Automotive door control system

Contents

I. Overview of system components

A. ECU 1

ECU 1 is a microcontroller responsible for receiving data from three sensors

- The vehicle speed (Analog input with the speed value)
- The light switch (A digital input switch has two states on or off)
- Door state sensor (detect if the door is closed or open)

And resend the data received from the sensors to ECU 2 Via can bus

B. ECU 2

ECU 2 is a microcontroller responsible for controlling three devices

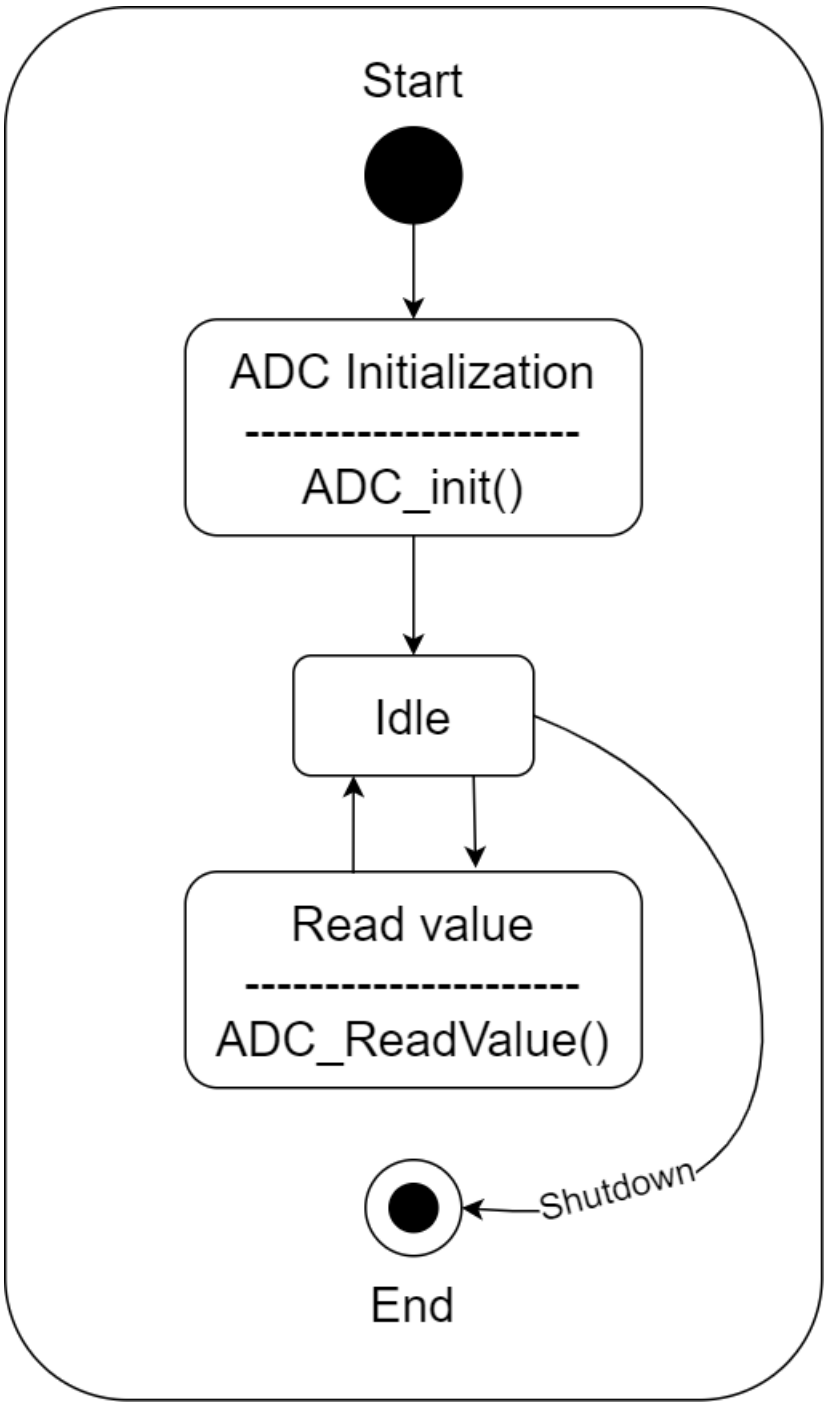
- Left lights (by a switch with two states ON/OFF)
- Right lights (by a switch with two states ON/OFF)
- The buzzer

