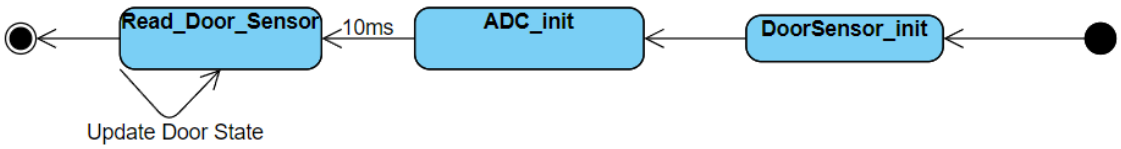
Automotive door control system design

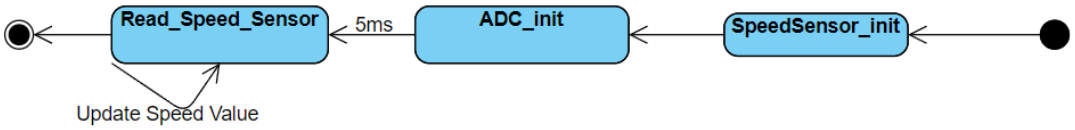
DYNAMIC DESIGN

State machine for each Component in ECU1:

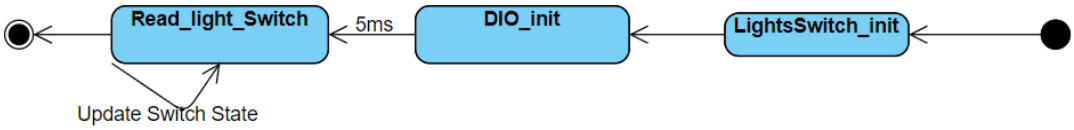
DOOR SENSOR:



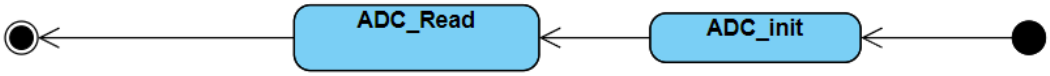
SPEED SENSOR:



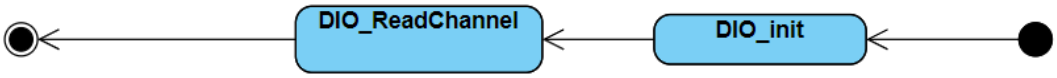
LIGHT SWITCH:



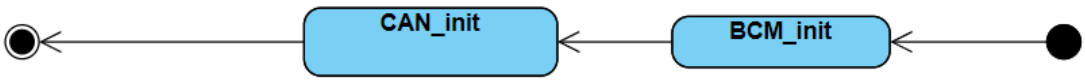
ADC:



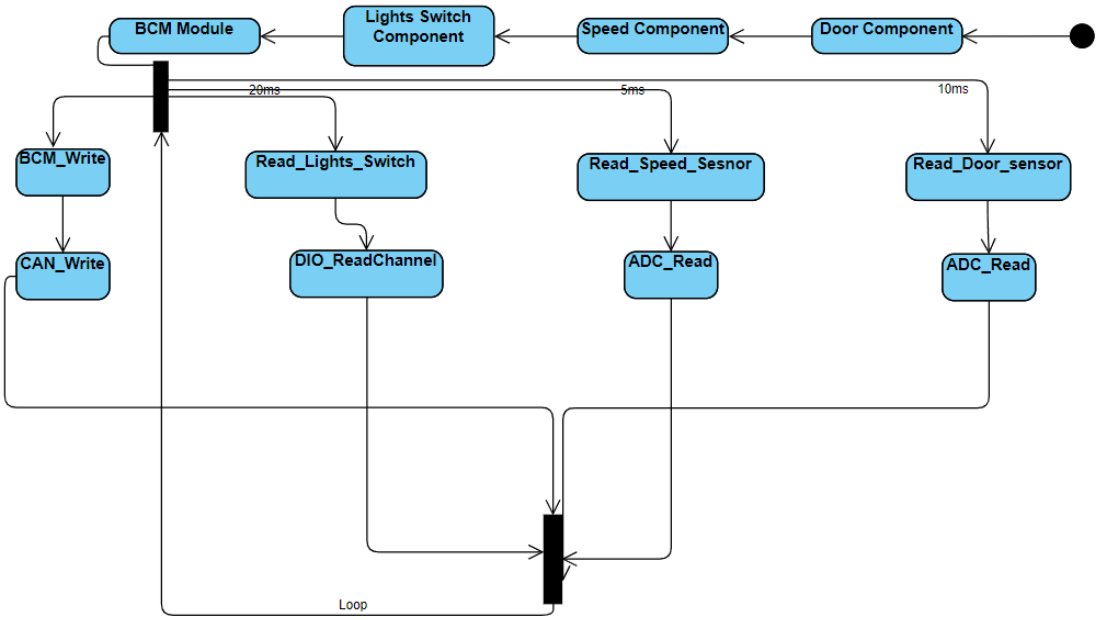
GPIO:



