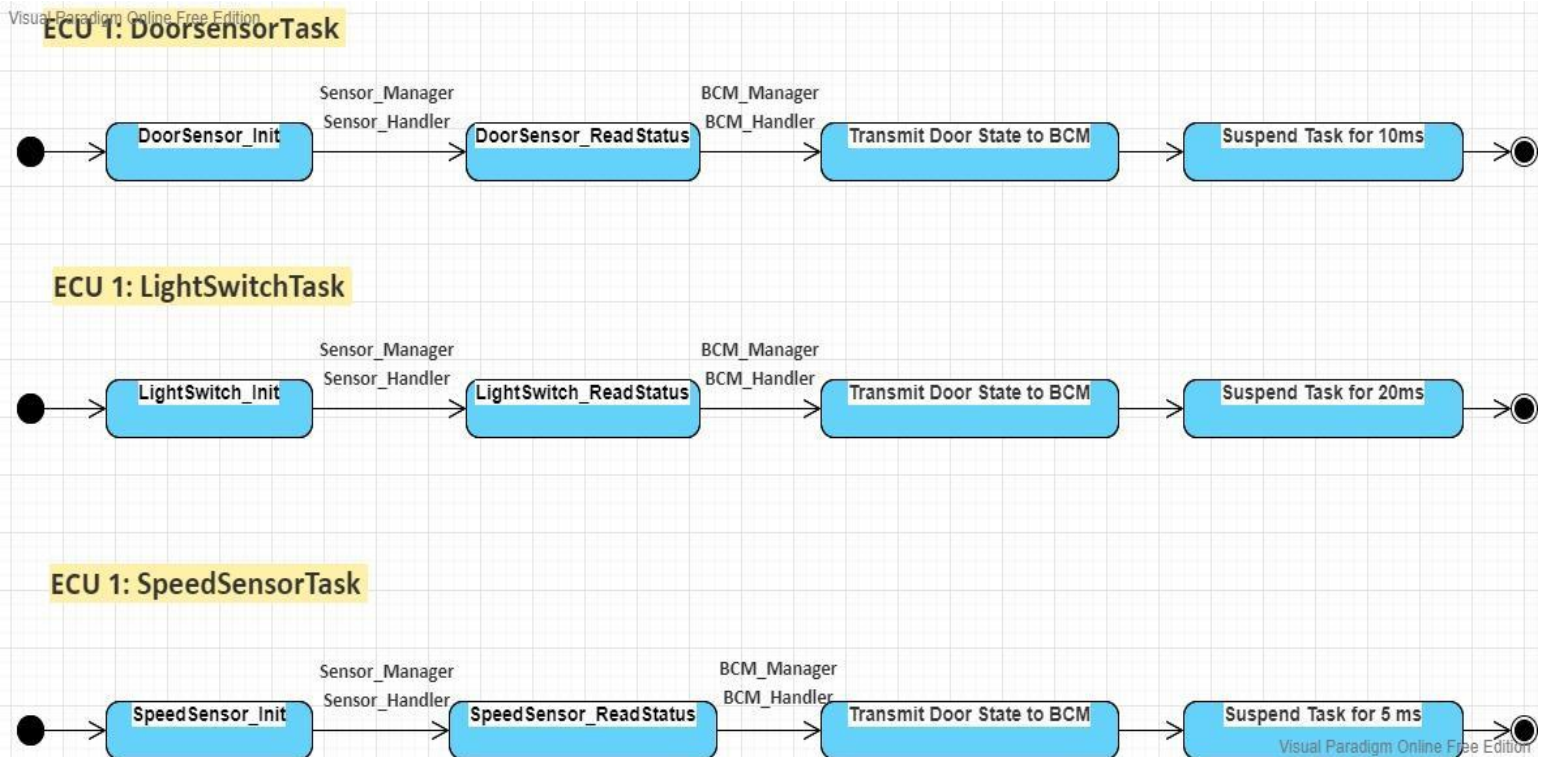


Dynamic Design

Name: Ahmed Elkhateeb

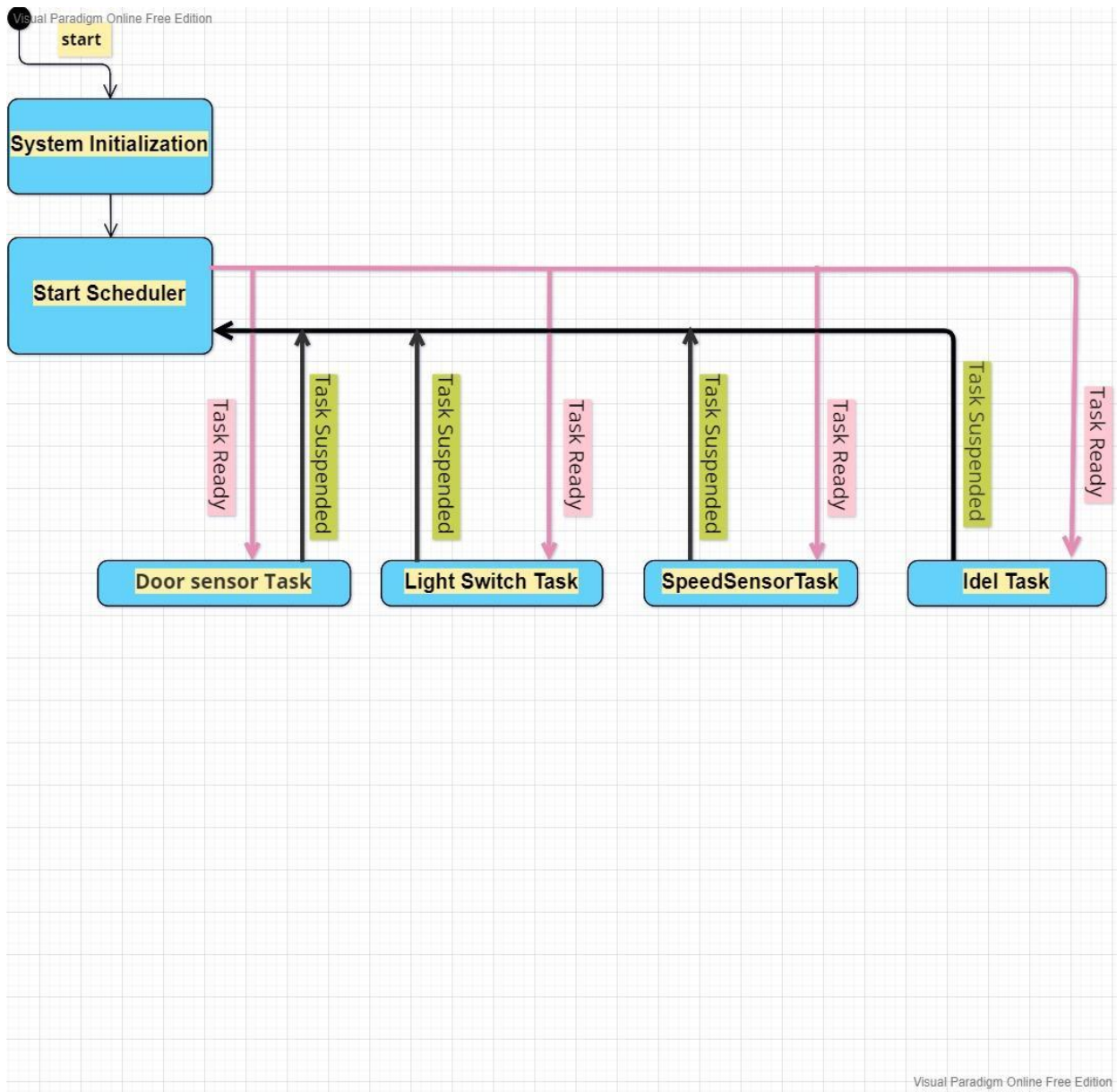
Email : ahmedelkhateeb.asurt@gmail.com

For ECU 1:
1- state machine diagram for ECU 1 component:



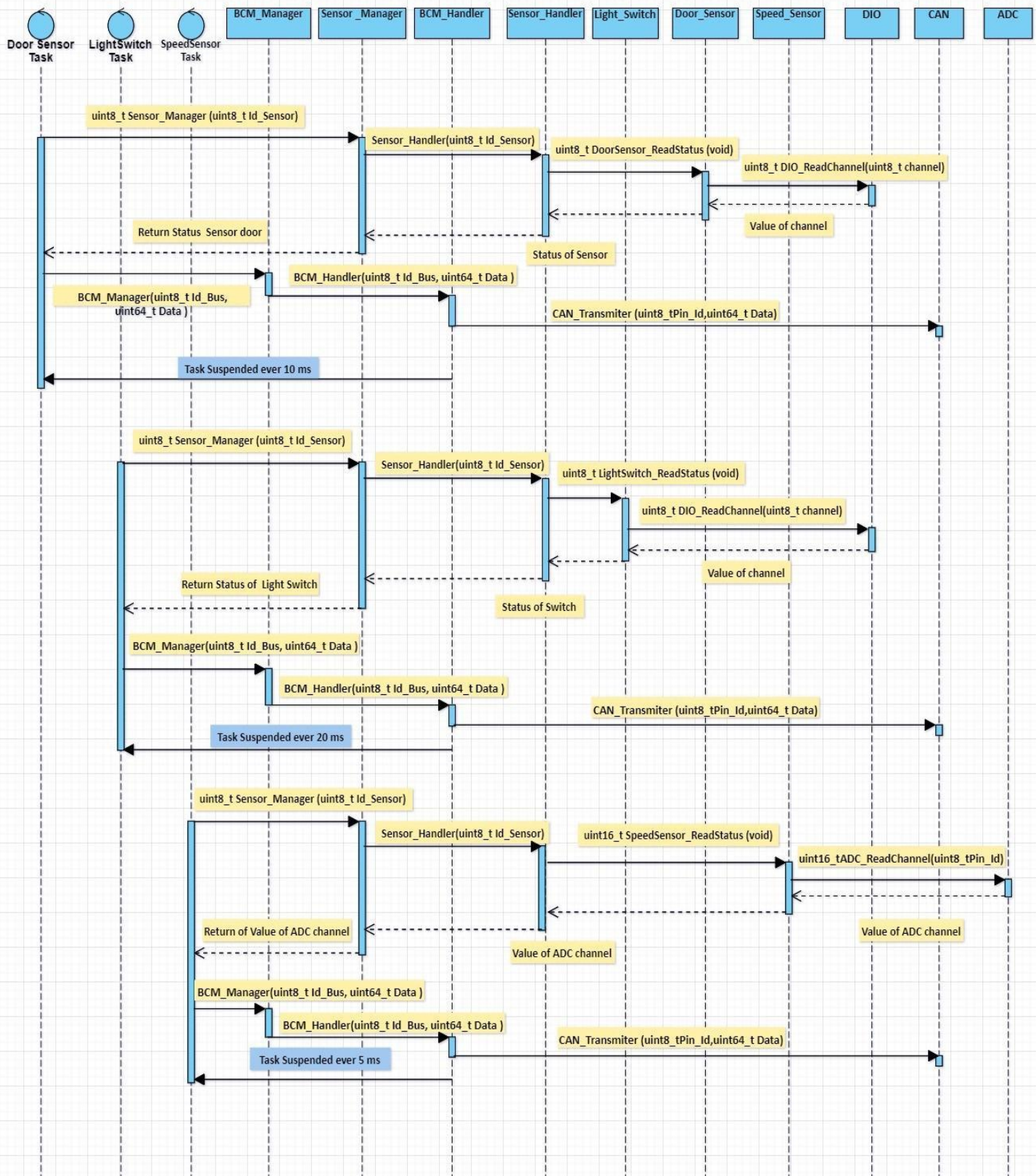
Notes: IDLE task exaction when the processor does not exaction any task.

2- state machine diagram for the ECU 1 operation:



3- sequence diagram for the ECU 1 :

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4- Calculate CPU load for the ECU 1:

The system contains three tasks assuming the worst case scenario that the execution time of the task is 500 μ s.

Name Task	Periodicity	Execution Time
Door Sensor Task	10 ms	500 μ s
Light sensor Task	20 ms	500 μ s
Speed Sensor Task	5 ms	500 μ s

