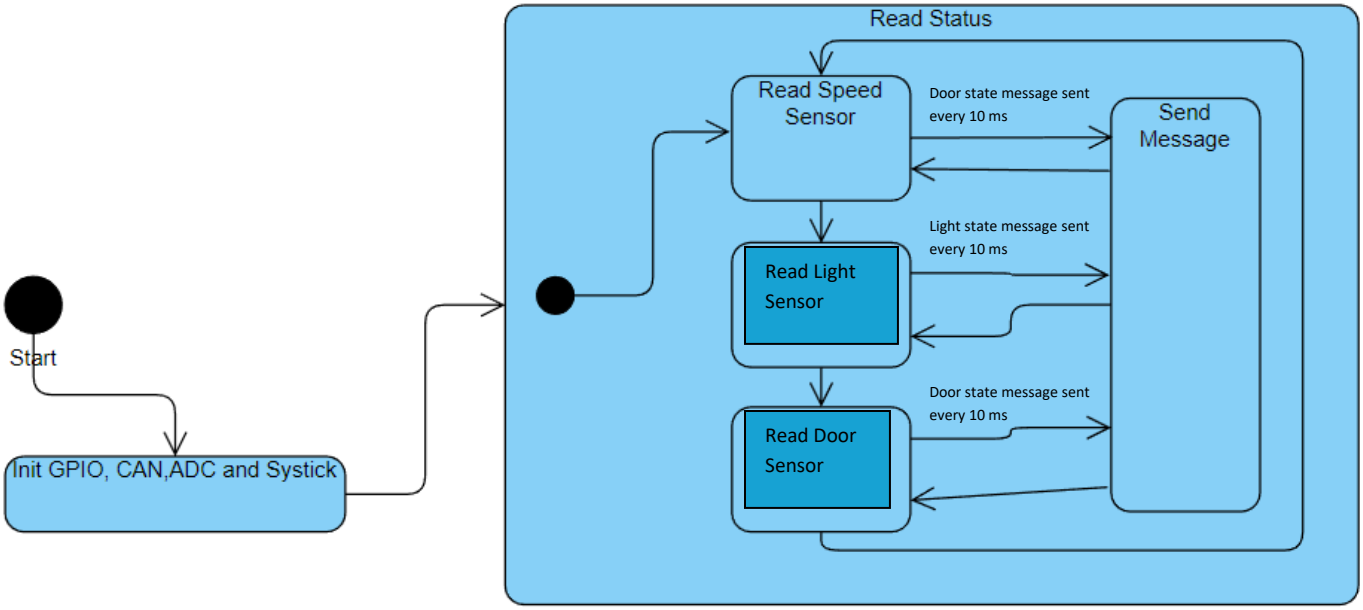
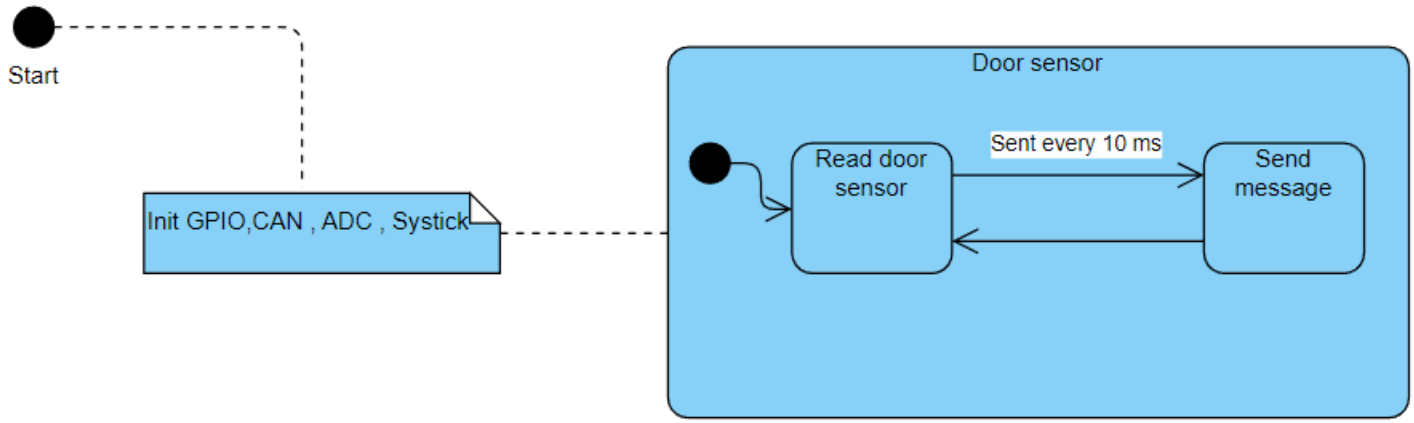
Dynamic Design

