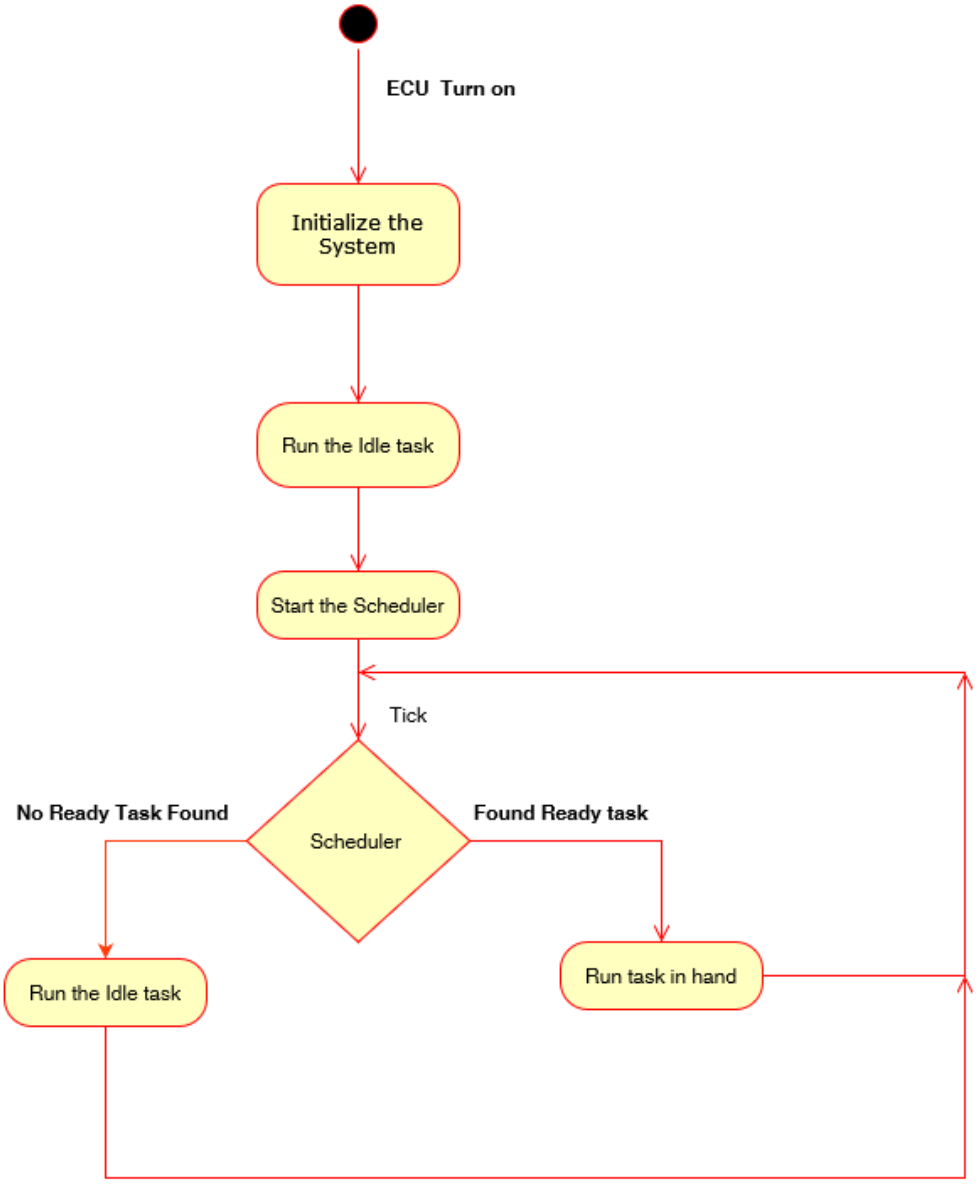
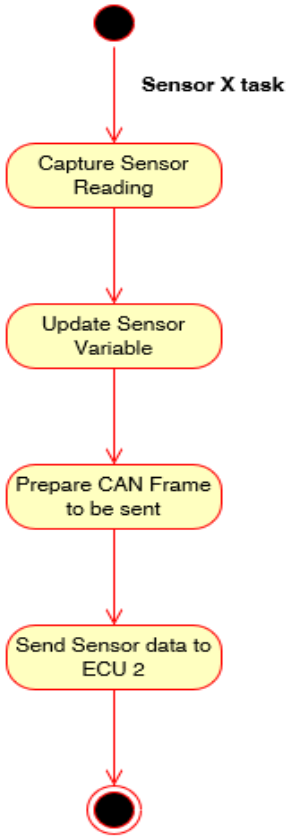
- ECU 1 State Machine Diagram
  - ECU 1 Operation

