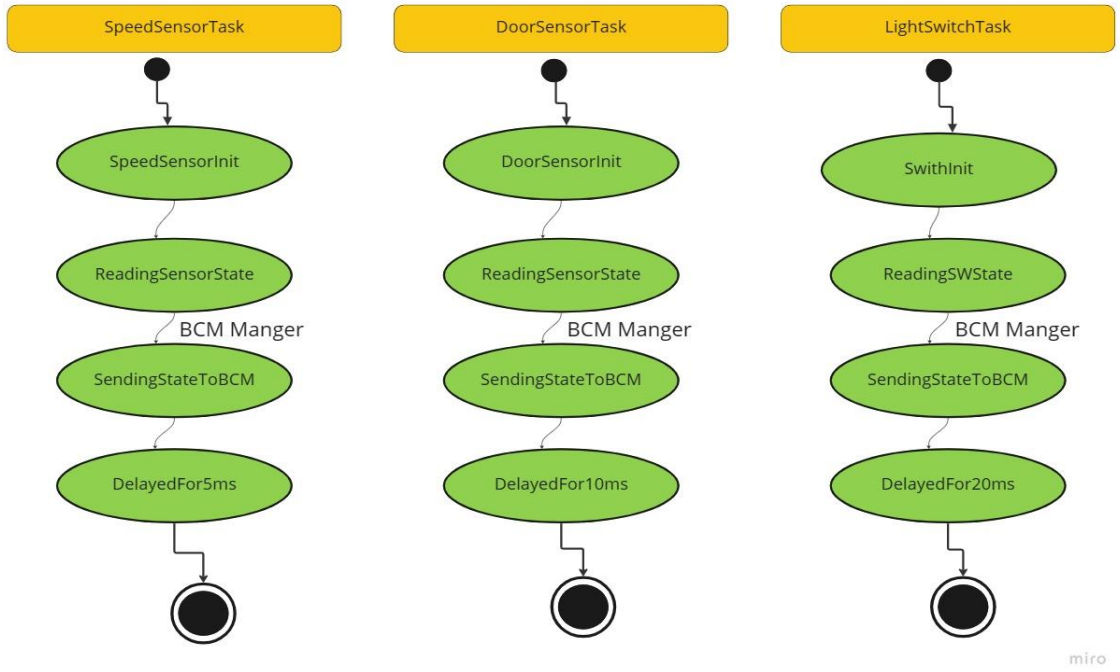
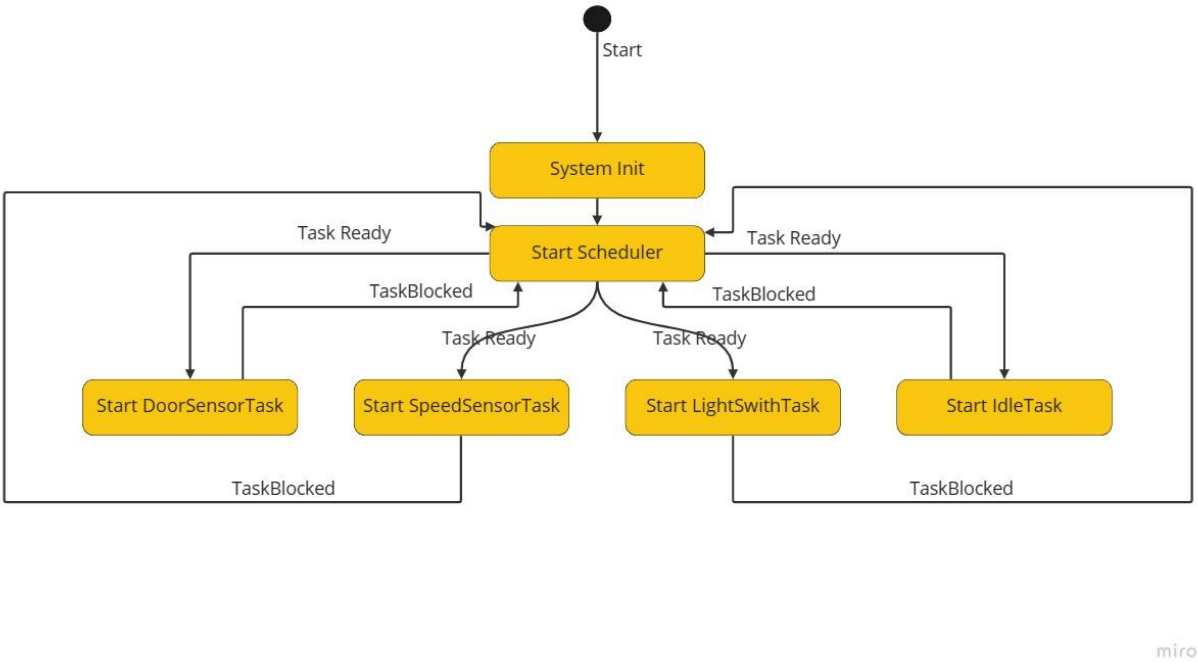
Dynamic Design