ECU 2 also take the decision according to the received data from ECU.1

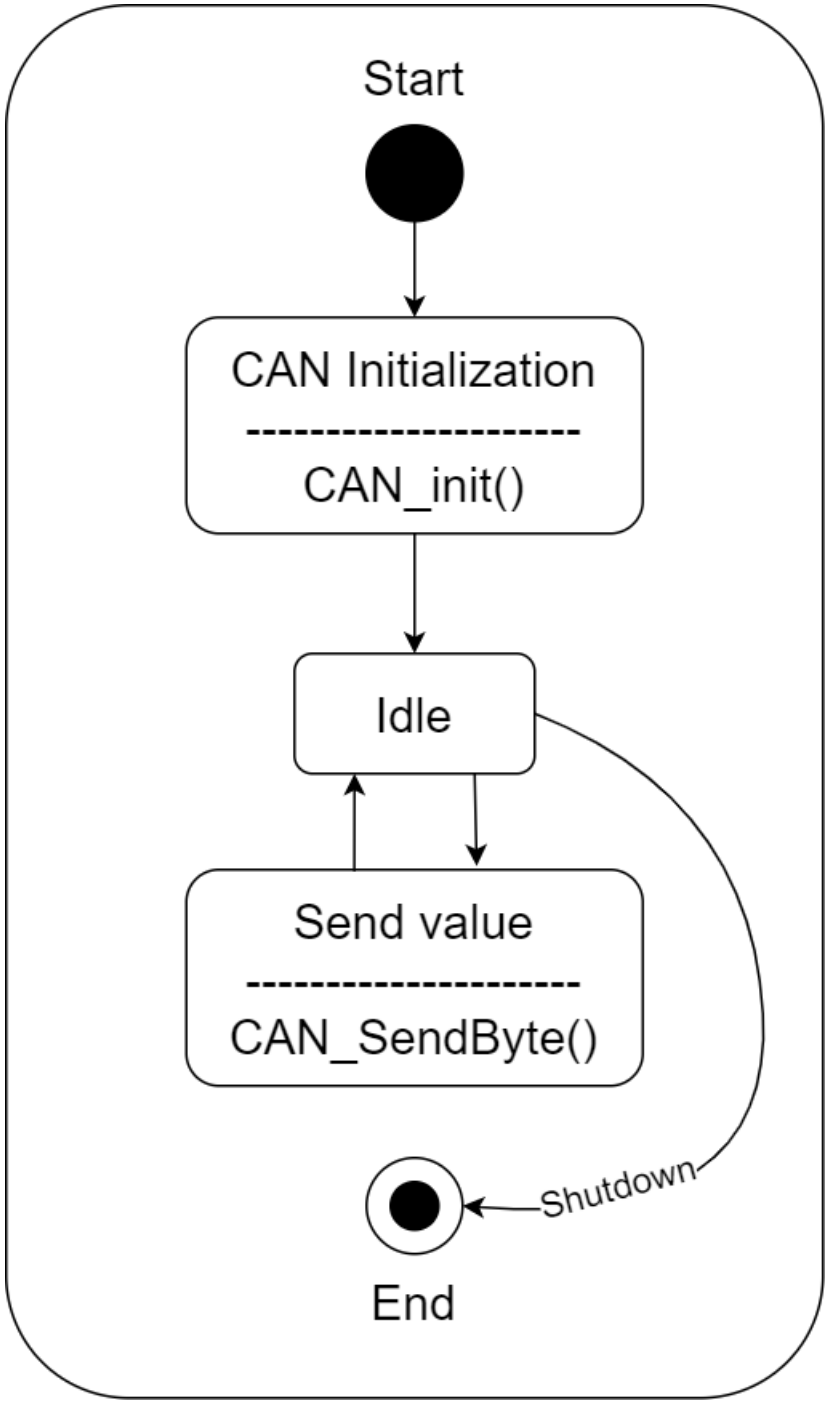
II. State machine diagram

A. ECU 1 state machine diagram for each component

ADC



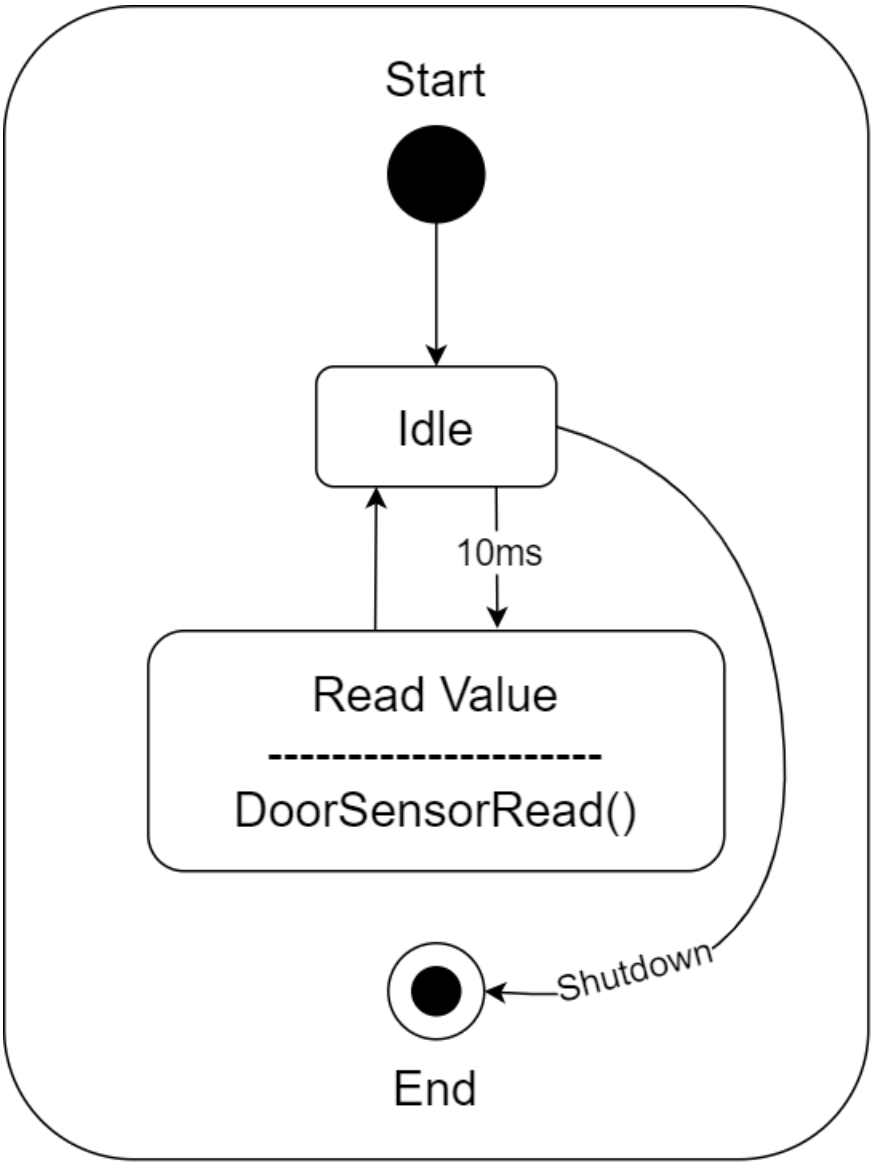
CAN Send


Start
CAN Initialization