    ECU 1 uses RTOS to handle all Tasks

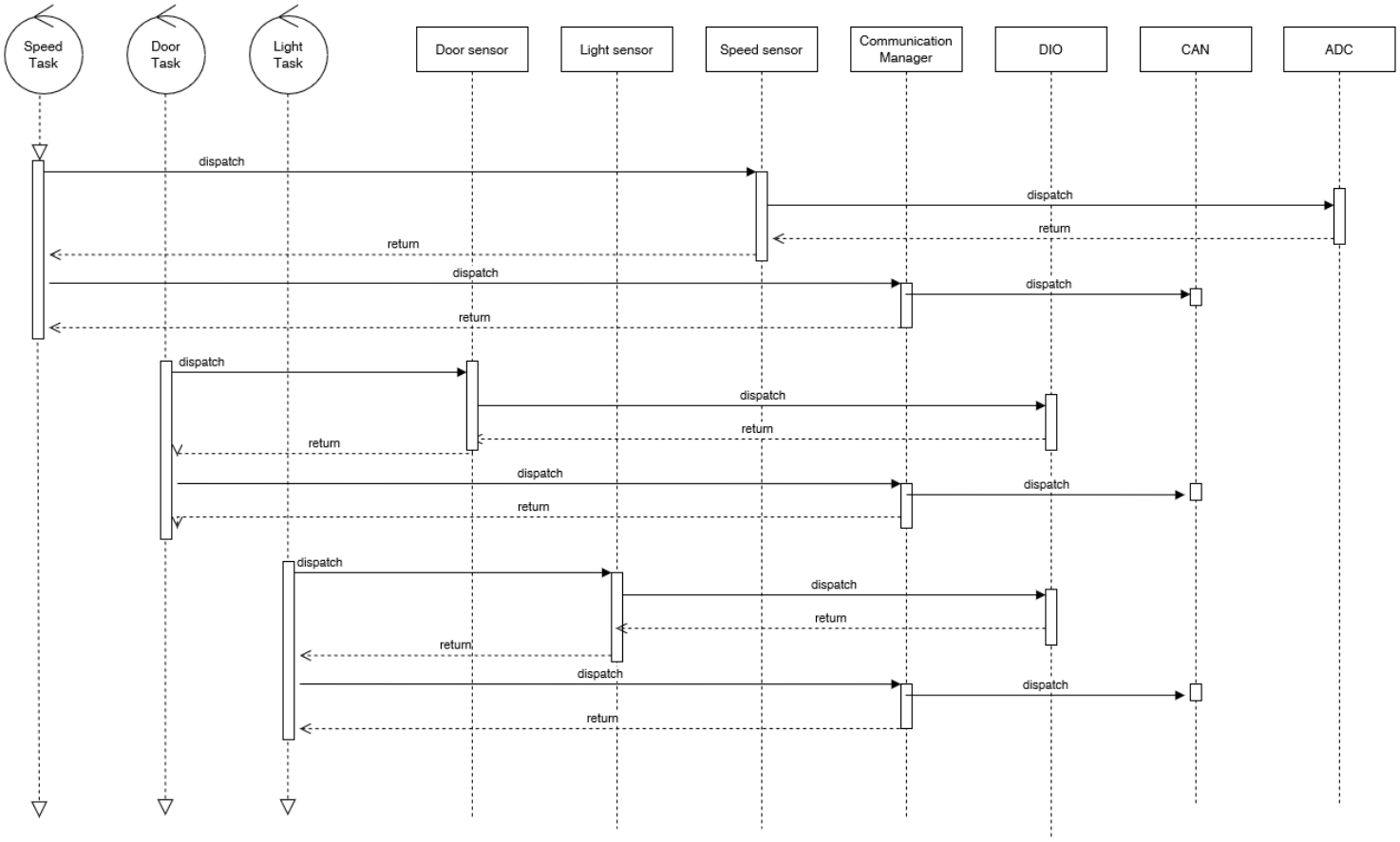


  - ECU 1 Components

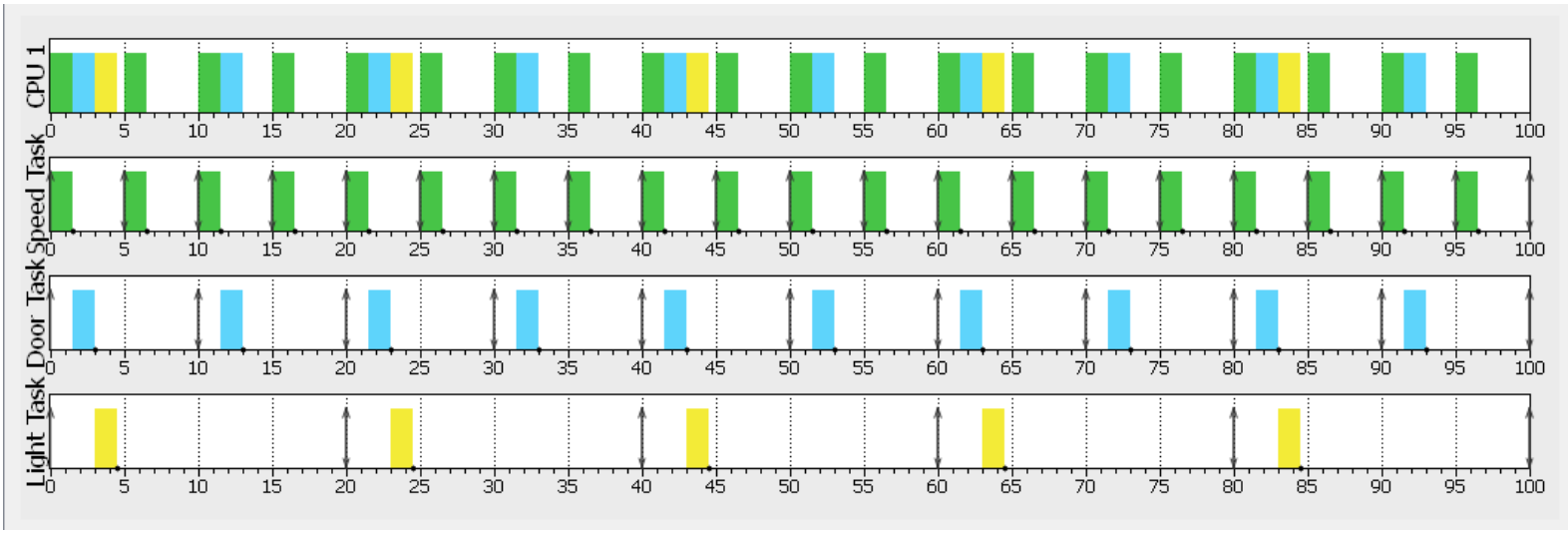
    The system has 3 Tasks one for each sensor and each task get the sensor data and sends it to ECU 2 via can bus .



