Automotive Door Control System Design
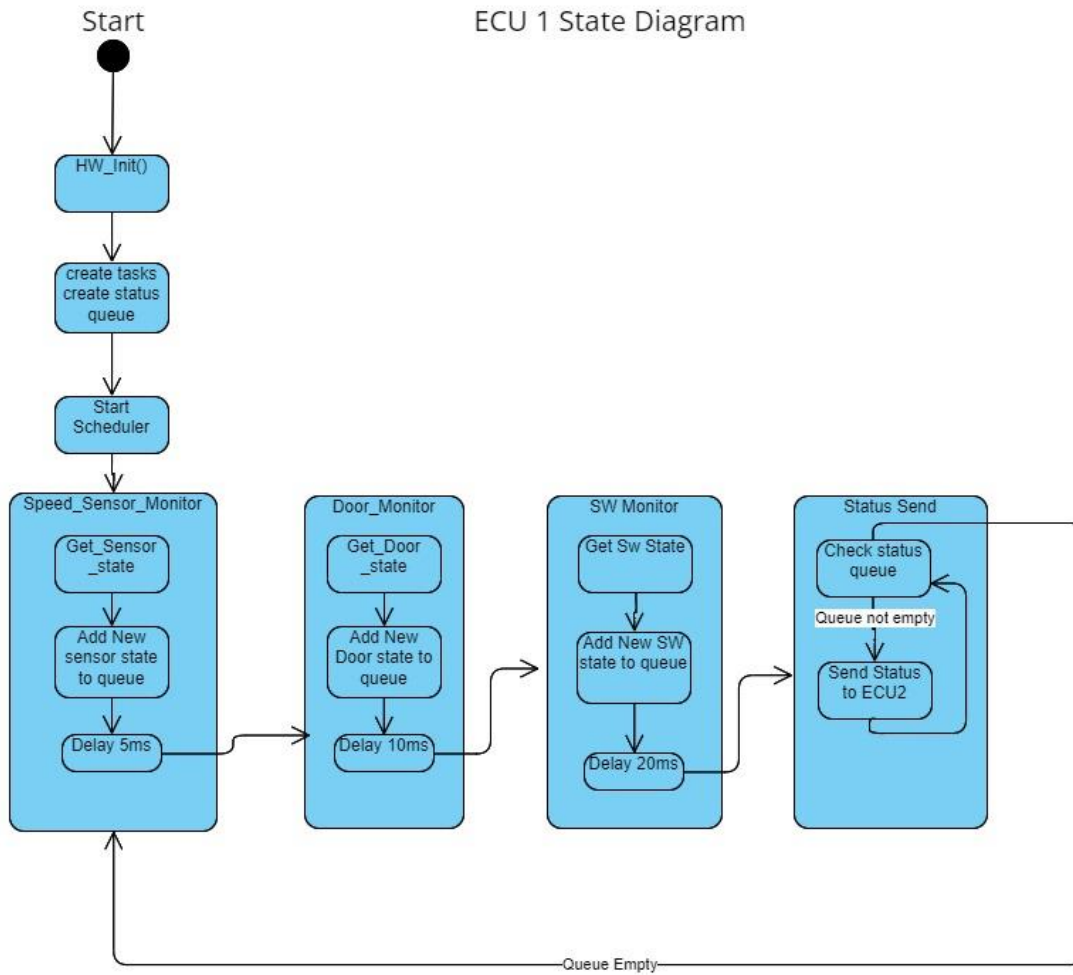
DYNAMIC DESIGN

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ECU1

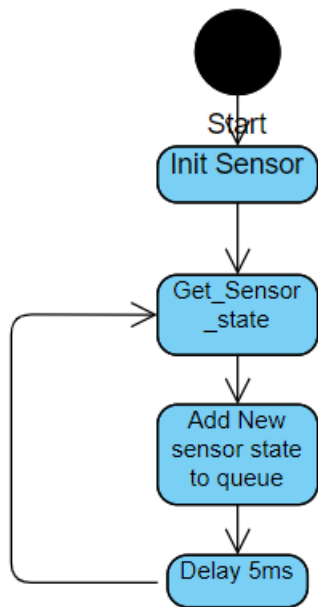## STATE MACHINE DIAGRAM

Start

ECU 1 State Diagram

HW_Init()

create tasks
create status
queue

Start
Scheduler

Speed_Sensor_Monitor
- Get_Sensor_state
- Add New sensor state to queue
- Delay 5ms