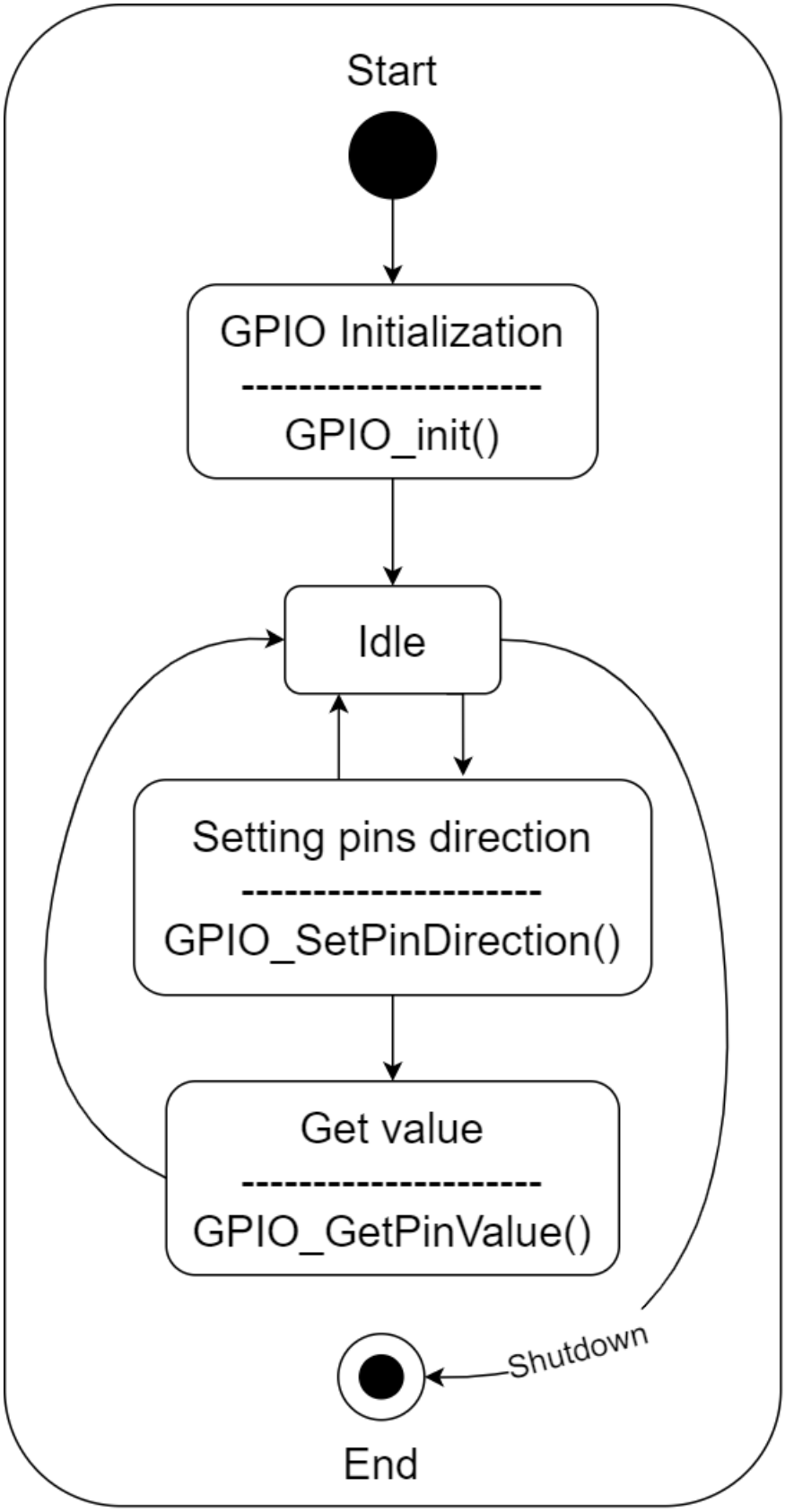
CAN_init()
Idle
Send value

CAN_SendByte()
Shutdown
End

Door Switch



GPIO

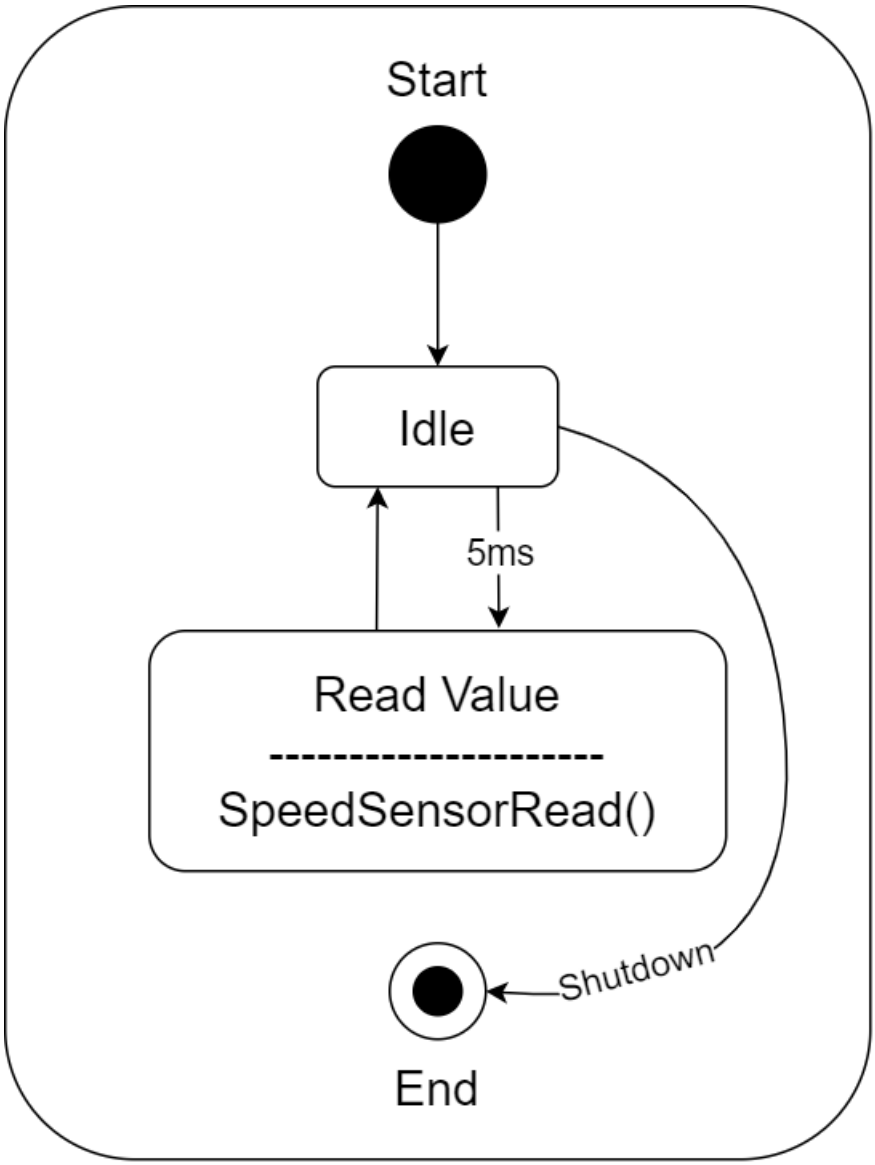

Start
GPIO Initialization

GPIO_init()
Idle
Setting pins direction

GPIO_SetPinDirection()
Get value