- ECU 1 Sequence Diagram



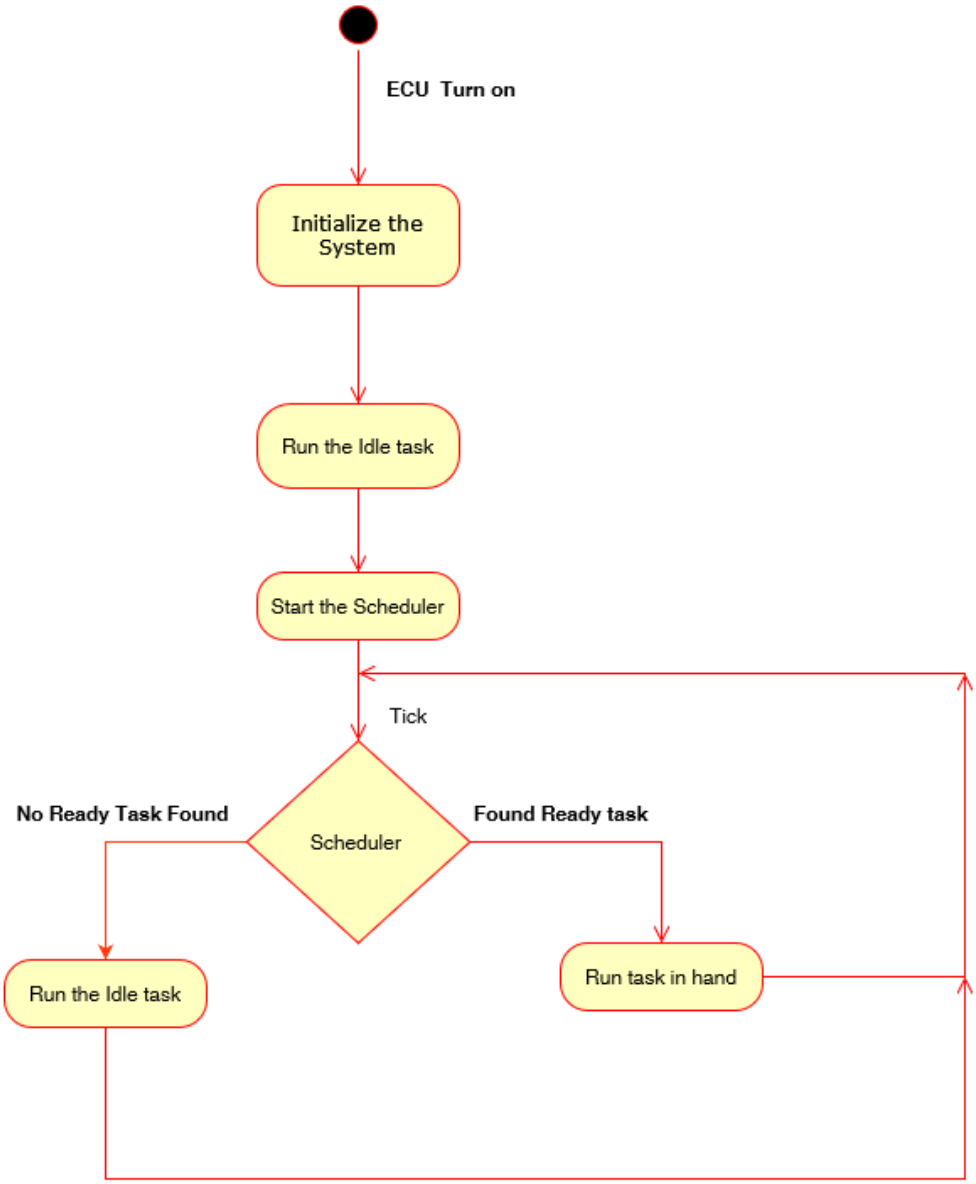
- ECU 1 CPU Load
    1. Tasks Periodicities:
        - Speed_Task Periodicity = 5ms
        - Door_Task Periodicity = 10ms
        - Light_Task Periodicity = 20ms
        - OS_Hyperperiod = 20ms
    2. Tasks Execution time (Assumed for all tasks):
       Assume all tasks take 1.5 ms for execution (reading sensor data and sending it).