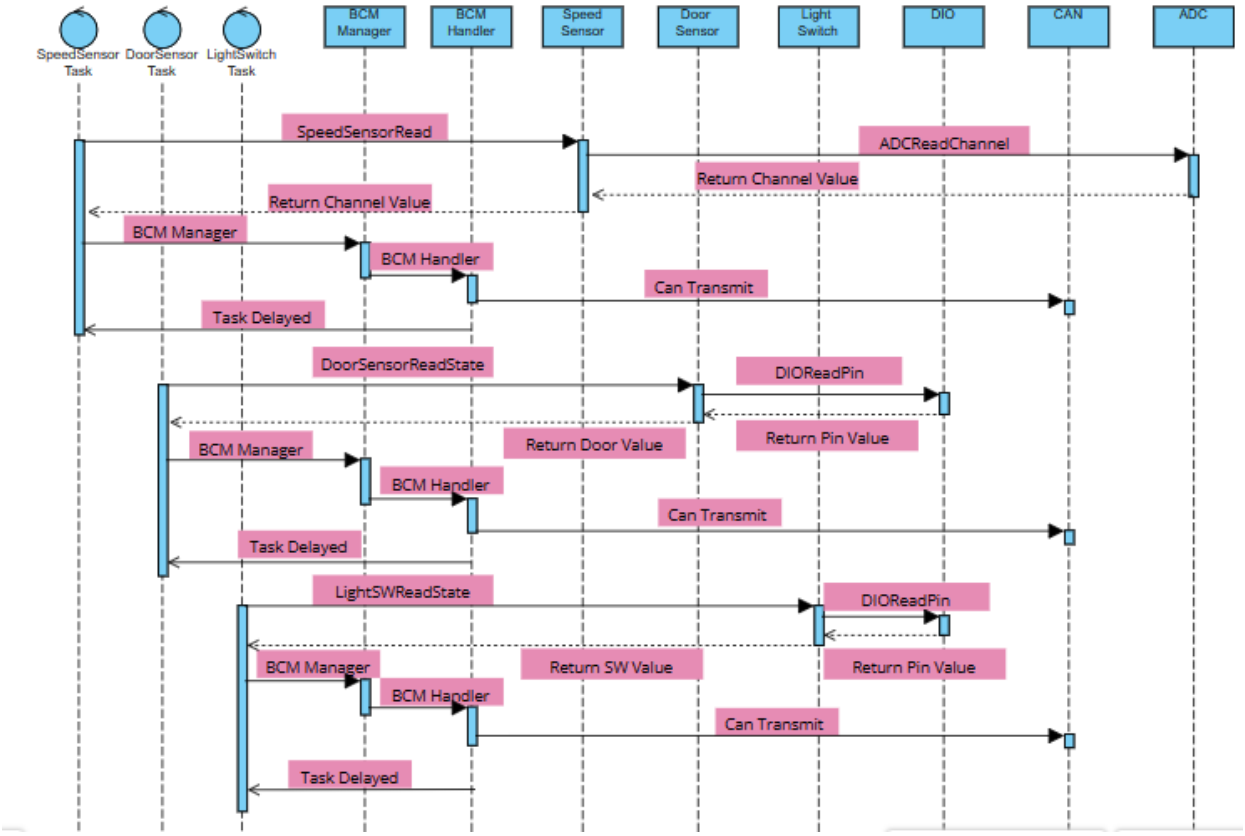
1) For ECU1
   - state machine diagram for each ECU component