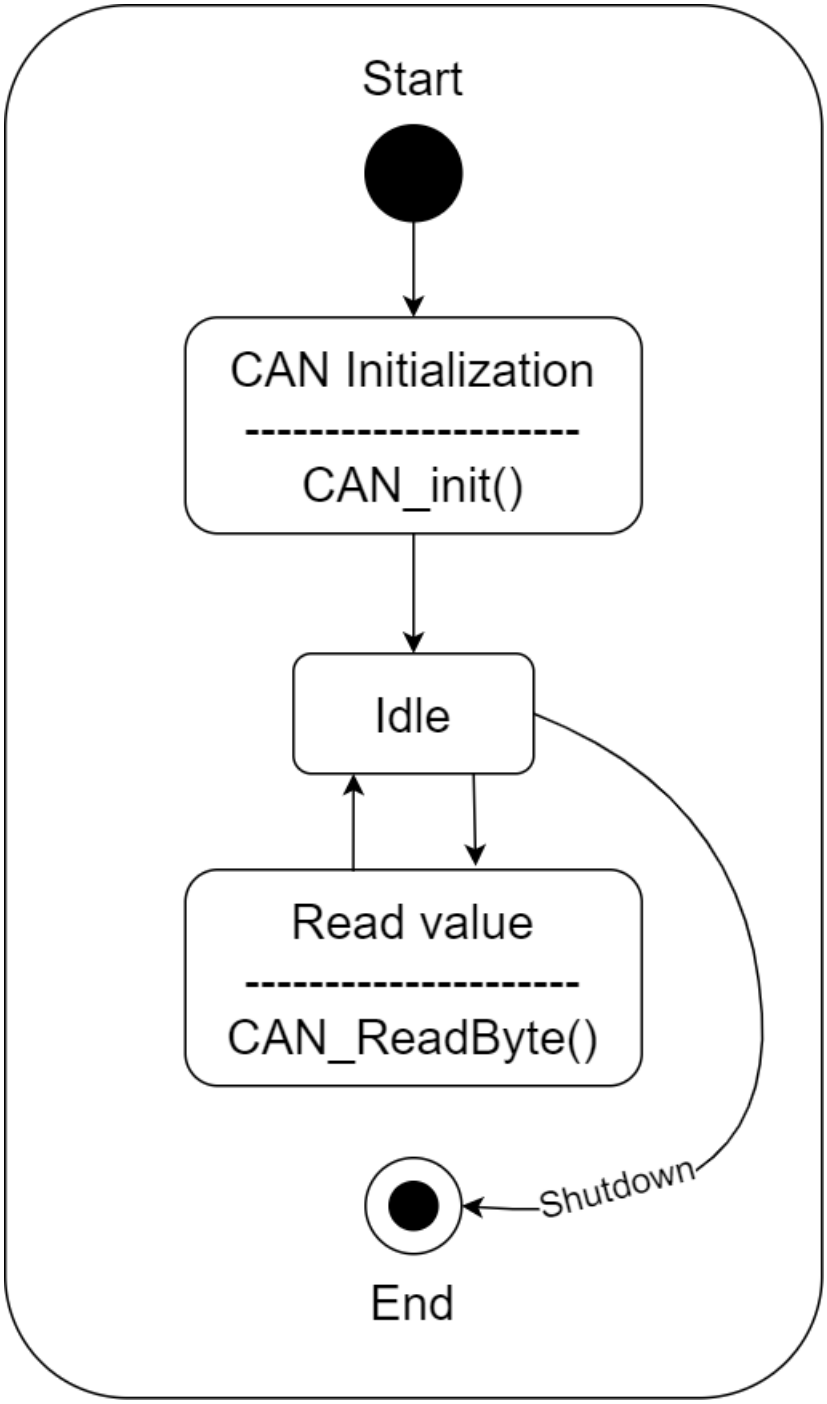
GPIO_GetPinValue()
Shutdown
End

Speed sensor

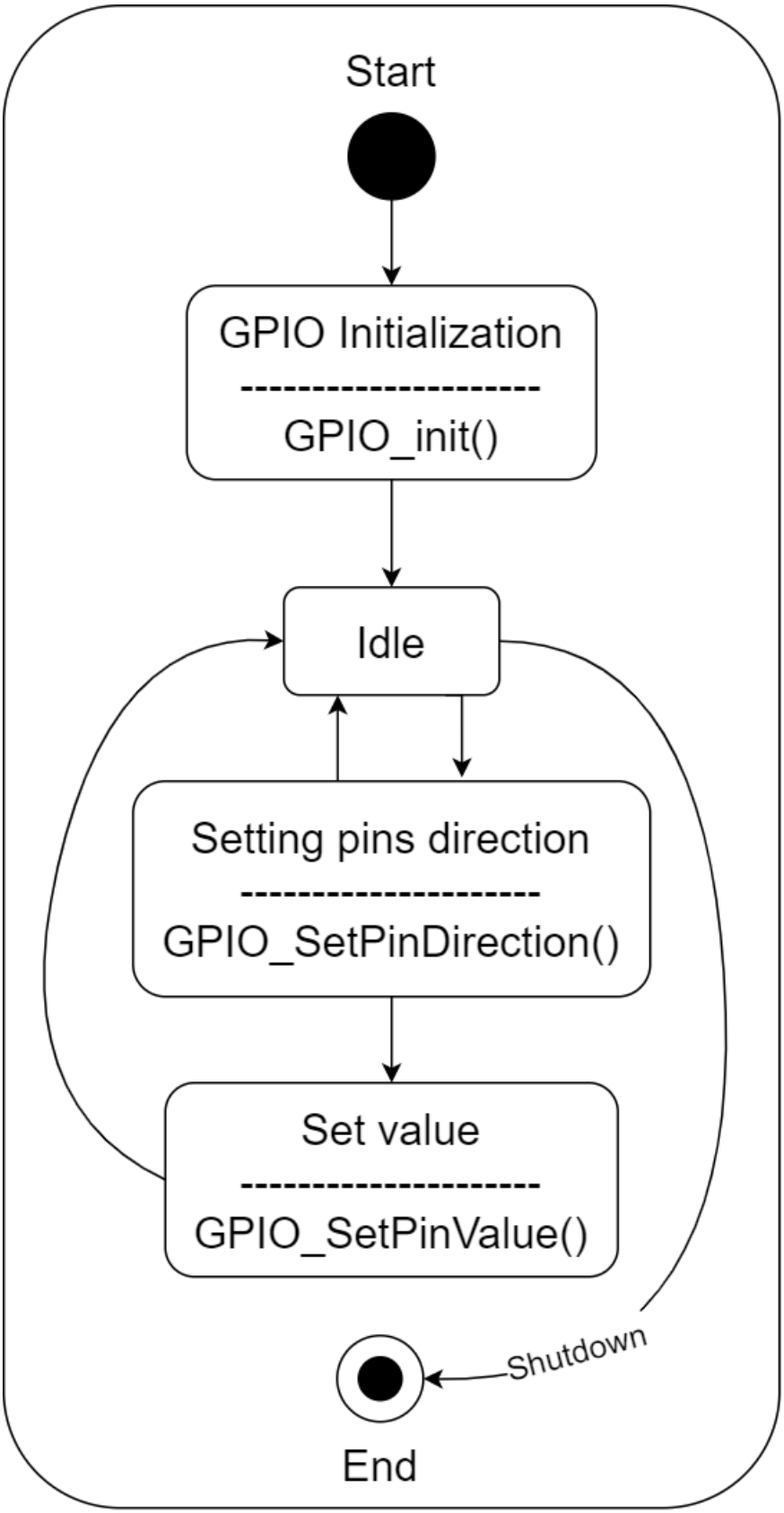


B. ECU 2 state machine diagram for each component

CAN



GPIO

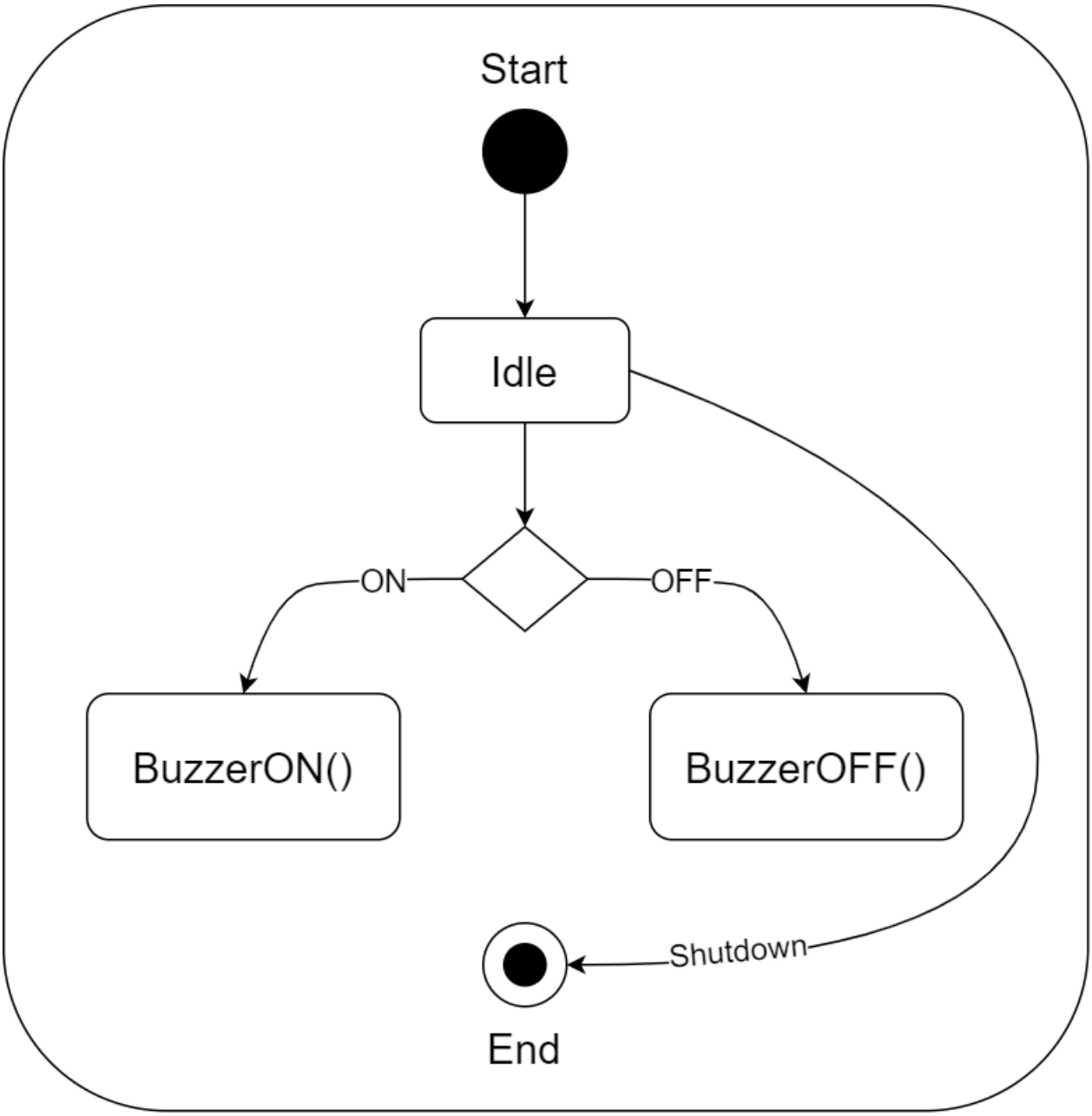

Start
GPIO Initialization

GPIO_init()
Idle