	Total load	Payload	System load
CPU 1	0.5250	0.5250	0.0000
Average	0.5250	0.5250	0.0000

- ECU 2 State Machine Diagram
  - ECU 2 Operation

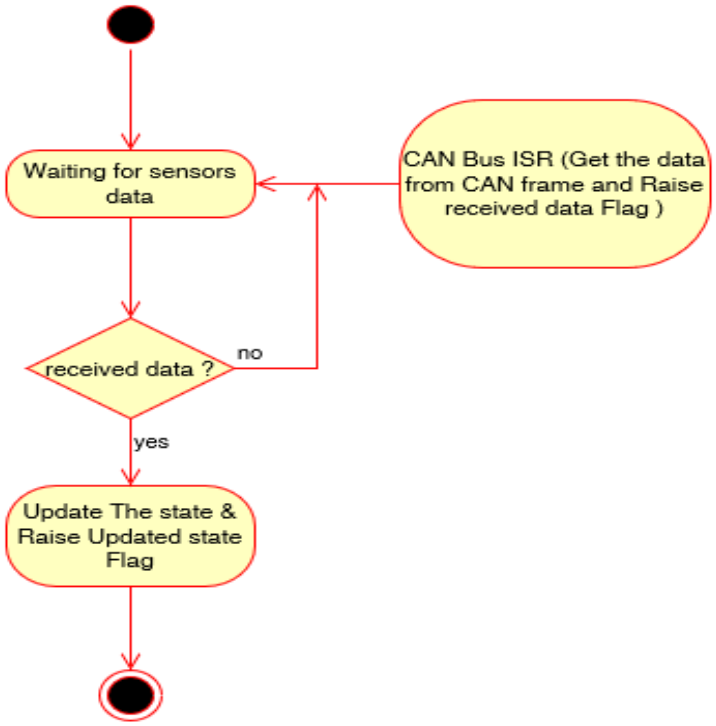
    ECU 2 uses RTOS to handle all Tasks