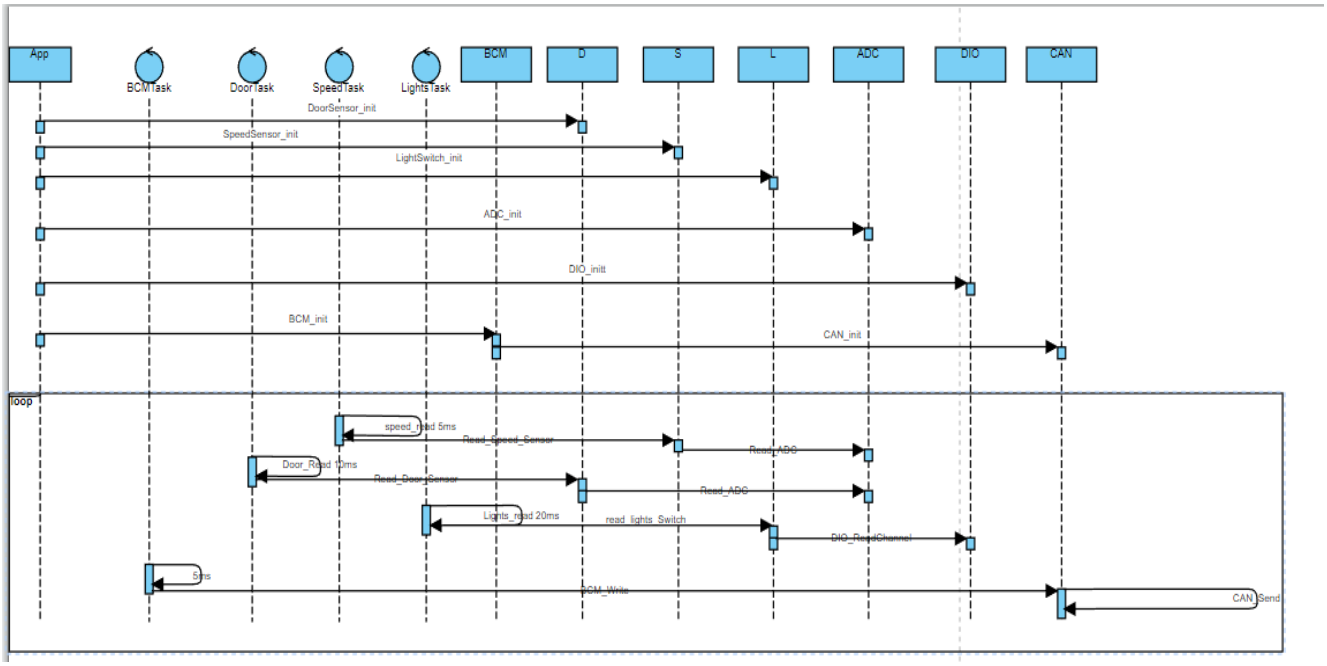
BCM MODULE:



State machine for ECU1:



Sequence Diagram for ECU1:



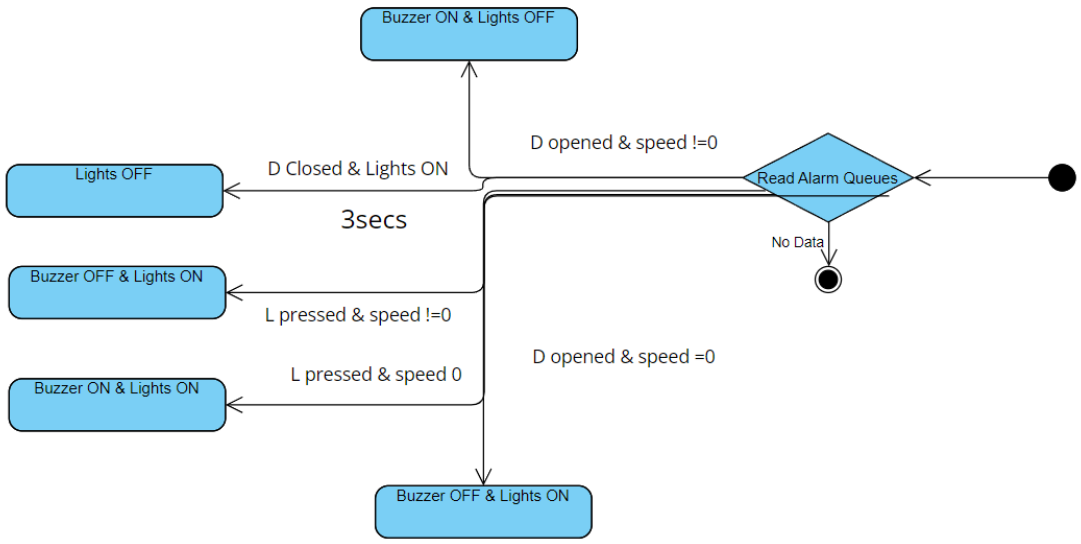
Each sensor task is responsible for read data at the proper rate and update the global variable of the states then according to those states Bcm task send the data to ECU2 each 5 ms

Busy Time and Bus Load For ECU1:

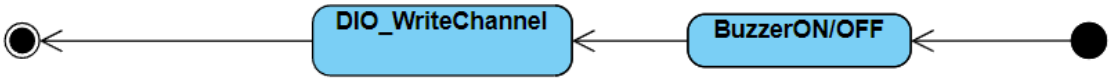
- Assume D_Task, S_Task, L_Task and BCM_Task execution time is 1 ms, periods are 10ms ,5ms , 20ms and 5ms.
- Hyper period = 20ms
- Then CPU Load = BCM*4 + S*4 + L*1 + D *2 = 11ms -> **CPU_Load = 11/20 = 55%**
- Assume baud rate is 24000 bit/sec - > 3000 bytes/sec
- Msg size is 2 bytes (id and msg data)
- BCM send 4 messages in hyper period with rate 5ms
- Bus_Load = ((4*2bytes)*(1000/20)) / baud_rate = 13%

State Machine for ECU2 components and modules:

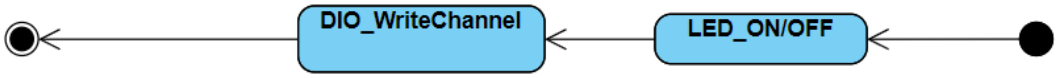
ALARM MANAGER MODULE:



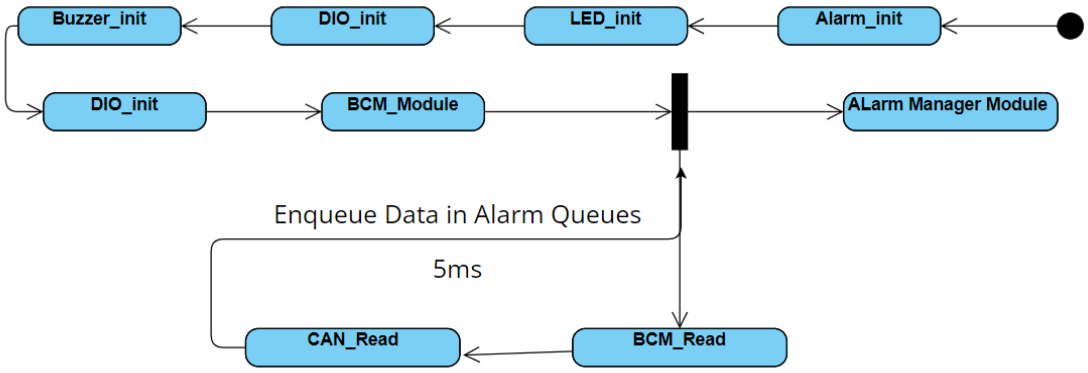
BUZZER:



