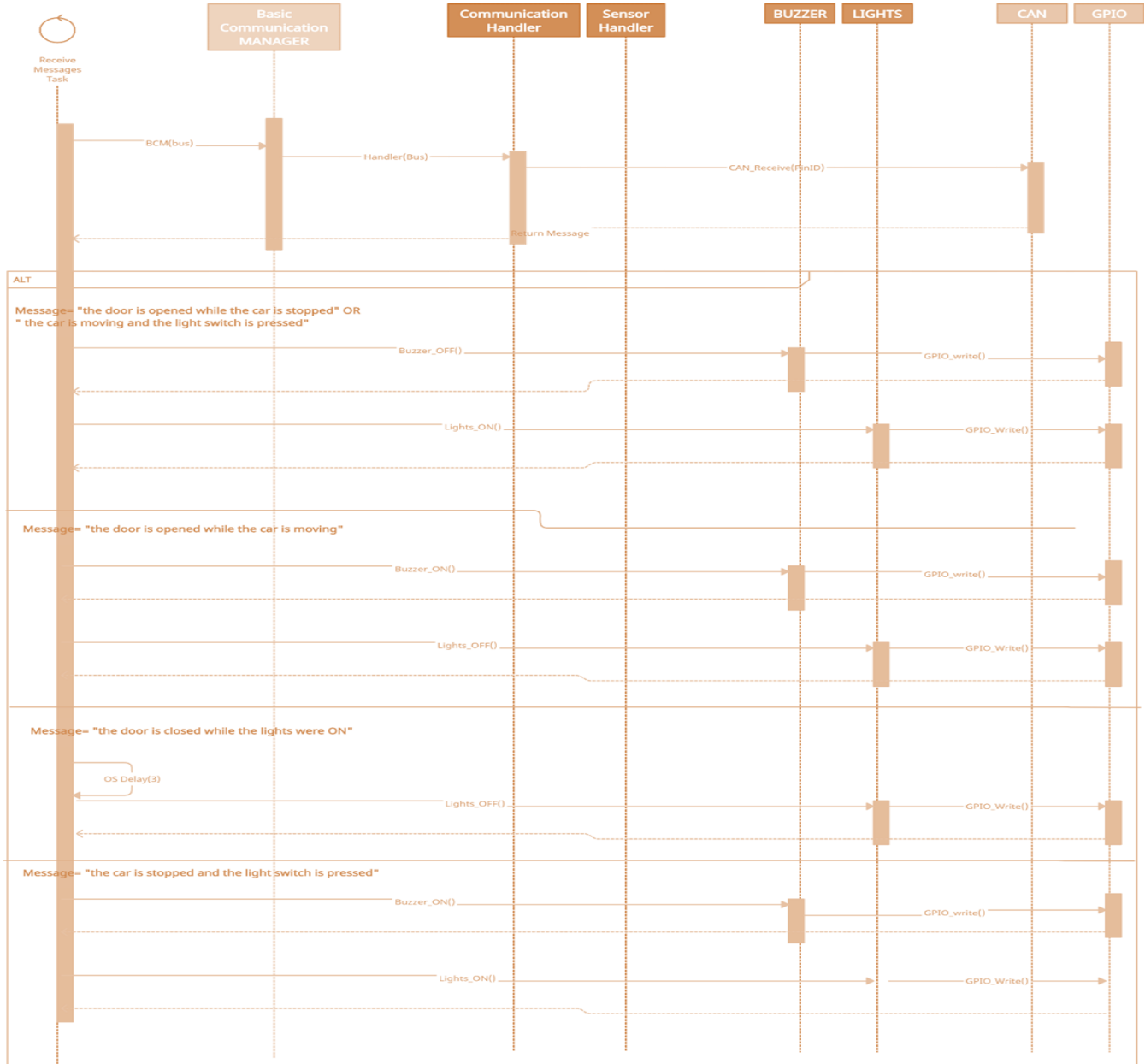
$$U = (E1 + E2 + E3) / H = ((1.5*1) + (1.5*2) + (1.5*4) / 20) * 100 \% = 52.5\%$$

ECU 2

1- State Machine Diagram



2- Sequence Diagram



3- CPU Load

The system contains only one task assuming execution time 2ms and periodicity is 10ms.

T1 {P:10, E:2}

Hyper period = 10

$$U = E1 / H = ((1 * 2) / 10) * 100 = 20\%$$

BUS LOAD:

Assuming CAN frame consists of **64 bit** and using **125 kb/s**

Bit time = $1 / \text{bit rate} = 1 / (125 * 1000) \text{ s} = \mathbf{8 \text{ us}}$

Frame time = number of bits * bit time = 125 bit * 8 us = **1000 us**

the bus load for 3 messages every 5ms , 10ms and 20ms can be calculated by

- 1 frame every 5ms = 200 frame every 1000ms
- 1 frame every 10ms = 100 frame every 1000ms
- 1 frame every 20ms = 50 frame every 1000ms

Total frames in 1 s = **350**

Total time on bus = $350 * 1000 \text{ us} = 350000 \text{ us}$

Bus load in 1 s = $(350 * 1000\text{ms} / (1000)) * 100 \% = \mathbf{35 \%}$