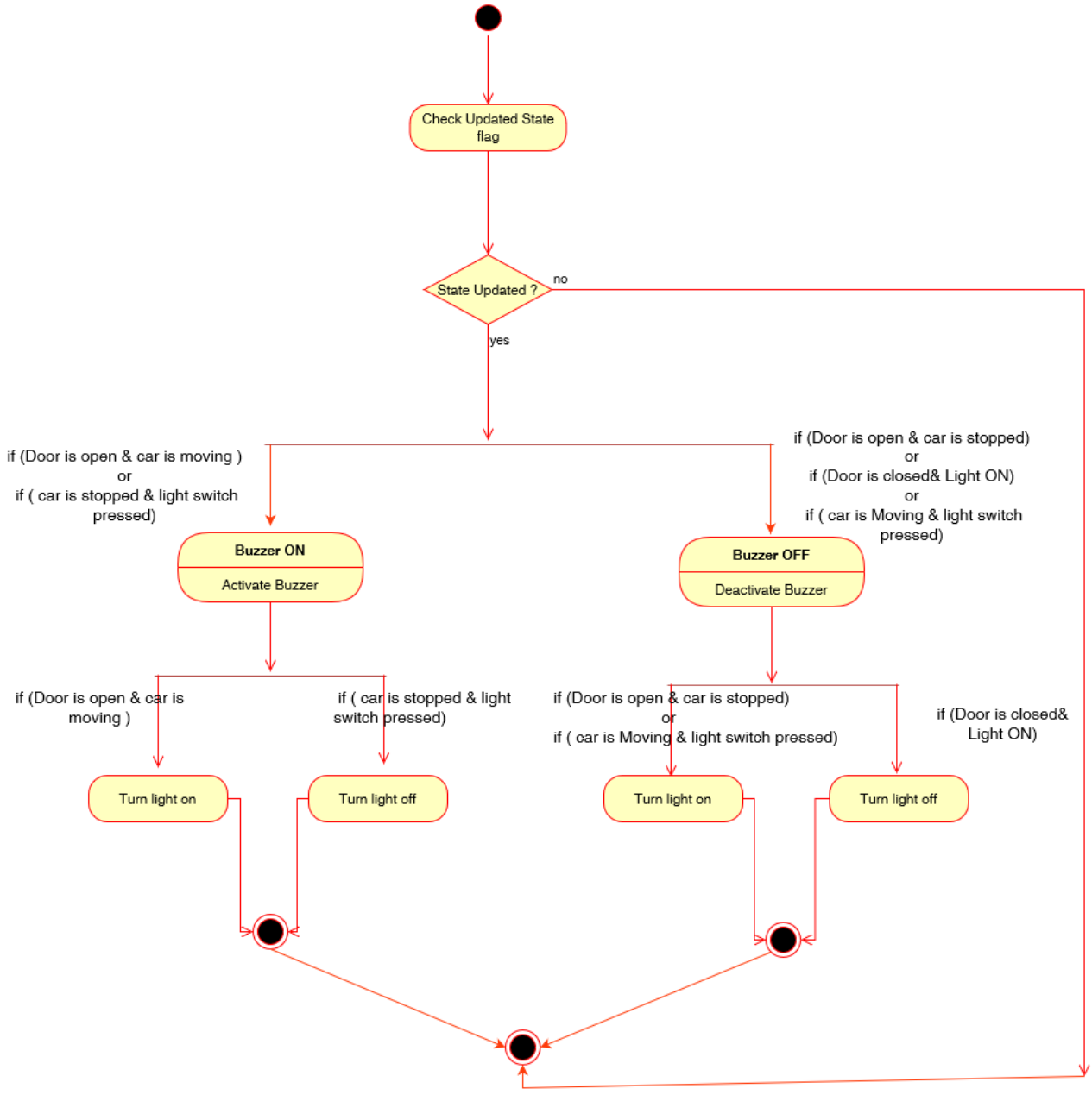
- ECU 2 Components

  The system has 2 Tasks one to update the sensors state when data received from ECU 1 and the other task do actions depending on the new state.