   - state machine diagram for the ECU operation



- sequence diagram for the ECU



- Calculate CPU load for the ECU

<u>Suppose Execution Time for each task 1 ms</u>

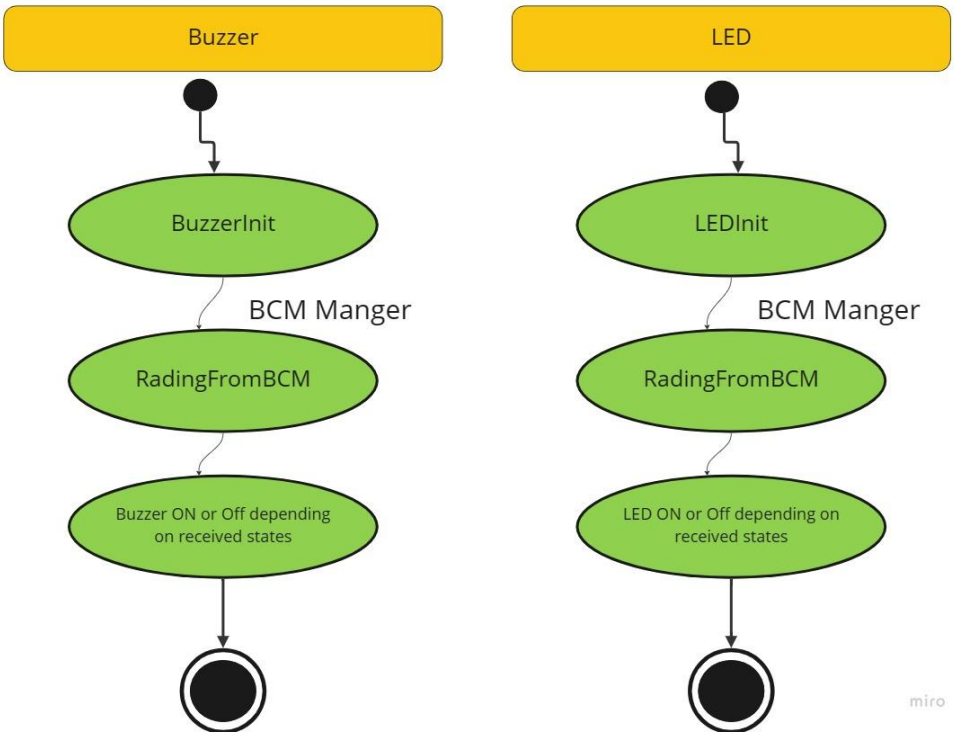
Speed Sensor Task → {E: 1ms, P: 5ms}
Door Sensor Task → {E: 1ms, P: 10ms}
Light Switch Task → {E: 1ms, P: 20ms}