Door_Monitor
- Get_Door_state
- Add New Door state to queue
- Delay 10ms

SW Monitor
- Get Sw State
- Add New SW state to queue
- Delay 20ms

Status Send
- Check status queue
- Queue not empty
- Send Status to ECU2

Queue Empty

Speed Sensor Monitor

Start
Init Sensor
Get_Sensor _state
Add New sensor state to queue
Delay 5ms

Light SW Monitor

Start
Init SW
Get_SW _state
Add New SW state to queue
Delay 20ms

Door Sensor Monitor

Start
Init Sensor
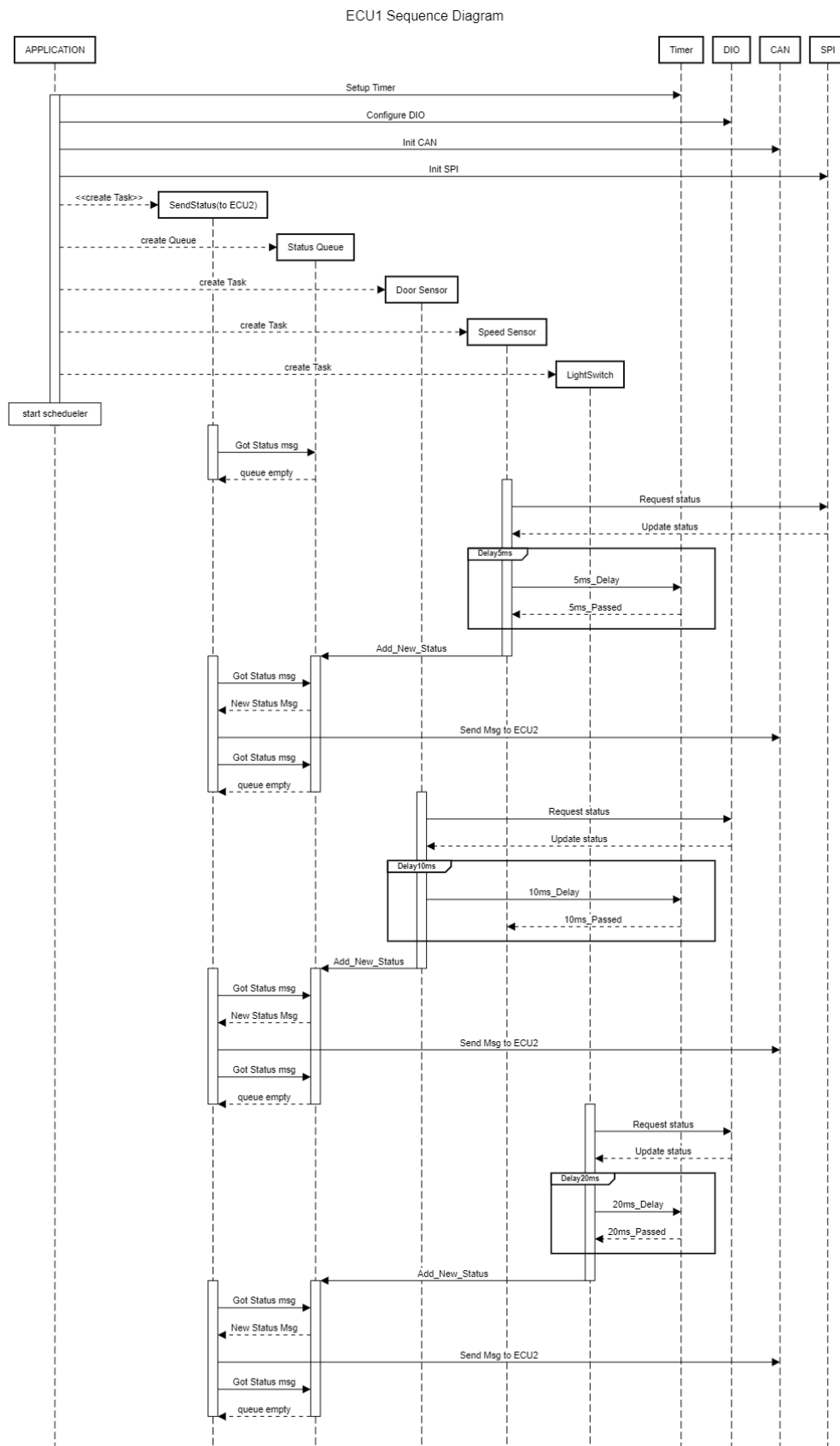Get_Sensor _state
Add New sensor state to queue
Delay 10ms
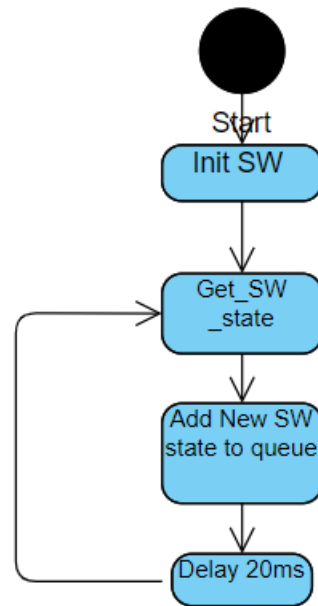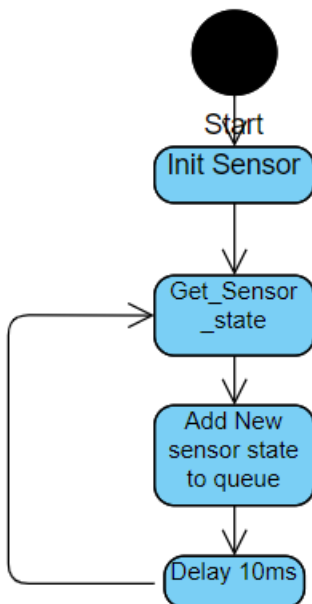
ECU1 SEQUENCE DIAGRAM