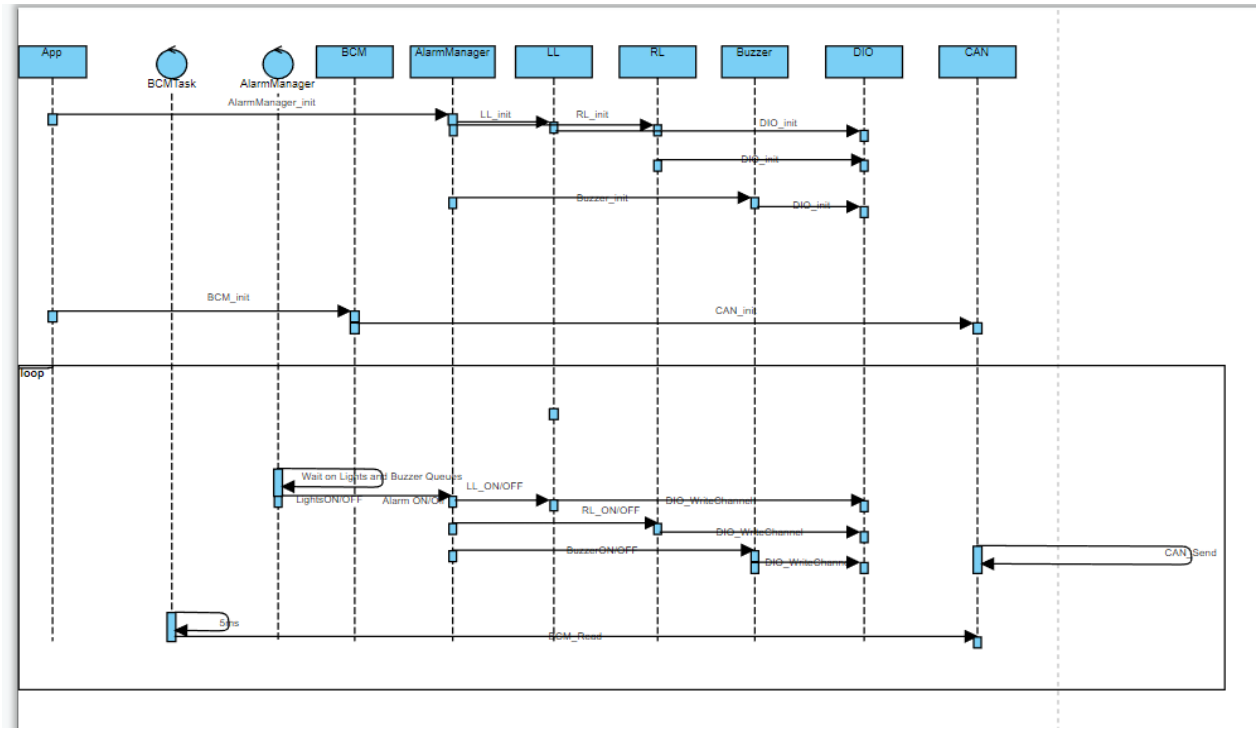
LIGHTS:



State machine for ECU2:



Sequence Diagram of ECU2:



Each 5 ms BCM receive msg with id and data. Id identify what sensor is data came from.Then send data to AlarmManager -through RTOS Queue-which take decision about what is the next state of the system.

Busy Time and Bus Load For ECU2:

- Assume AlarmTask and BCM_Task execution time is 1 ms and 2ms, periods are 5ms ,5ms
- Hyper period = 5ms
- Then CPU Load = BCM*1 + AlarmTask*1 = 3ms -> **CPU_Load = 3/5 = 60%**
- Assume baud rate is 24000 bit/sec - > 3000 bytes/sec
- Msg size is 2 bytes (id and msg data)
- BCM send 1 message in hyper period with rate 5ms

Bus_Load = ((1*2bytes)*(1000/5)) / baud_rate = 13%