ECU 1

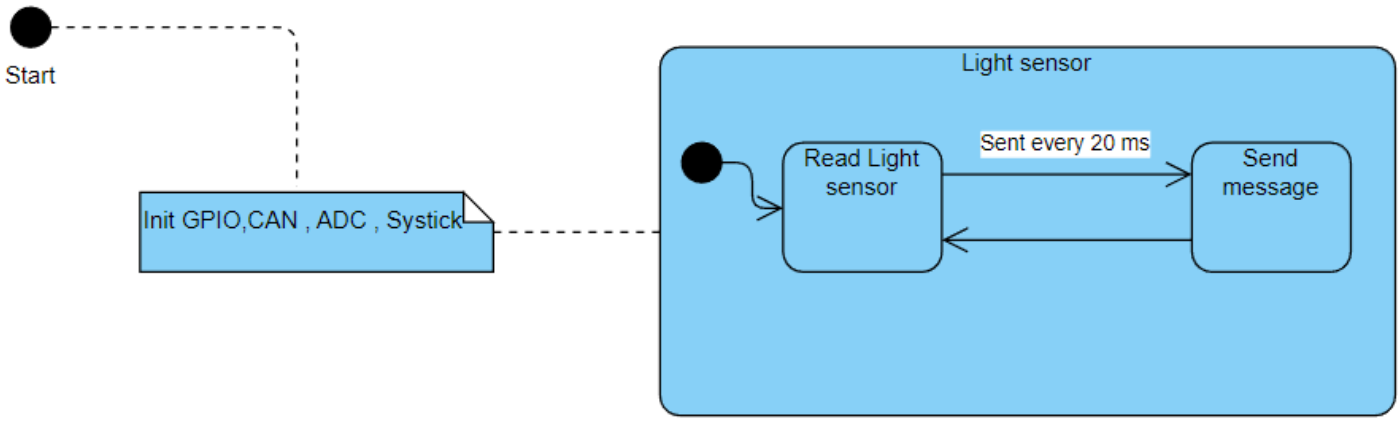
State Machine Diagram



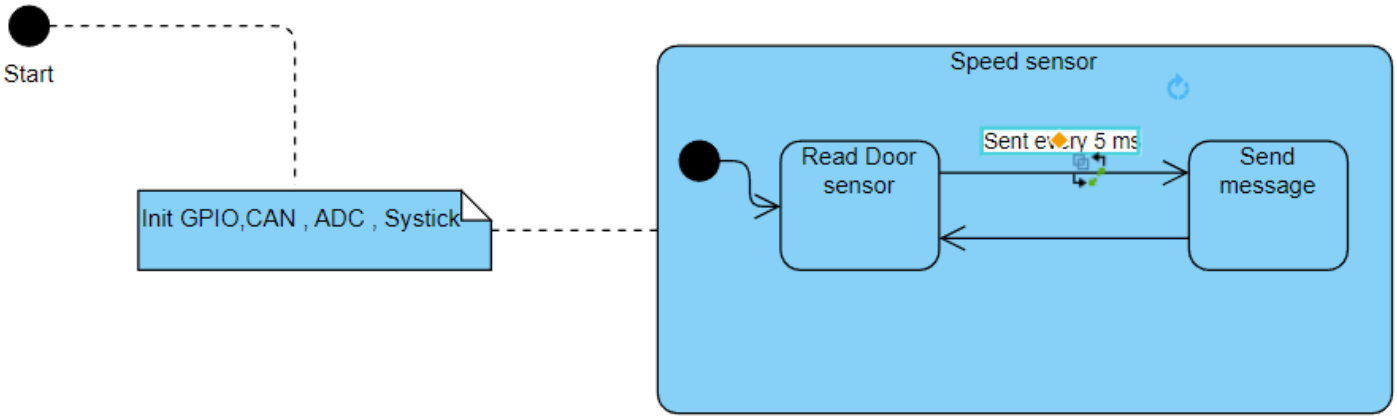
Door sensor :