ECU1 Sequence Diagram

ECU1 CPU LOAD

System has 4 tasks:

Door_Sensor_Monitor : exec time 15 us , period=10 ms

Speed_Sensor_Monitor : exec time 15us , period=5ms
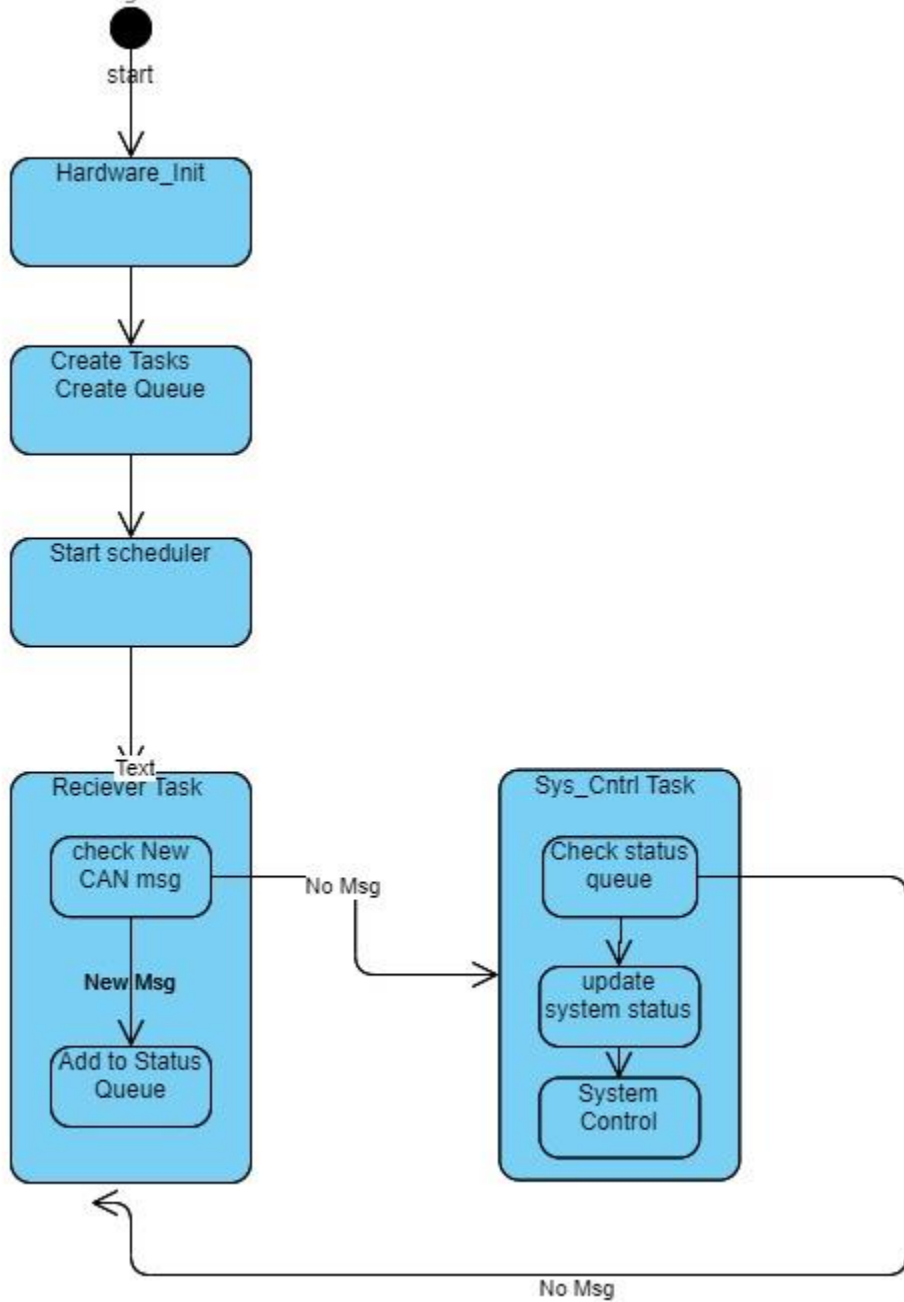
Light_SW_Monitor : exec time 15 us, period=20 ms