Setting pins direction

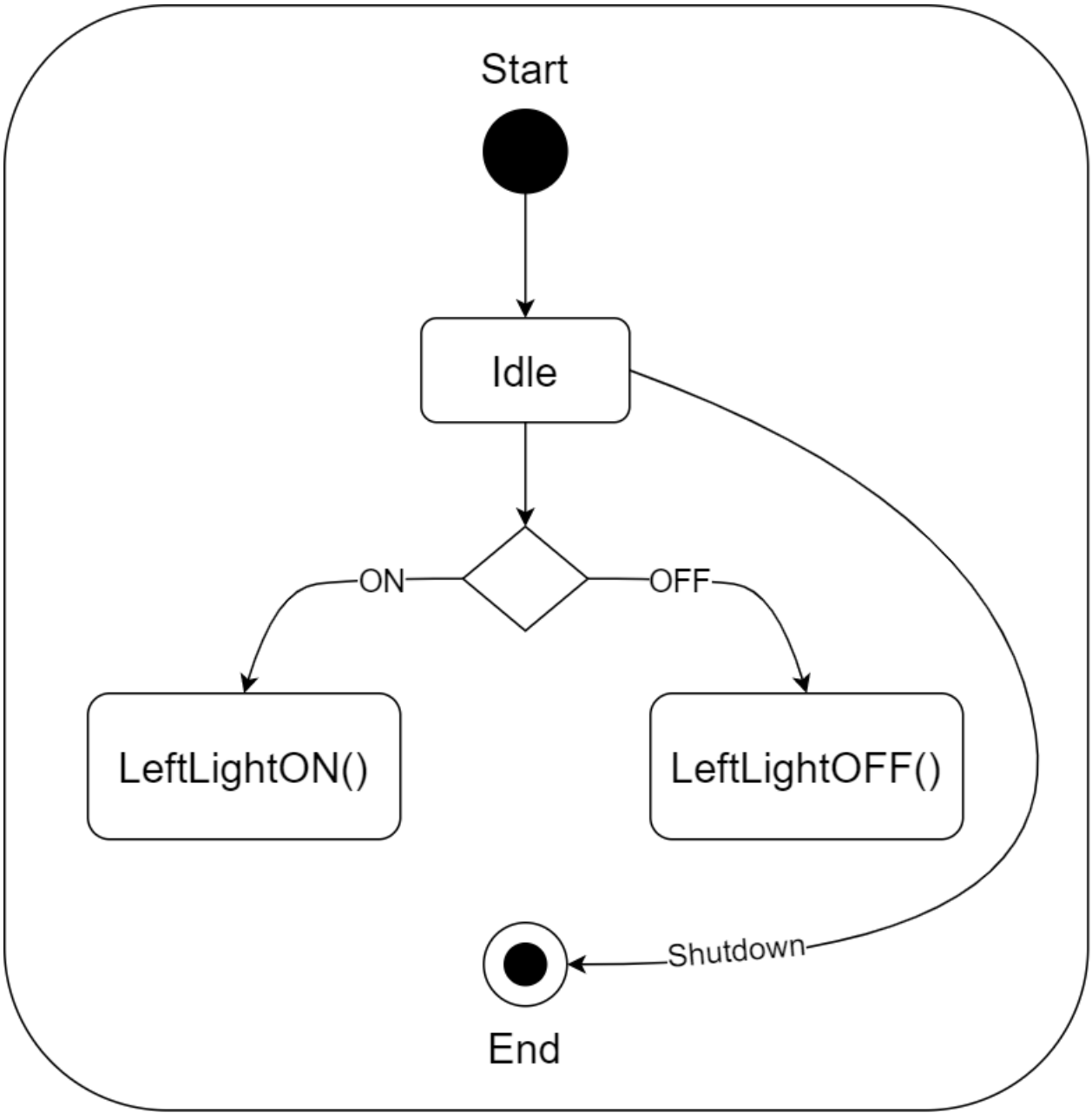
GPIO_SetPinDirection()
Set value

GPIO_SetPinValue()
Shutdown
End

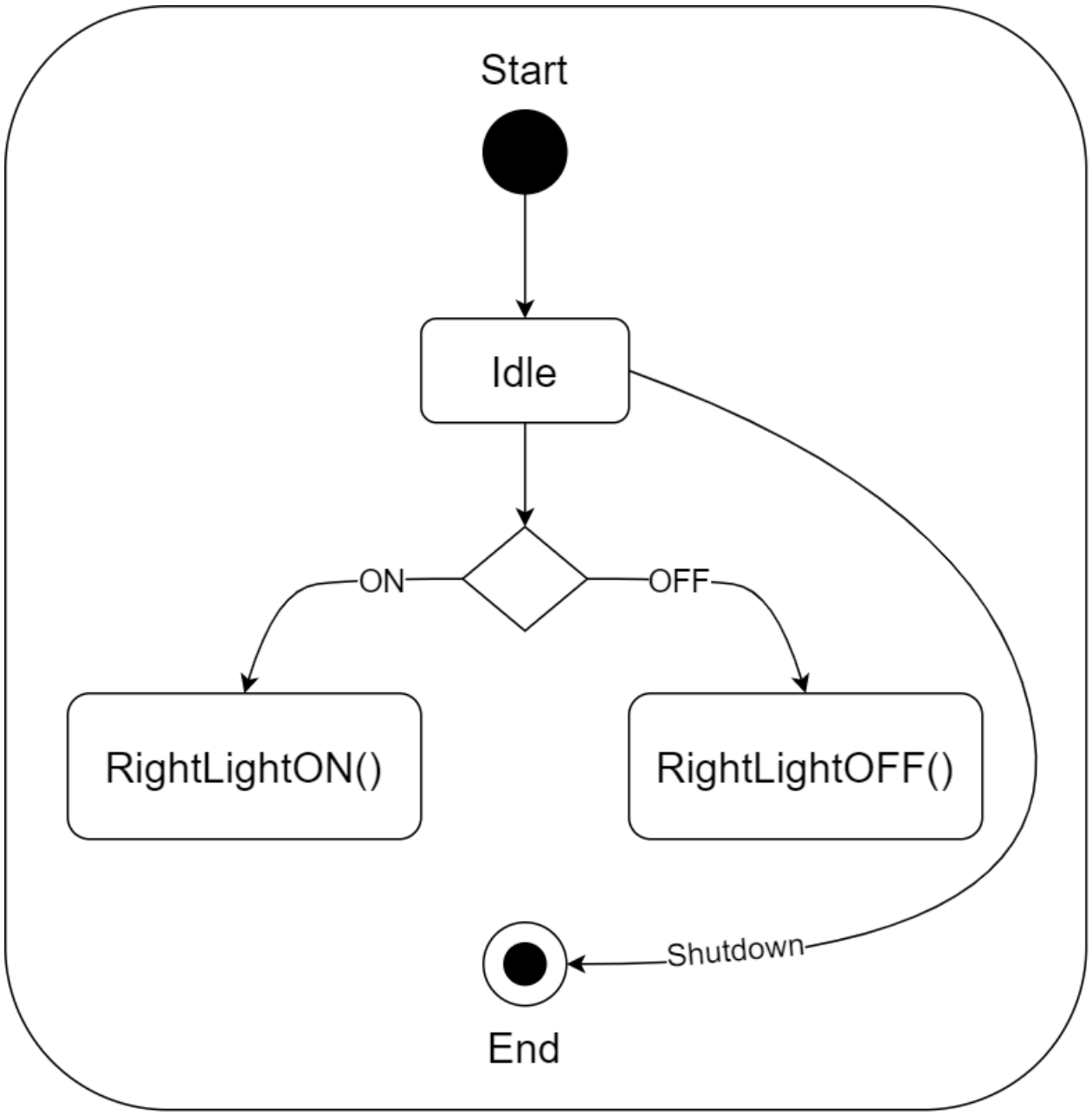
Buzzer



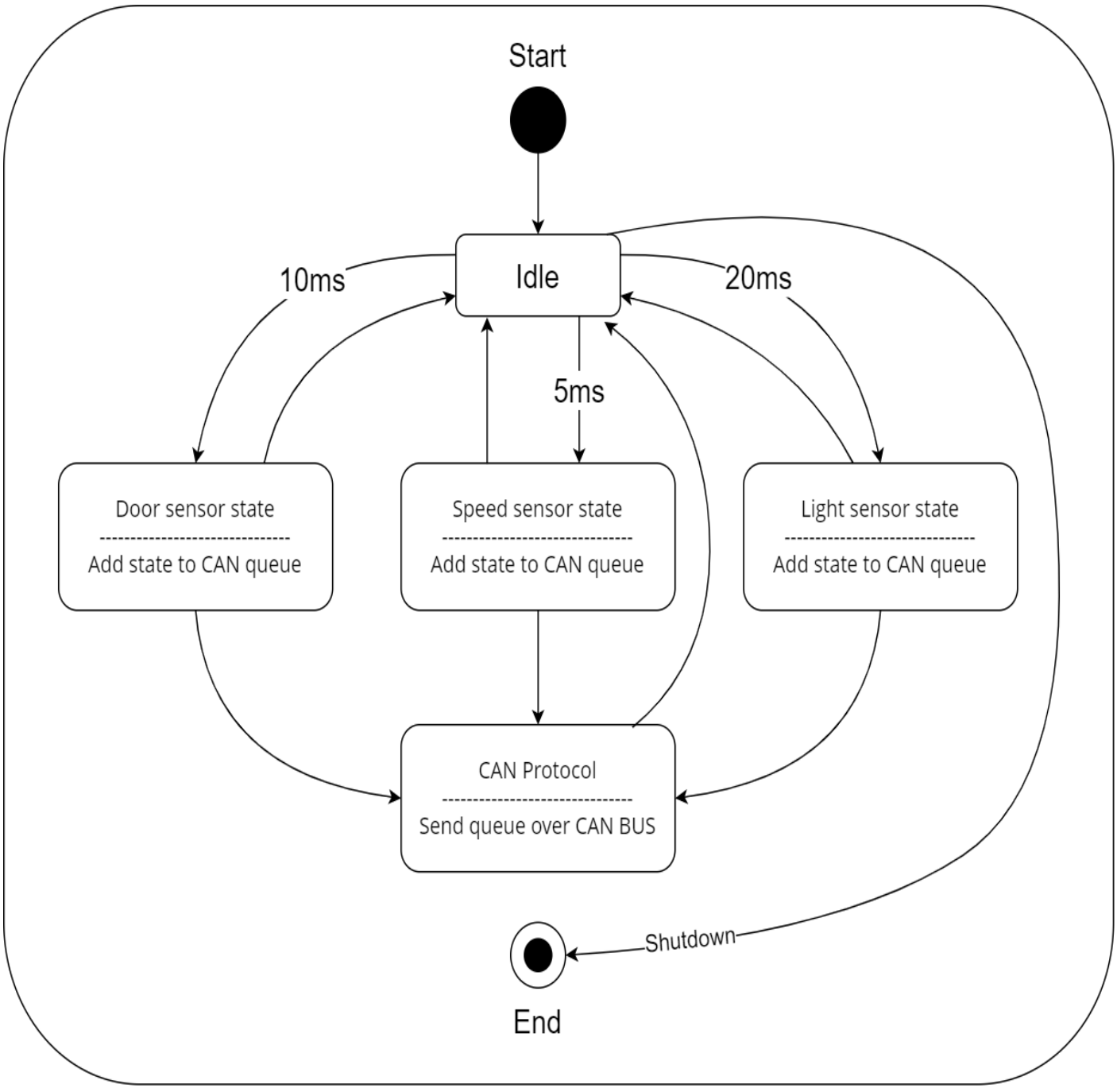
Left light



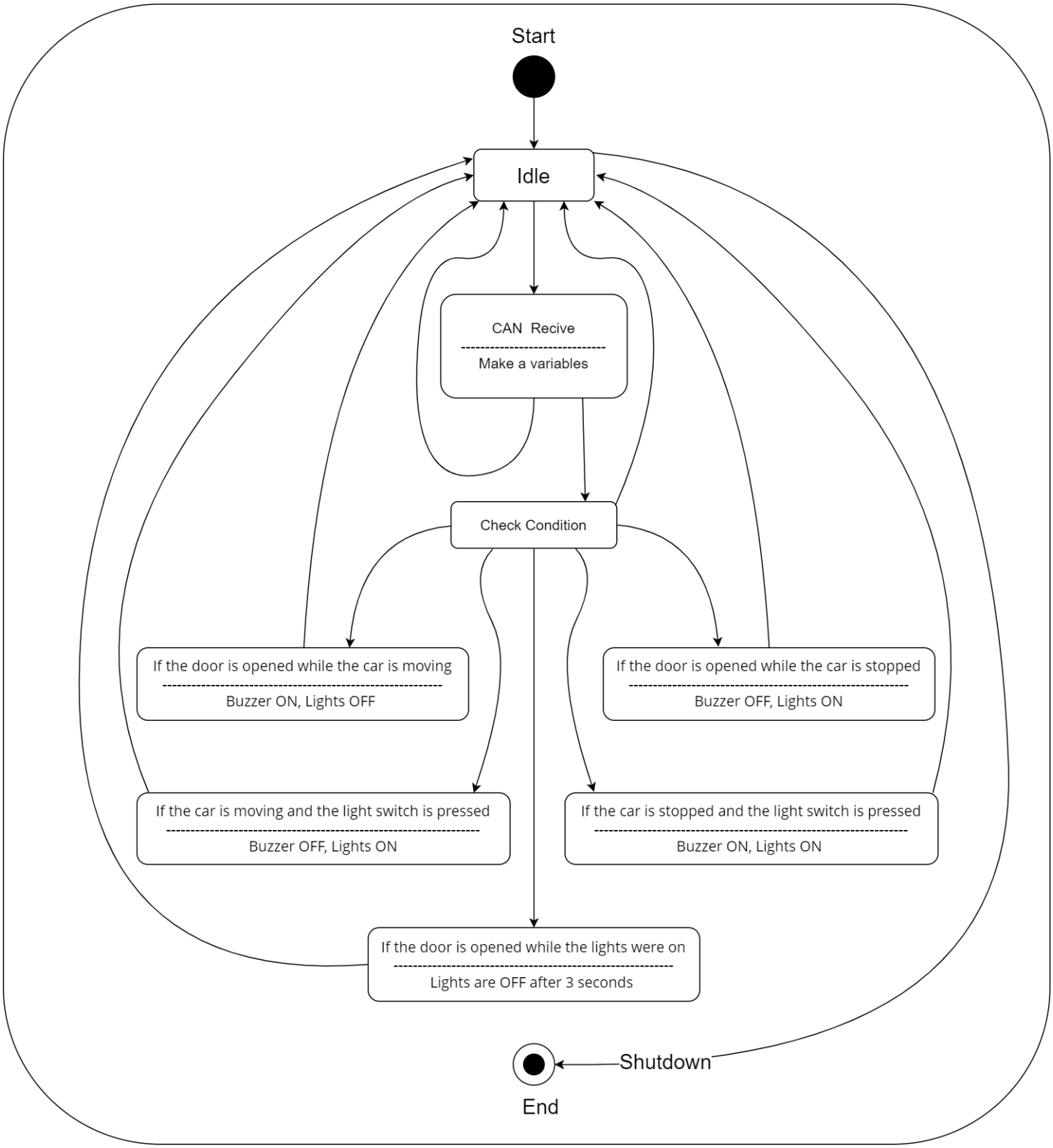