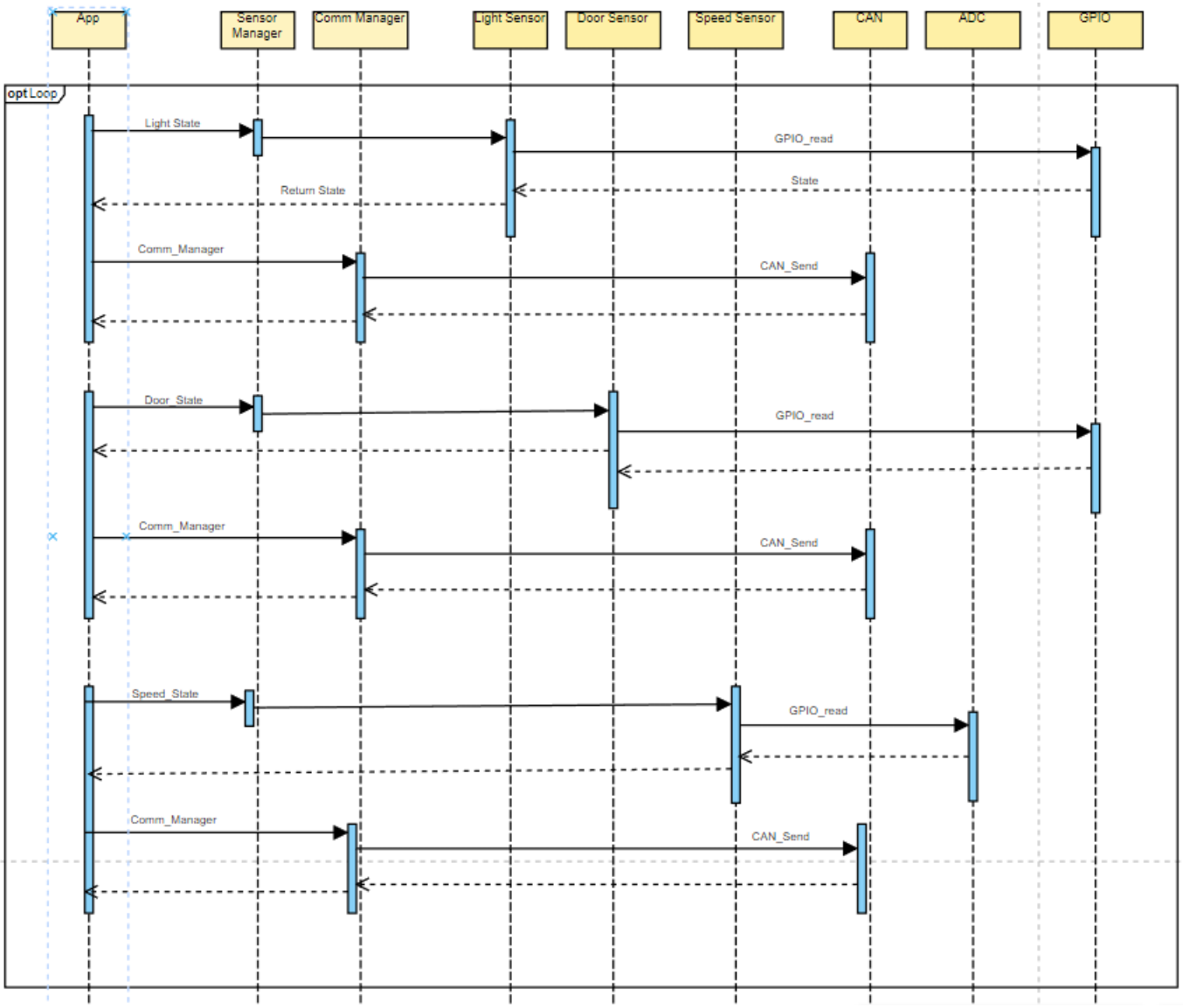
Light sensor :