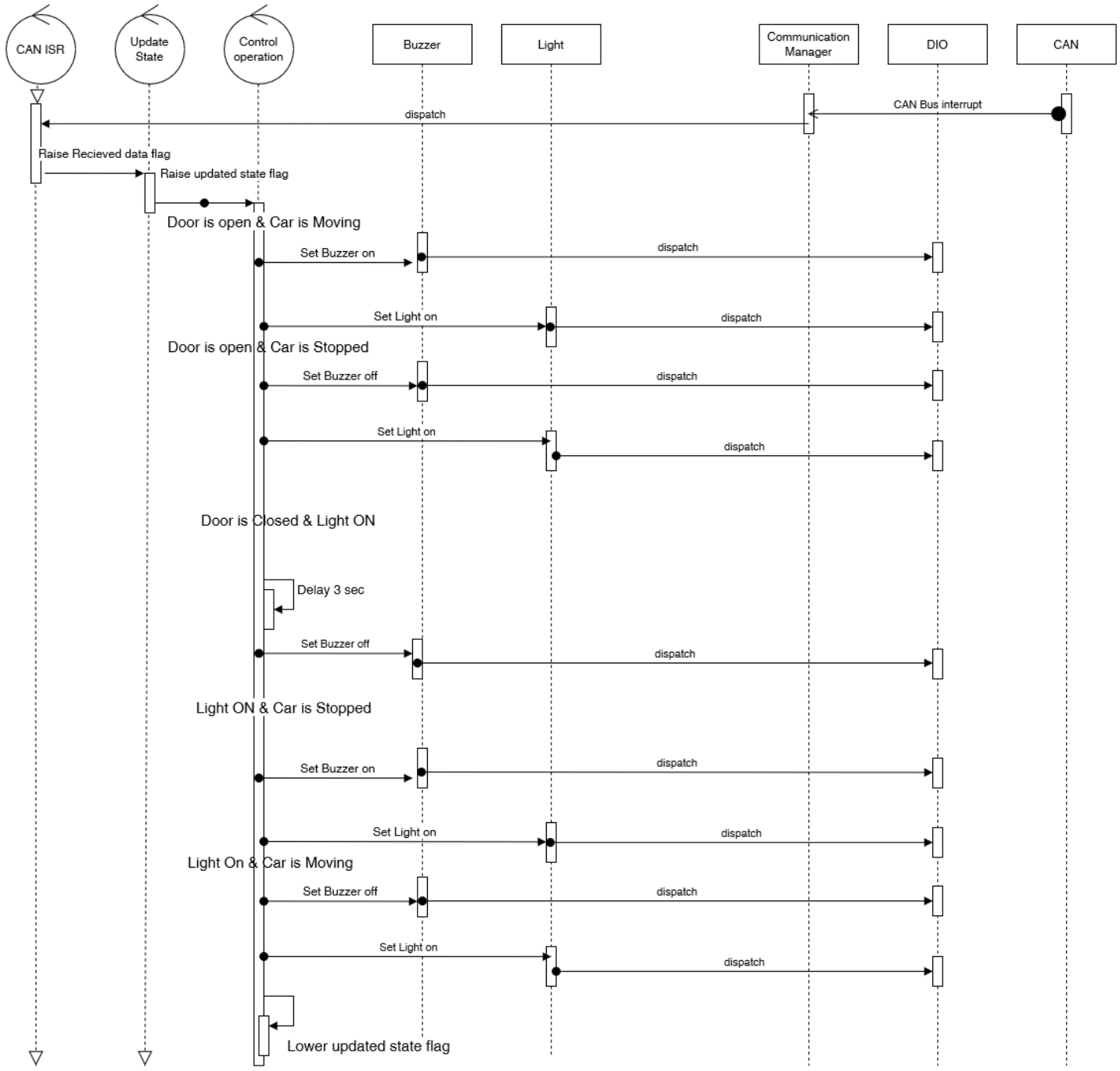
- The first task which waits for data coming from ECU 1



- The Second task which controls the behavior of ECU 2 depending on the data received from ECU 1



- ECU 2 Sequence Diagram



- ECU 2 CPU Load

  CAN_Bus_ISR to receive the coming data from ECU1, second after ISR finished executing it.
  Raising the Recievd data Flag allowing an algorithm to update the system
  Raising the updated tate Flag allowing an algorithm to control the system

  Assume the execution time of the CAN_Bus_ISR = 1ms
  Assume the execution for the update task = 1ms
  Assume the execution for the control task = 1ms
  OS Hyperperiod = 5m (interrupt rate)

  CPU Load = ((1*1)+(1*1)+(1*1))/5 = 60 %

- Bus load

  Message sent via CAN_Bus from ECU1 to ECU2 has periodicity = 5ms,

  Means sending 200 Message/sec

  Assuming the message sent is 8-Bytes width , so total CAN frame width = 111bits

  So data send per sec = Message Rate * Message Size = 200 * 111 = 22,200 bits/s

  And Using the CAN_Bus common baud rate of 125 Kbits/s,

  Bit sending time = (1/ (125*1024)) sec ,

  Frame sending time = 22200 * (1/ (125*1024)) = 0.1734375 sec ,

  Therefore, Bus Load in one second = 17.34 %