Right light


Start
Idle
ON
OFF
RightLightON()
RightLightOFF()
Shutdown
End

C. ECU 1 state machine diagram for each Operation

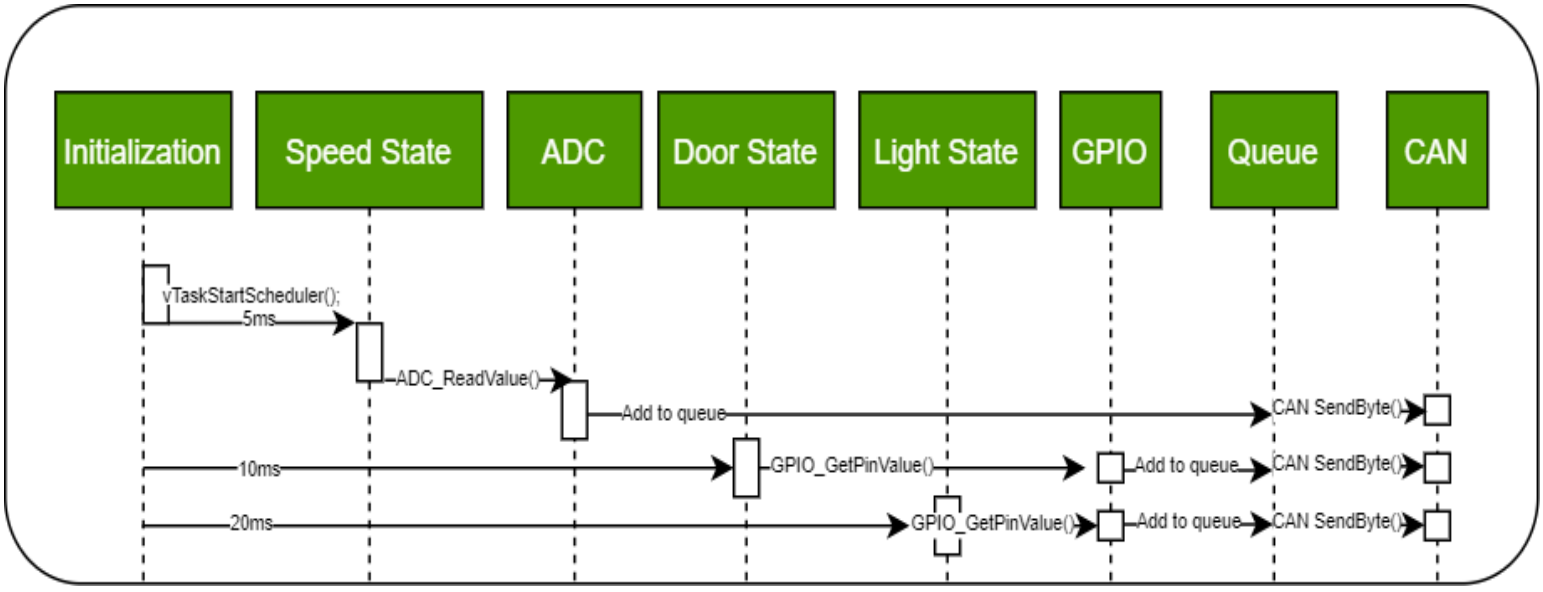


D. ECU 2 state machine diagram for each Operation

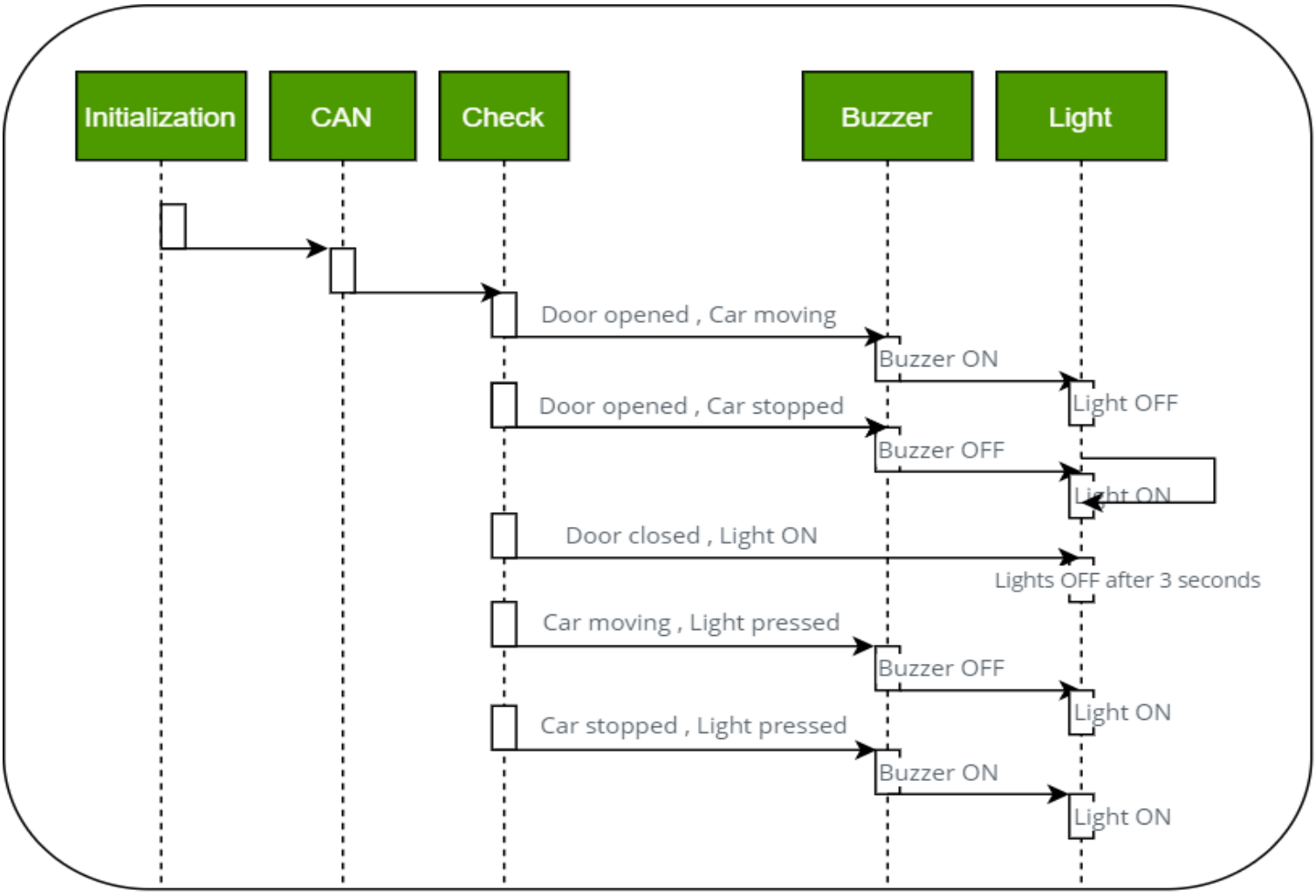