Speed sensor :



Sequence Diagram



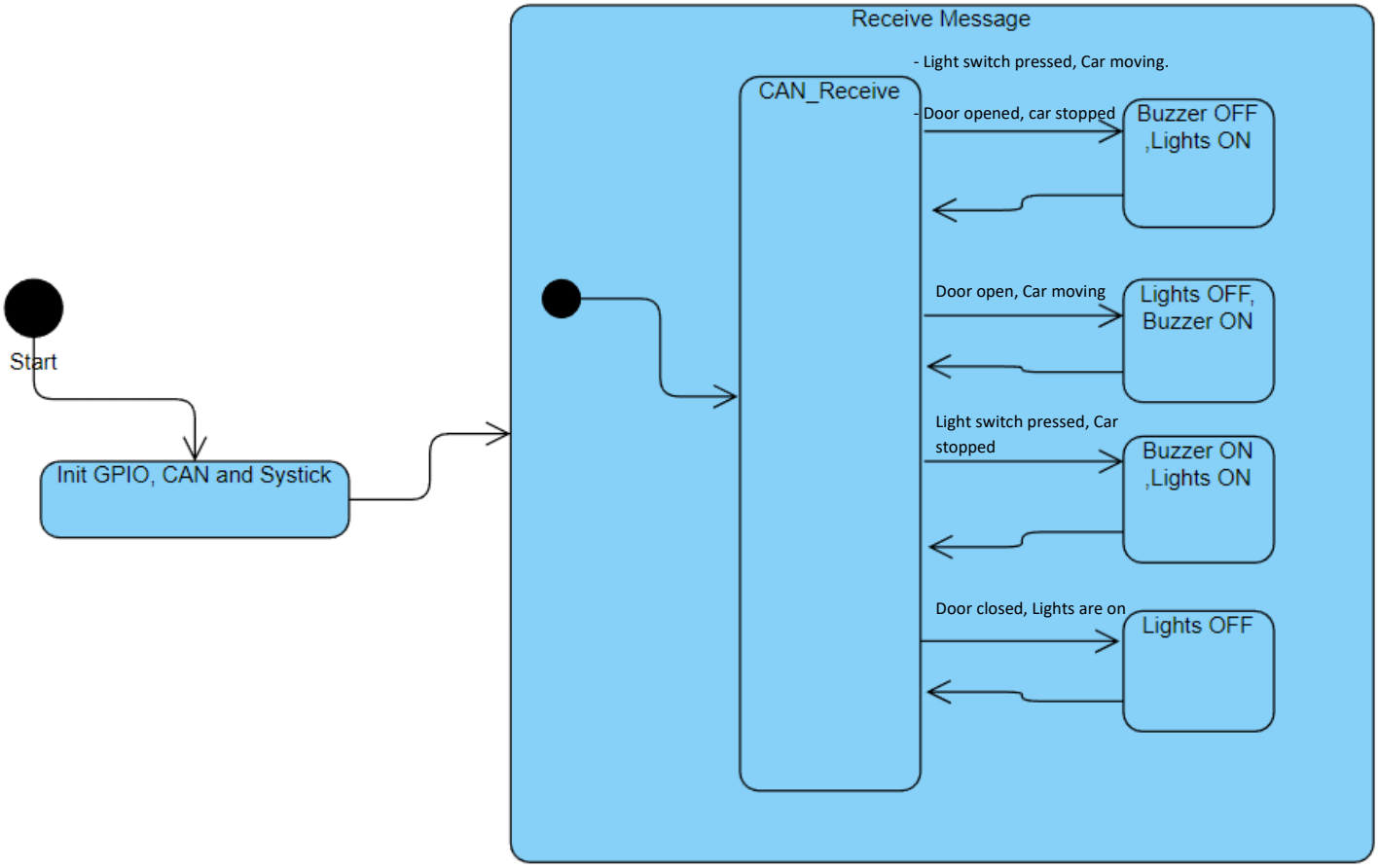
CPU Load

- Assume execution time of each part of super loop is **1 ms**
- Periodicities of **20, 10, and 5**