<u>Hyper period = 20</u>

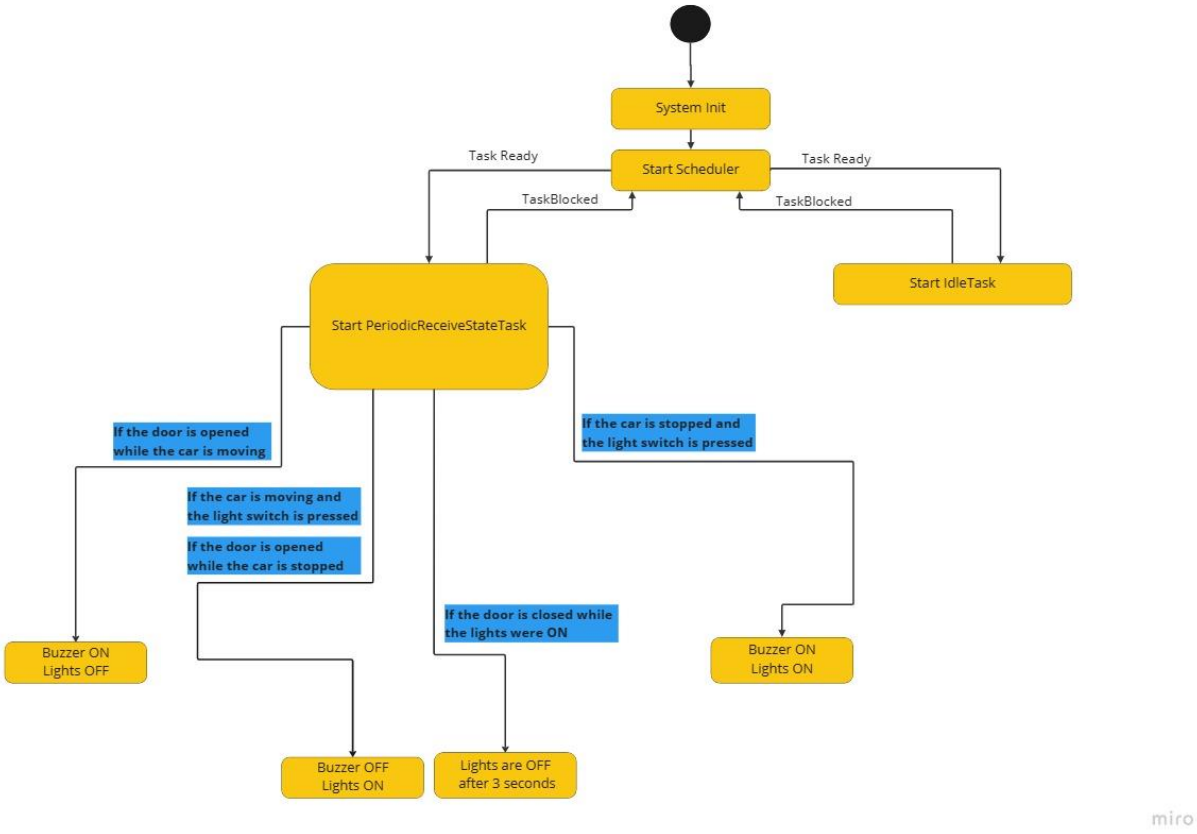
CPU Load = SUM (E/P) at hyper period=((1*(20/5) + 1*(20/10) + 1*(20/20))/20)*100 = 35 %