III. sequence diagram

A. ECU 1 Sequence diagram



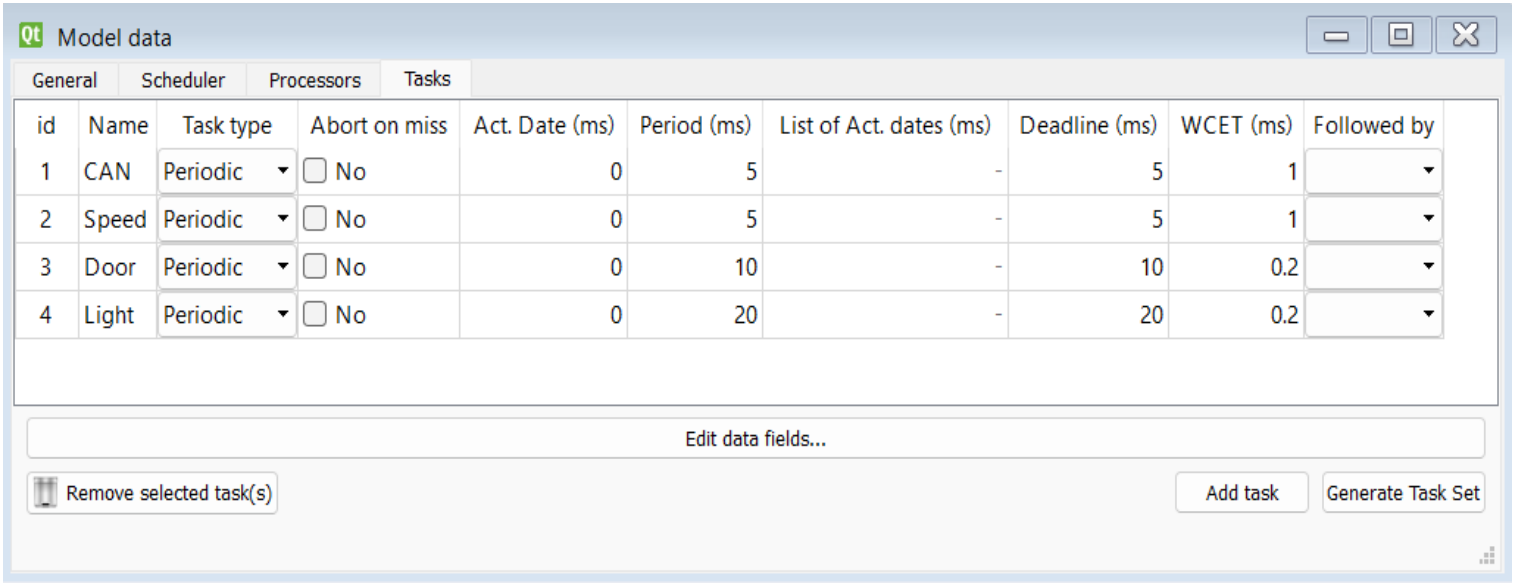
B. ECU 2 Sequence diagram



IV. SimSo simulation and estimated CPU load

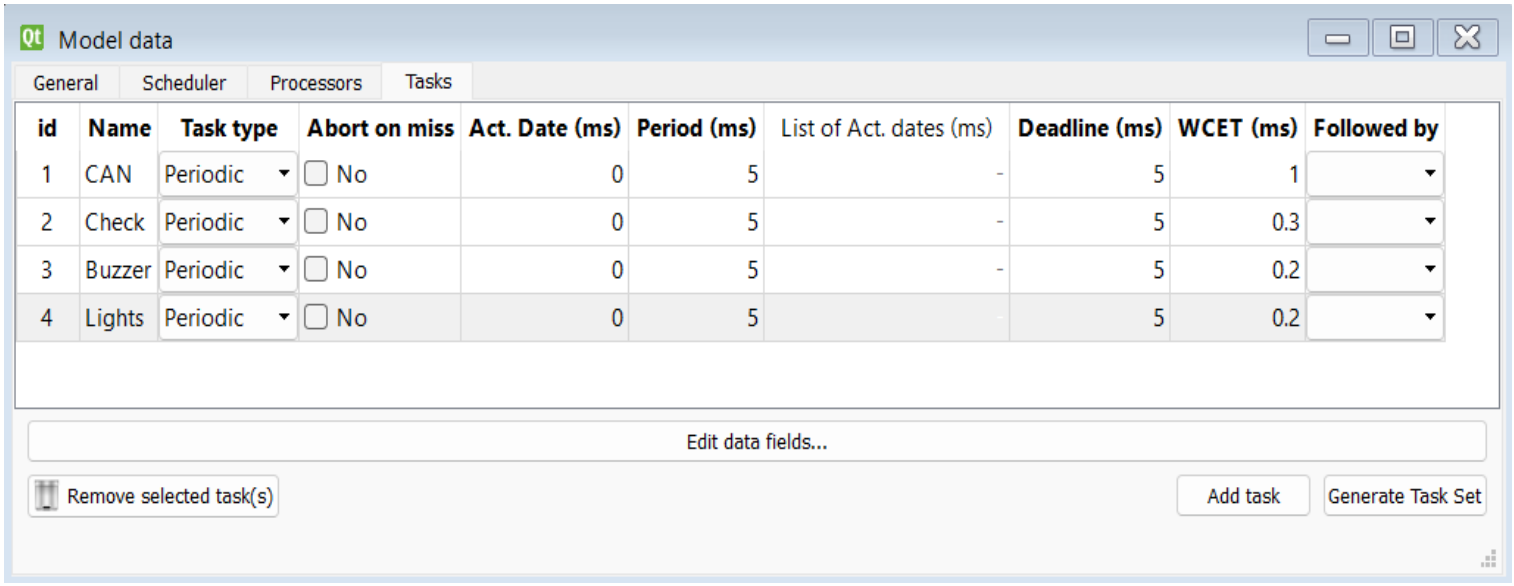
Simulating the estimated task execution time on each ECU as follows