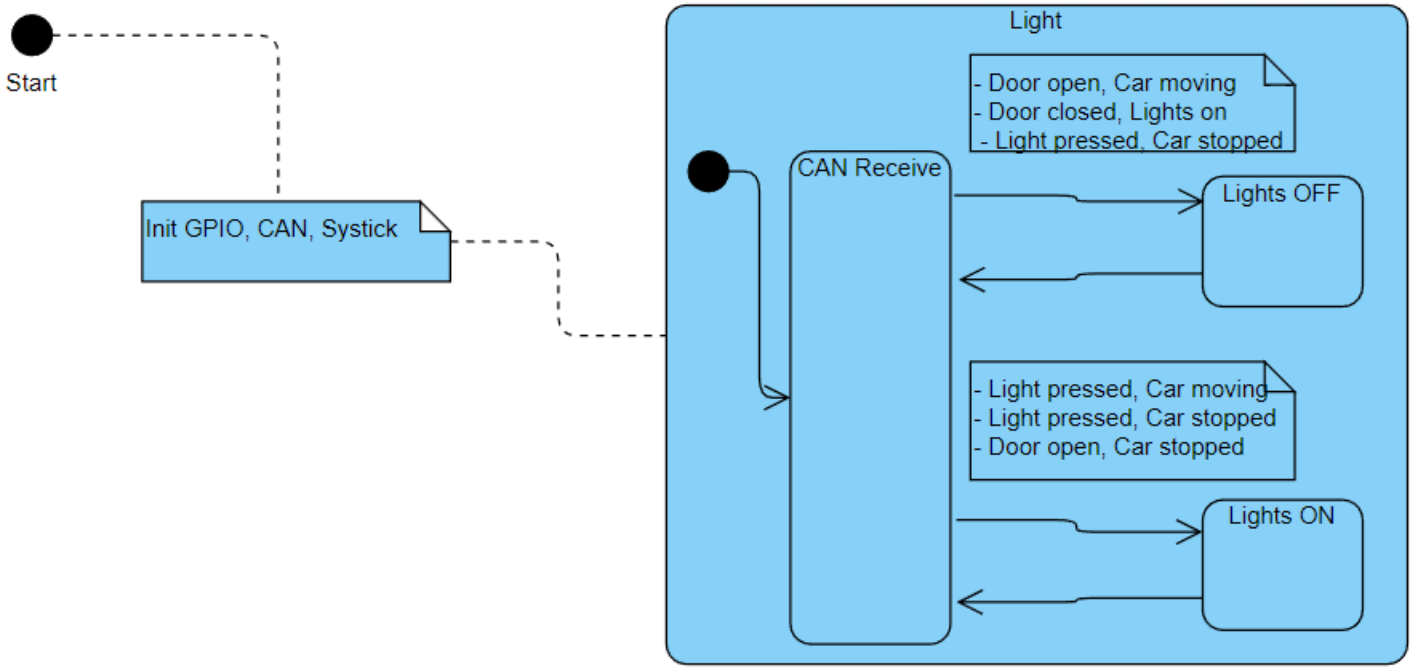
CPU Load = $\left(\frac{\sum E}{Hyper\ period}\right) = \left(\frac{1+1*2+1*4}{20}\right)*100 = 35\ \%$