Send_Status_Task : exec time 18 us, period=5ms

HyperPeriod =20 ms.

CPU Load = ((0.015*2+0.015*4+0.015+0.018*4)/20) x 100 = 0.885 %

ECU2 STATE DIAGRAM

start

Hardware_Init

Create Tasks
Create Queue

Start scheduler

Text

Reciever Task

check New
CAN msg

No Msg

New Msg

Add to Status
Queue

Sys_Cntrl Task

Check status
queue

update
system status

System
Control

No Msg

System Control
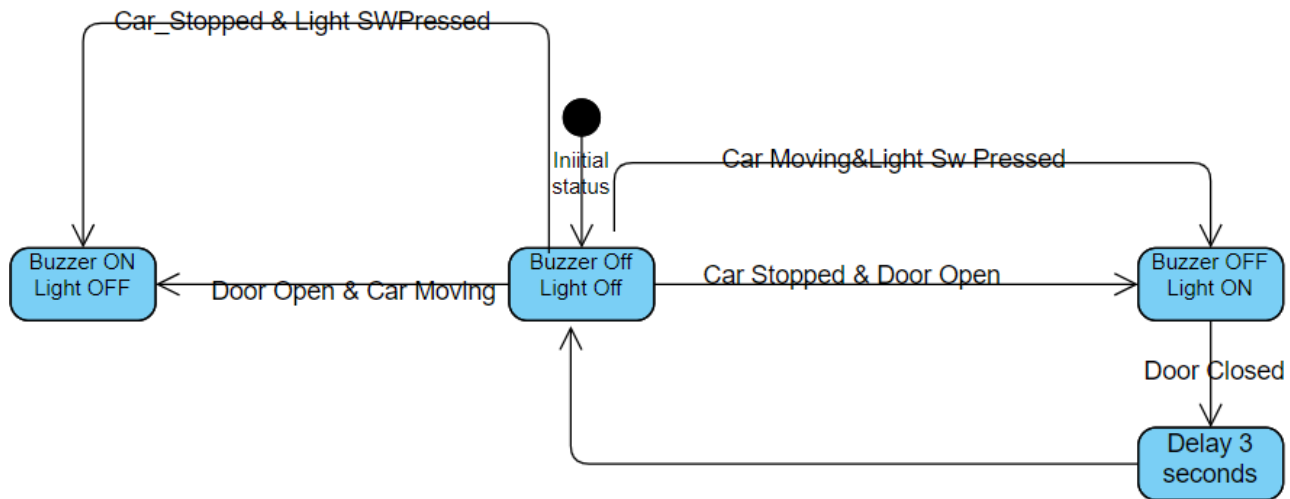
ECU2 SEQUENCE DIAGRAM

ECU2 Sequence Diagram
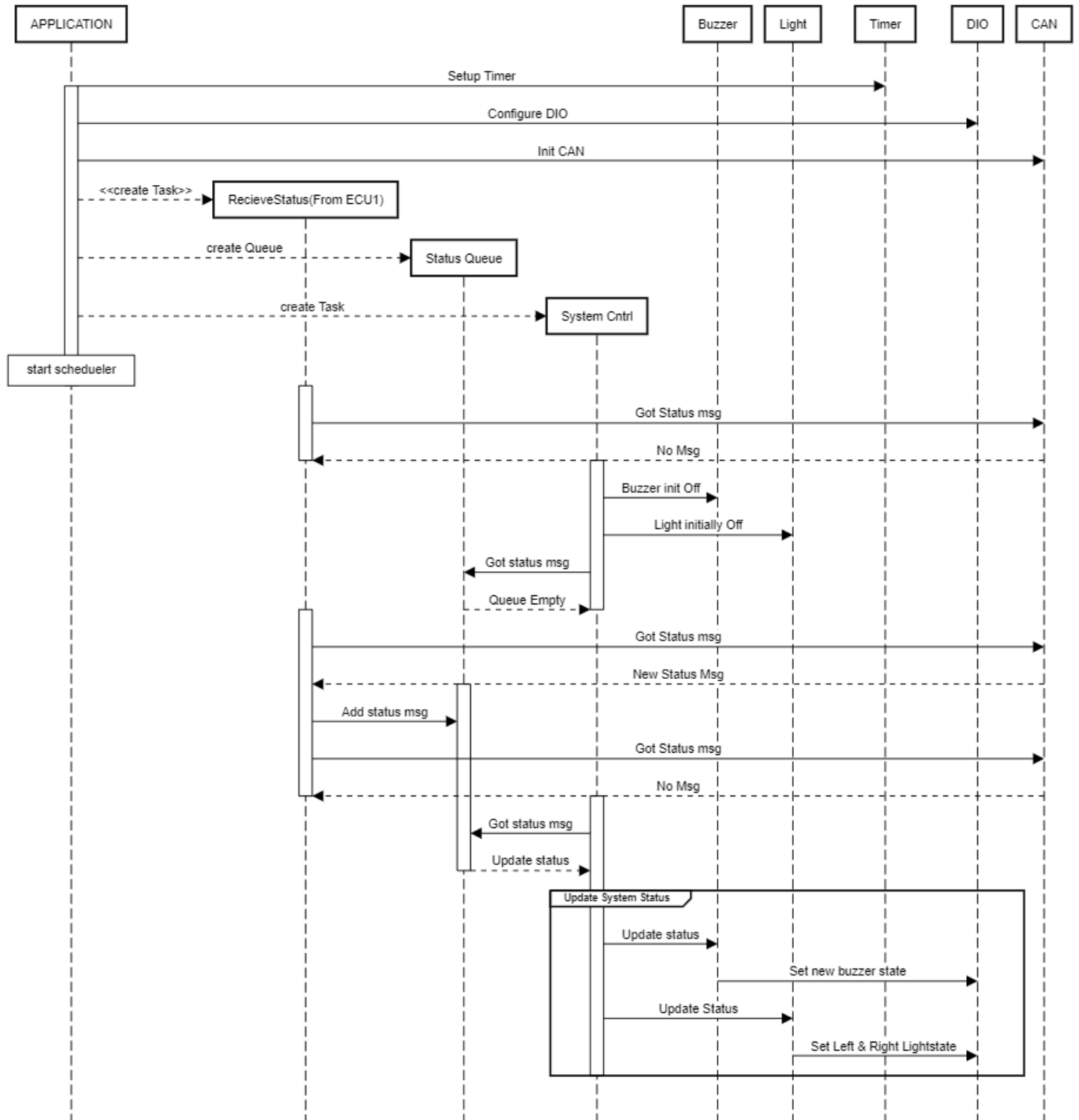
ECU2 CPU LOAD

System has two tasks :

RecvStatus_task : exe time= 18 us , period =5ms

SystemCntrl: exe time =15 us, period =5ms

Hyper period =5ms

CPU Load = ((0.015+0.018)/5)x100 =0.66 %

NOTE: task exe time was assumed according to real exec time for similar tasks form RTOS project.

SYSTEM BUS LOAD

Speed Sensor Status (5ms)=200 message/second

Door Sensor Status(10ms)=100 message/second

Light Sw Status(20ms) = 50 message /second

Total messages on bus = 350 message/second.

Assuming simple can protocol with 125 bit frame length at speed 500kbit/s:

Bus Load= ((350*250)/(1000*1000))*100=8.75%