2) For ECU 2

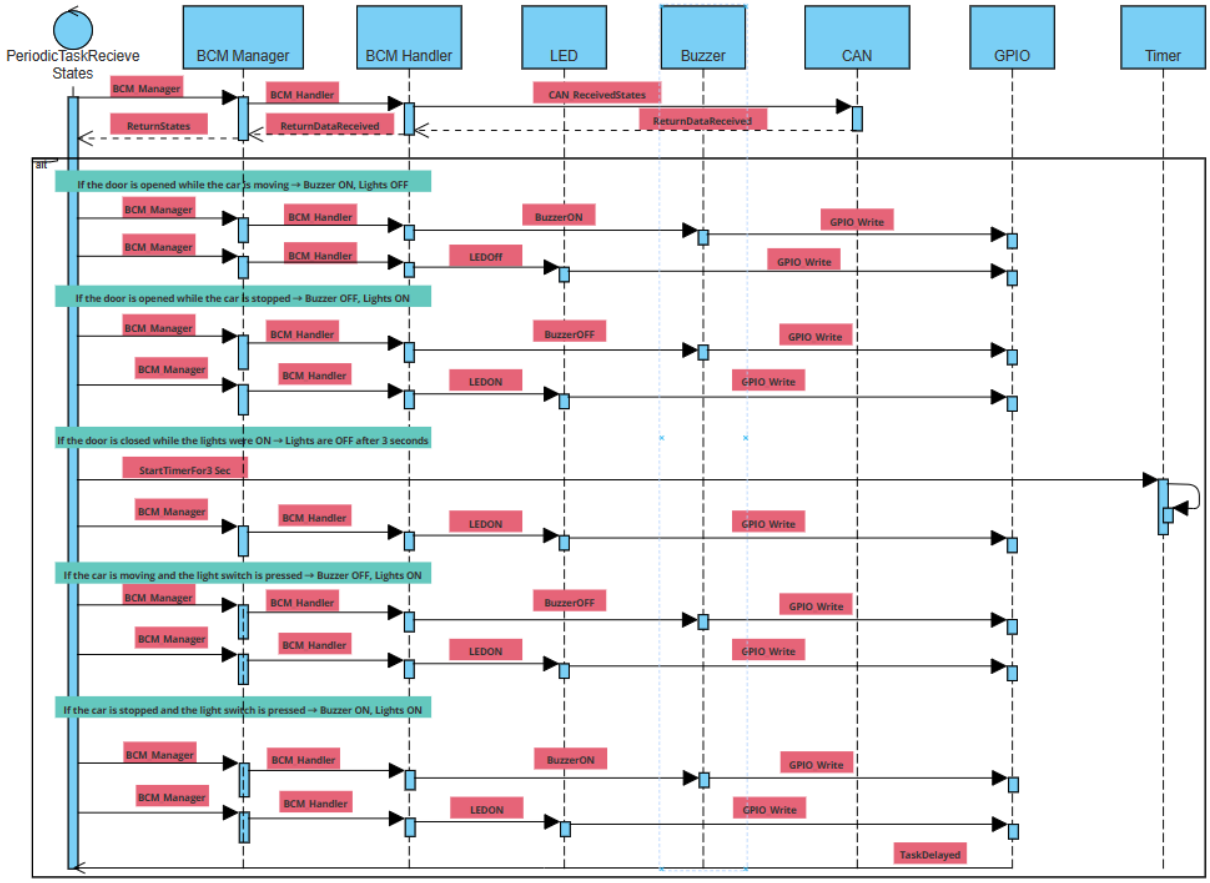
- state machine diagram for each ECU component



- state machine diagram for the ECU operation



- sequence diagram for the ECU



- Calculate CPU load for the ECU

<u>Suppose Execution Time for each task 1 ms</u>

PeriodicReceivedTask → {E: 1ms, P: 5ms}

<u>Hyper period = 5 ms</u>

CPU Load = SUM (E/P) at hyper period=(((1*(5/5)) /5)*100 = 20%

3) For Bus Load

CAN Frame have 125 bits so if we are using (500 kbit/s) rate
So to transfer one bit we need (1/bit rate) time = (1/500000*1000) = 2 microS
To transfer 1 frame we need 2*125 = 250 microS
In ECU1 there are 3 tasks use CAN Bus

First Task send 1 frame every 5 ms
Second Task send 1 frame every 10 ms
Third Task send 1 frame every 20 ms

Through **one second**

First Task send 200 frame
Second Task send 100 frame
Third Task send 50 frame

Totally 350 frames per second
Time on Bus = Total Frames * Frame Time = 350 * 250 = 87.5 ms
Bus Load = ((87.5 /1000)*100)% = 8.75 %