ECU 2

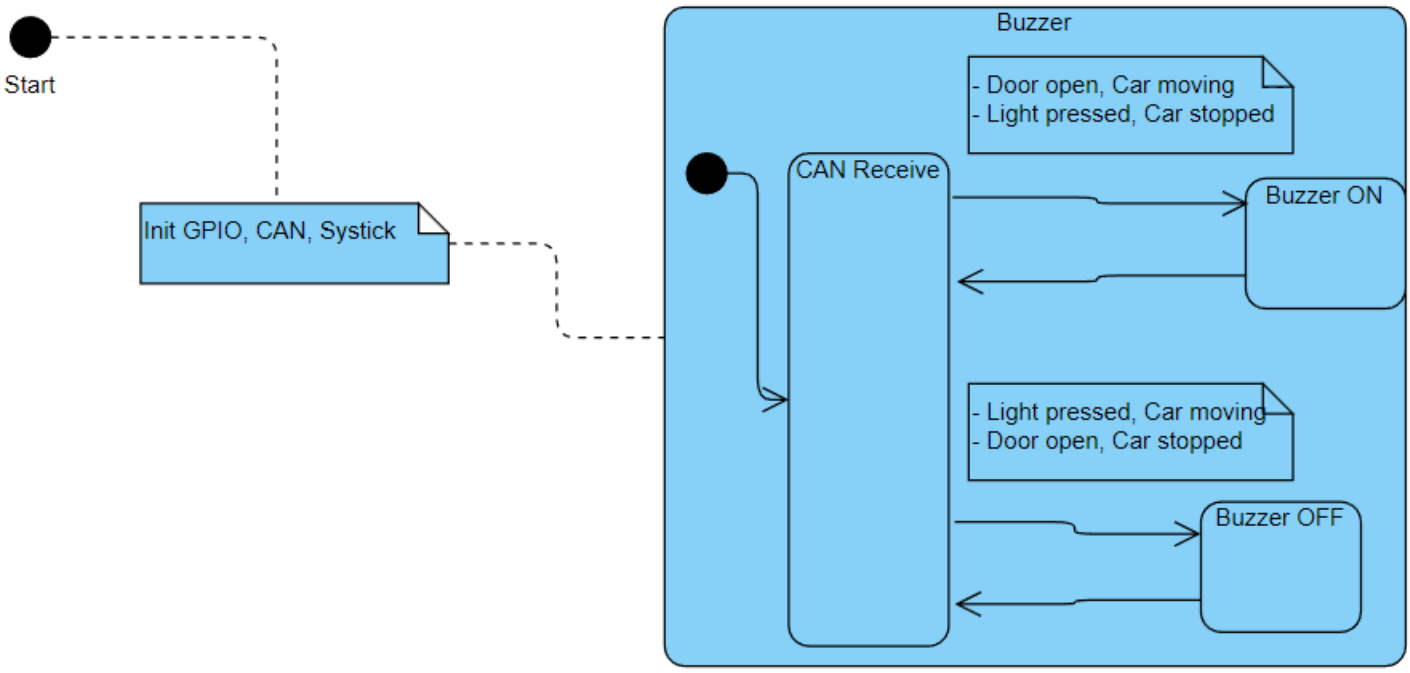
State Machine Diagram



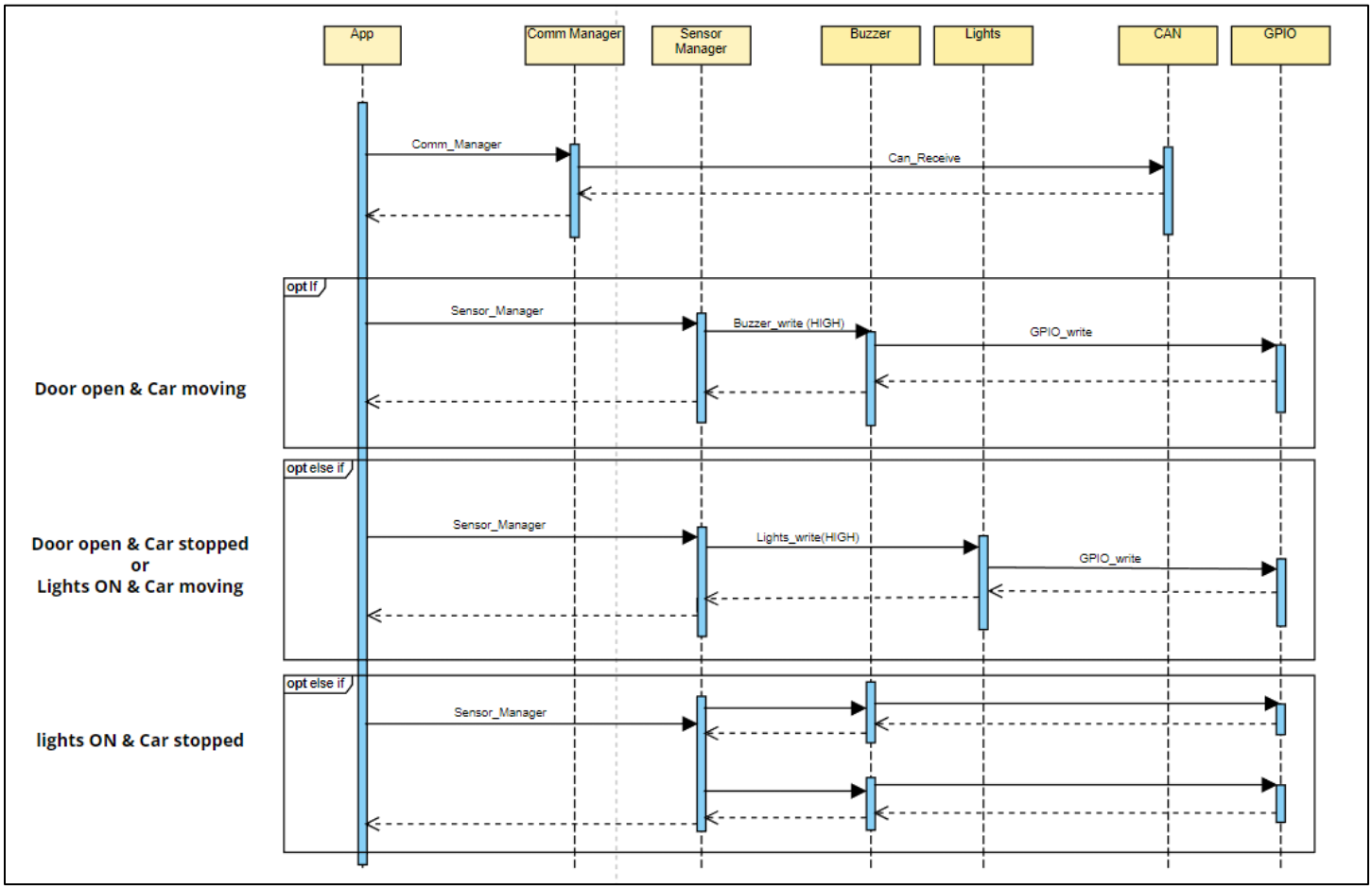
Lights:



Buzzer:


Start
Init GPIO, CAN, Systick
Buzzer
- Door open, Car moving
- Light pressed, Car stopped
CAN Receive
Buzzer ON
- Light pressed, Car moving
- Door open, Car stopped
Buzzer OFF

Sequence Diagram



CPU Load

- Assume execution time **2 ms** & periodicity of **6 ms**

CPU Load = $\left(\frac{\sum E}{Hyper\ period}\right) = \left(\frac{2}{6}\right) * 100 = 33\ \%$

CAN Bus Load

- Assume 1 CAN frame contains ~ 125 bits
- Using 500 Kbit/s bit rate

Bit time = 1 / bit rate = 1 / (500 * 1000) s = 2 * 10-6 s = 2 µs

1 bit will take 2 µs to transfer on bus when using 500 Kbit/s.

Time to transfer 1 frame is (2 µs/bit * 125 bit) = **250 µs**.

We send: **1 frame** every **20, 10, and 5 ms -> 200, 100, 50** frames every **1 s**

Total frames in 1 second is 350 frames

Total time = 350 * 250 = **87500 us**

Bus Load = (87500 * 1000 /1000) * 100 = **8.75 %**