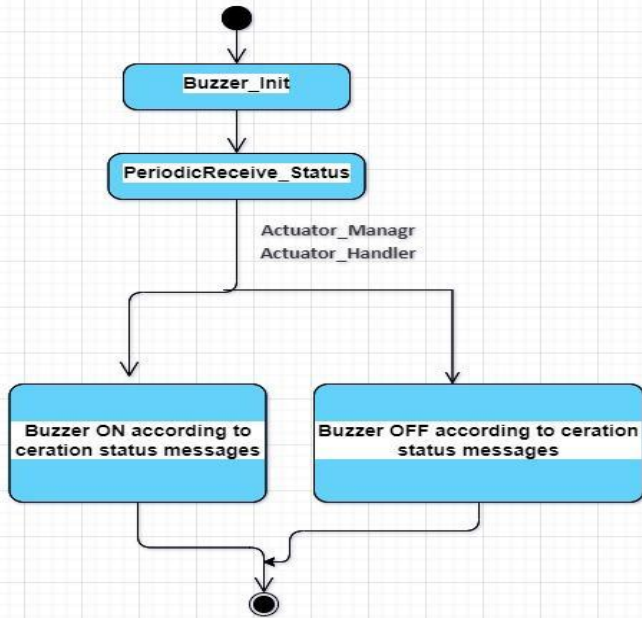
H (Hyper Period) = LCM(Pi) = 20 ms

CPU Load = $\sum E / H = (0.5*2 + 0.5*4 + 0.5*1) / 20 * 100 = 17.5 \%$

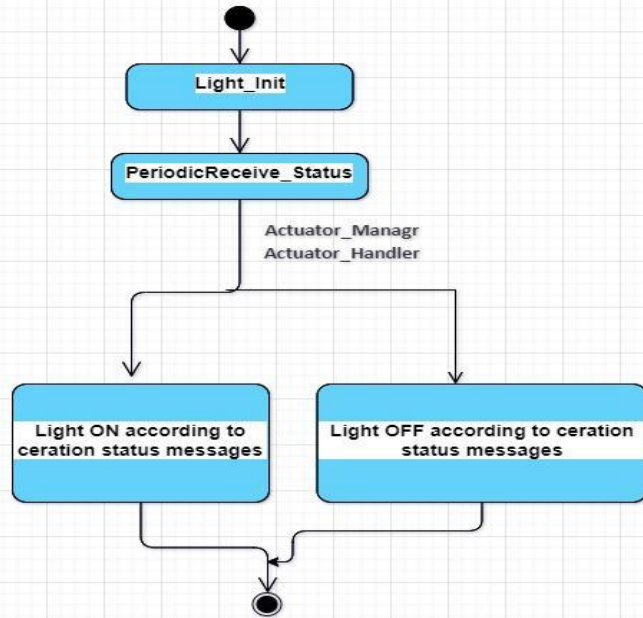
For ECU 2:
1- state machine diagram for ECU 2 component:

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Buzzer_state machine

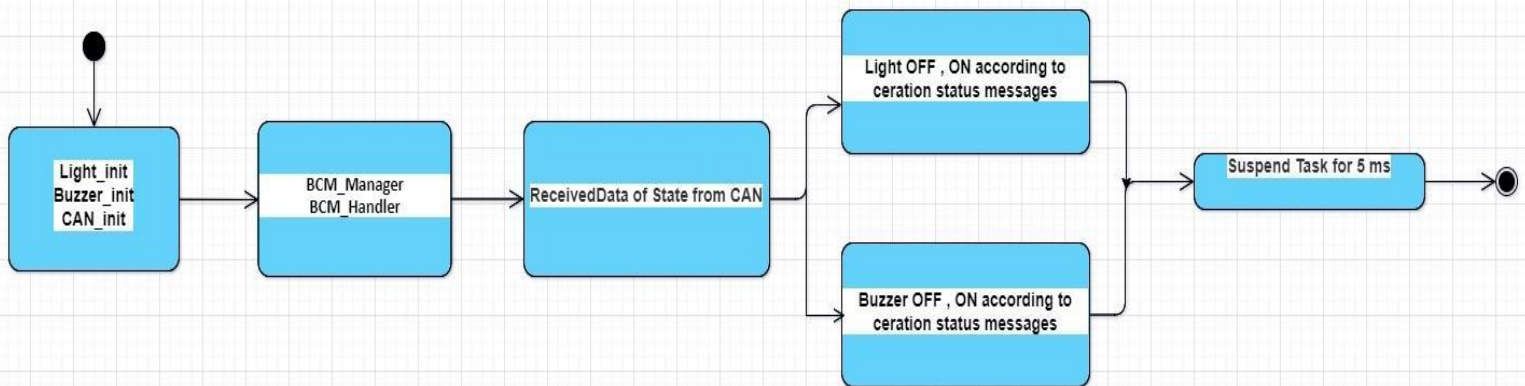


Light_state machine



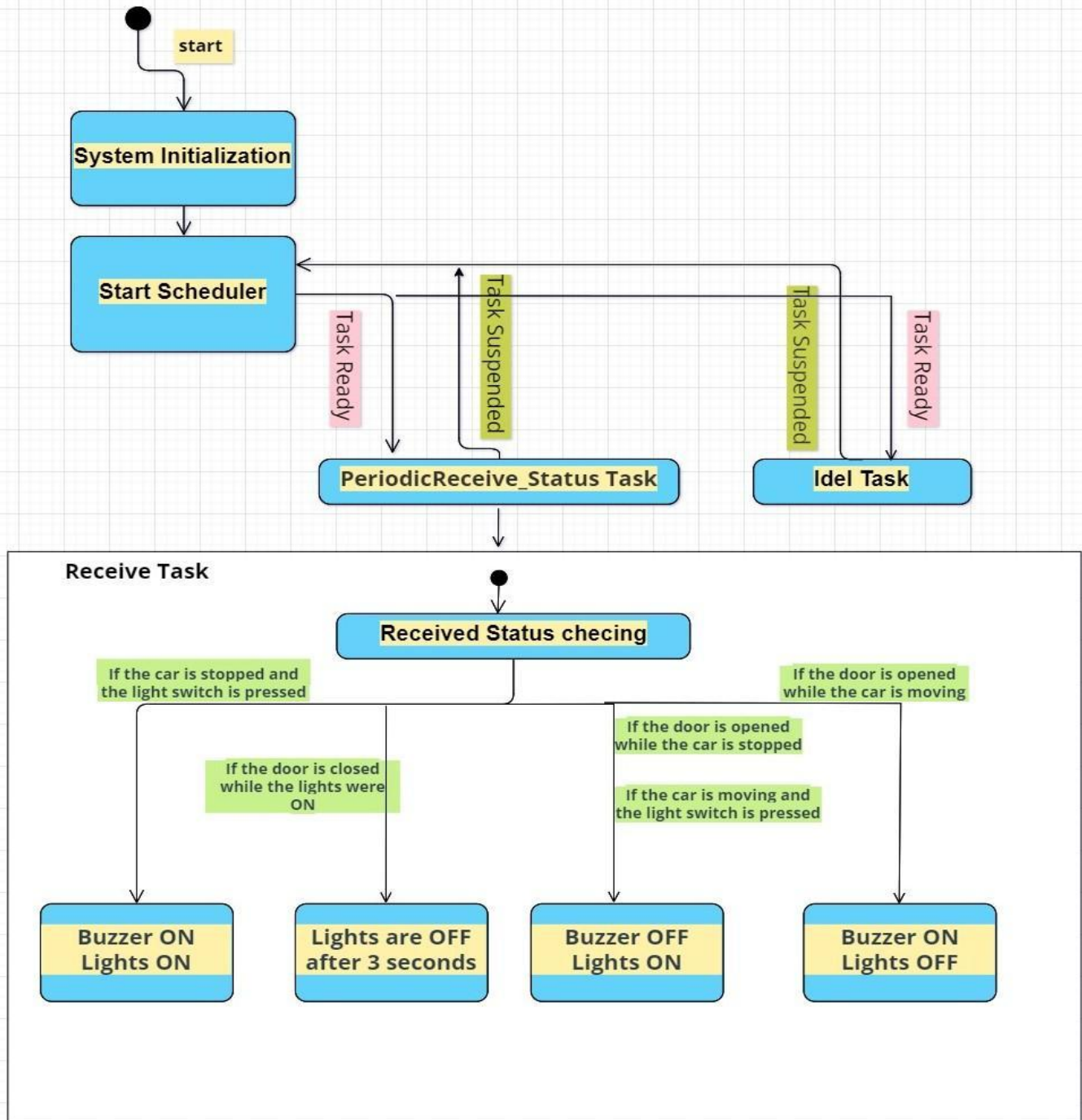
Visual Paradigm Online Free Edition

PeriodicReceive_Status Task



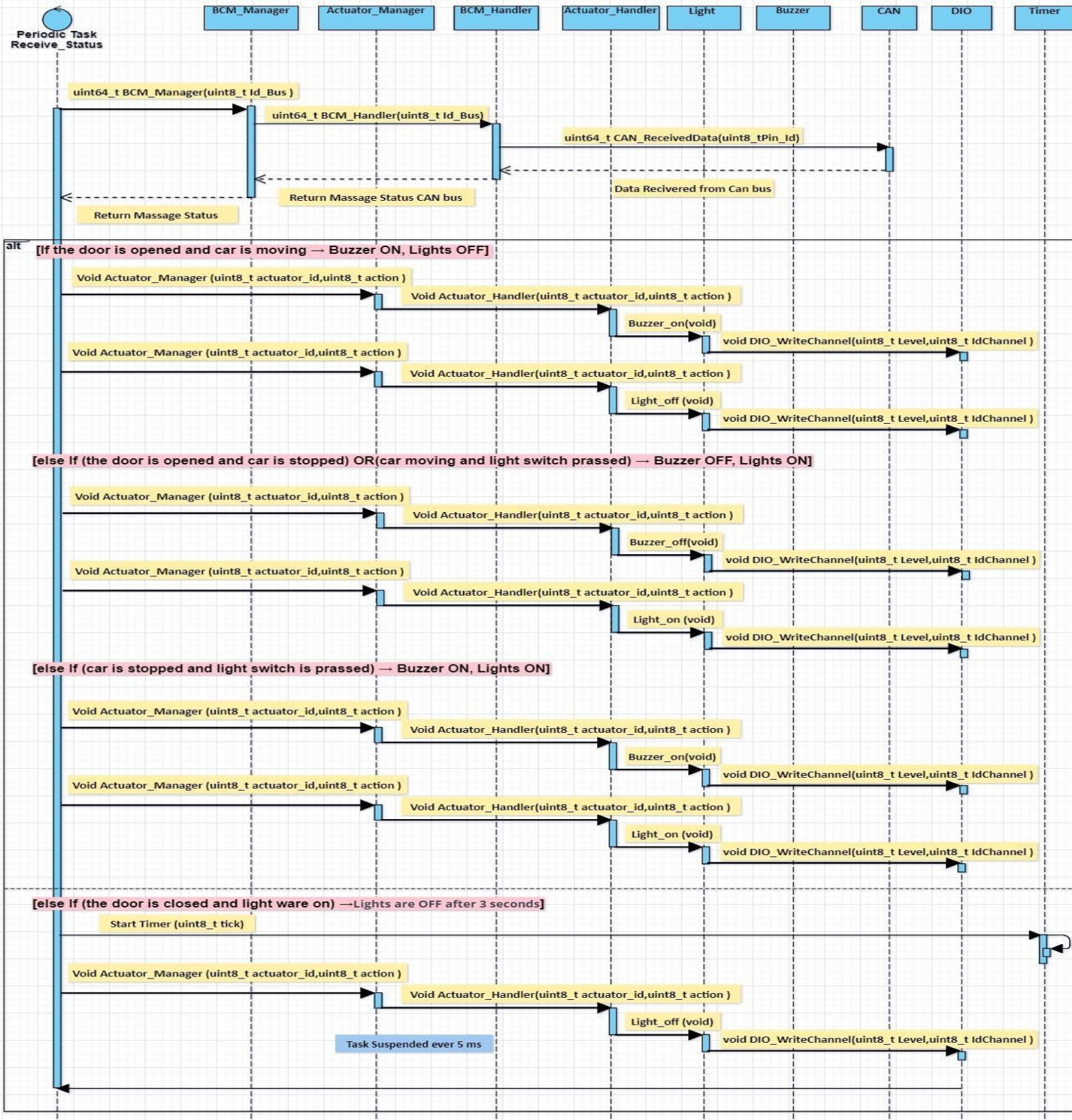
2- state machine diagram for the ECU 2 operations:

Visual Paradigm Online Free Edition



3- sequence diagram for the ECU 2 :

Visual Paradigm Online Free Edition



4- Calculate CPU load for the ECU 2:

The system contains one task assuming the worst case scenario that the execution time of task is 1 ms.

Name Task	Periodicity	Execution Time
Periodic Task Receive Status	5 ms	1 ms

H (Hyper Period) = LCM(P_i) = 5 ms

CPU Load = $\sum E / H = (1 * 1) / 5 * 100 = 20\%$

Calculate bus load in your system:

Notes: With what percentage of system bus was busy per 1 second

CAN Bus Load in System: time the CAN bus loaded with data
1 CAN frame contains approximately 125 bits.

assume we are using a 500 Kbit/s bit rate.

bit time = $1 / \text{bit rate} = 1 / (500 * 1000) \text{ s} = 2 \mu\text{s}$

Approximate time to transfer 1 frame = $(2 \mu\text{s/bit} * 125 \text{ bit}) = 250 \mu\text{s}$.

We have multiple sending intervals on the bus:

1 frame every 5 ms 200 frames every 1000 ms

1 frame every 10 ms 100 frames every 1000 ms

1 frame every 20 ms 50 frames every 1000 ms

This is in total = 350 frames every 1000 ms

Total time on bus = (total number of frames) * (time of 1 frame)

Total time on bus = $350 * 250 = 87500 \mu\text{s}$

Bus load = $\{((87500 \mu\text{s} * 1000) / 1000) * 100 \%\} = 8.75 \%$