A. ECU 1 Tasks



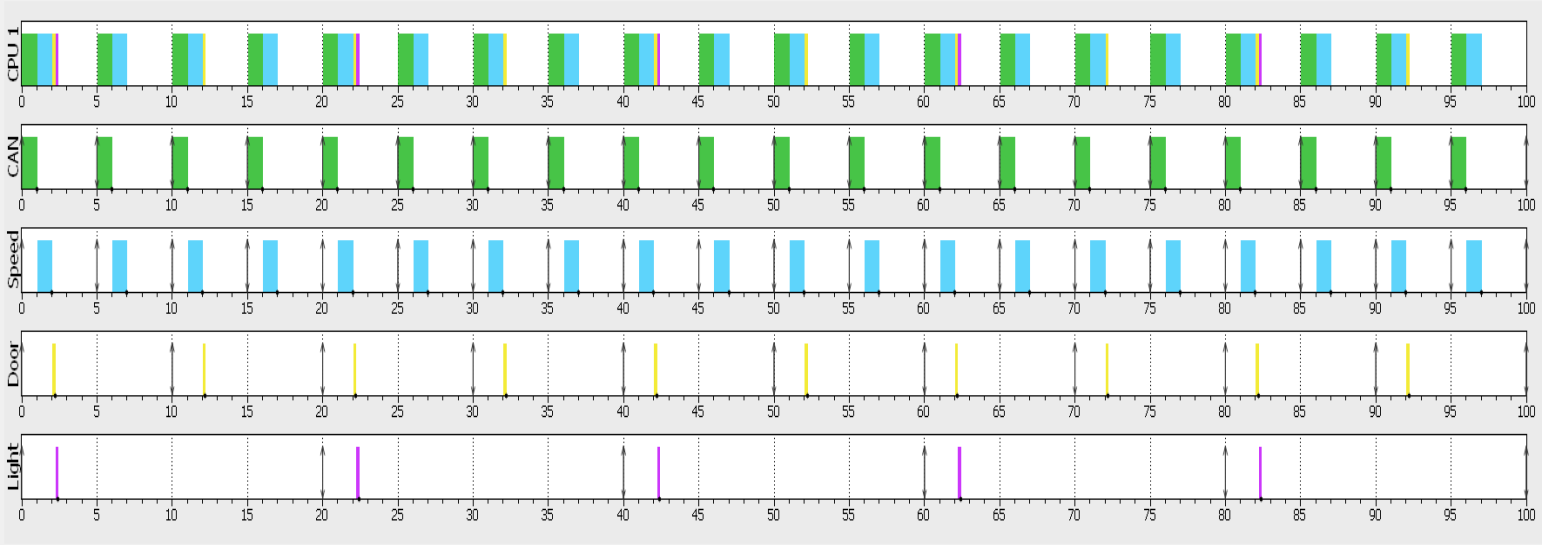
id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by
1	CAN	Periodic	No	0	5	-	5	1	
2	Speed	Periodic	No	0	5	-	5	1	
3	Door	Periodic	No	0	10	-	10	0.2	
4	Light	Periodic	No	0	20	-	20	0.2	

B. ECU 2 Tasks

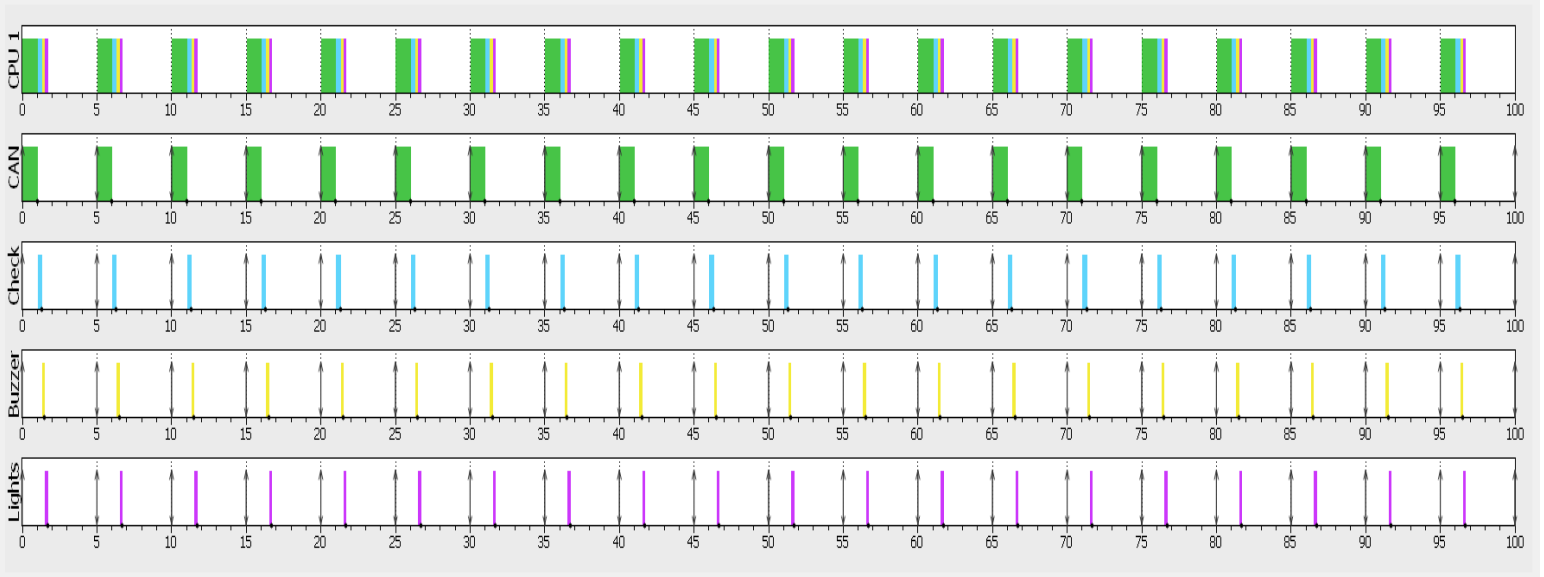


id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by
1	CAN	Periodic	No	0	5	-	5	1	
2	Check	Periodic	No	0	5	-	5	0.3	
3	Buzzer	Periodic	No	0	5	-	5	0.2	
4	Lights	Periodic	No	0	5	-	5	0.2	

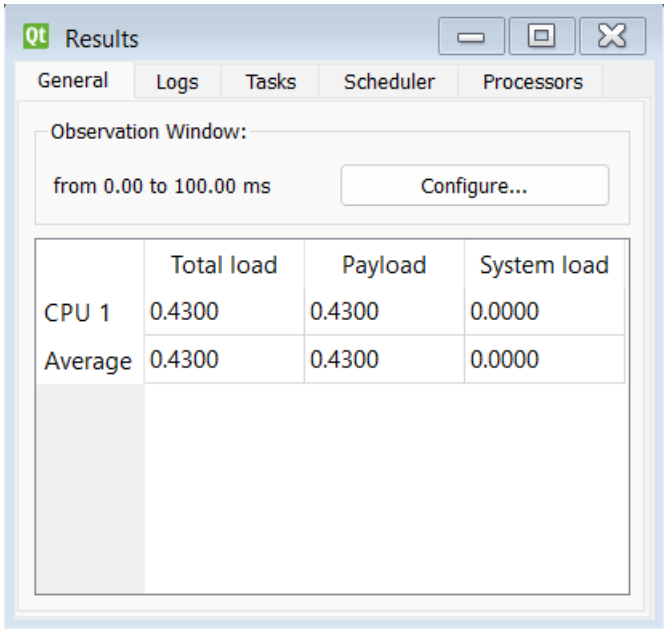
C. ECU 1 Gantt chart



D. ECU 2Gantt chart



E. ECU 1 CPU load



F. ECU 2 CPU load