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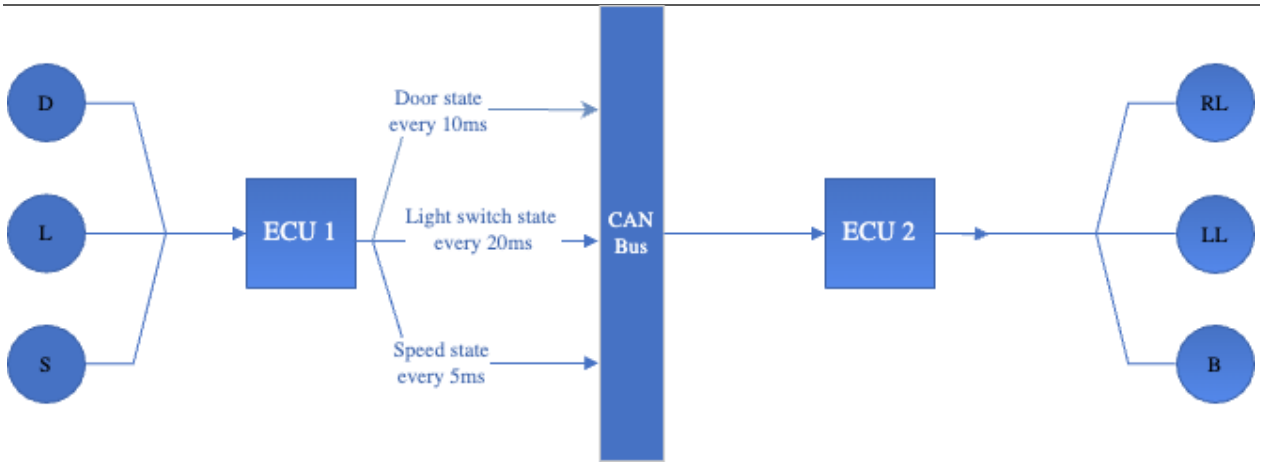
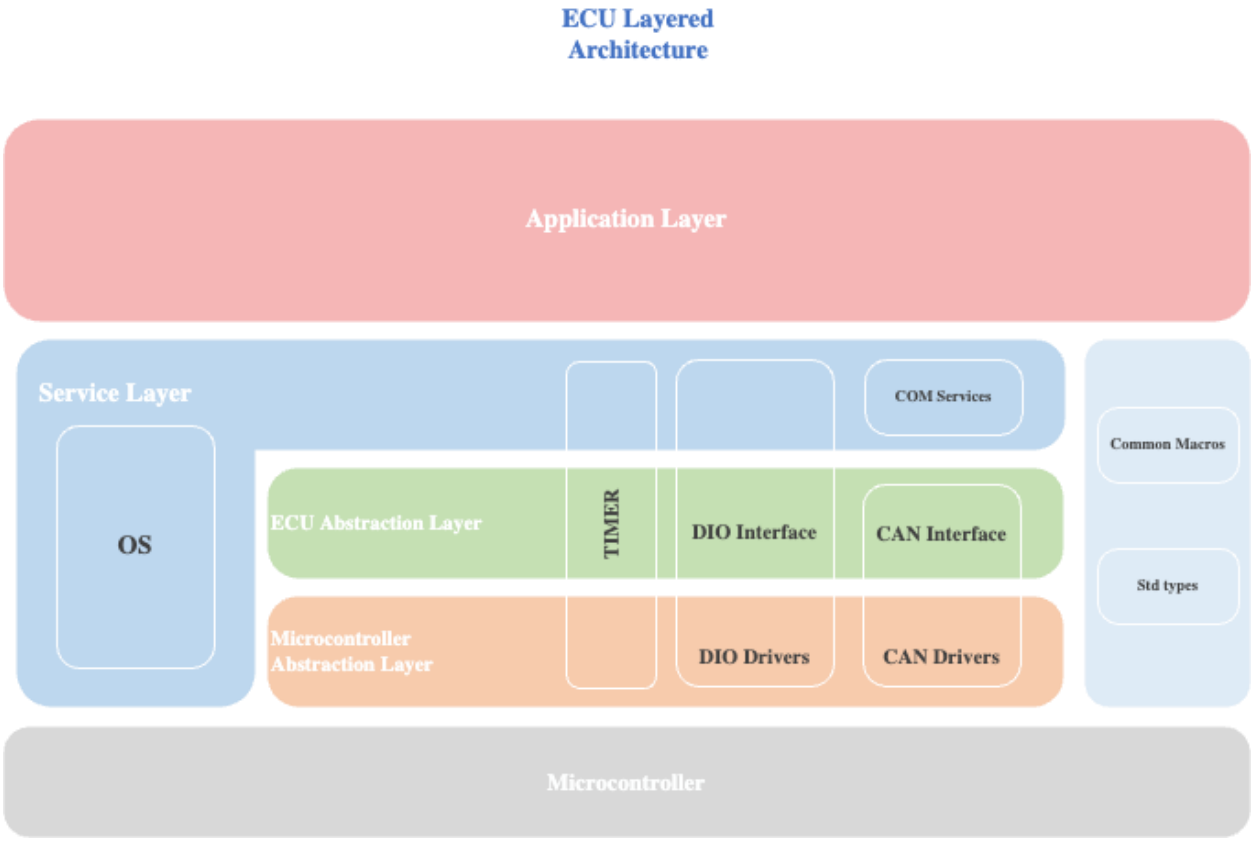
1 System Block Diagram



2 Static Design

2.1 Layered Architecture Design



2.2 ECU 1

2.2.1 Component and Modules

MCAL		ECU Abstraction Layer	
DIO APIs	• Initialize • read • write	**Door Sensor APIs**	• Initialize • Read
Timer APIs	• Initialize • Start • Stop	**Light Switch APIs**	• Initialize • Read
CAN APIs	• Initialize • Send • Receive	**Speed Sensor APIs**	• Initialize • Read
ADC APIs	• Initialize • Read		

2.2.2 APIs Description

DIO APIs:

Function name	**DIO_Init**		
Arguments	Inputs	pinConfig	DIO_pinConfig *
		array of pins configuration	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize ports according to the configurations in DIO_Config.c		

Function name	**DIO_Read**		
Arguments	Inputs	channel	Gpio_ChannelType
		the channel to be read	
	Output	uint8	channel value
	Input/Output	N/A	
Return	uint8	pin value	
Description	Reads the value of a certain pin in a port (channel)		

Function name	**DIO_Write**		
Arguments	Inputs	channel	Gpio_ChannelType
		the channel to be read	
	Output	N/A	
	Input/Output		
Return	uint8	pin value	
Description	Reads the value of a certain pin in a port (channel)		

Name	DIO_pinConfig	
Type	Struct	
Elements	channel	channel port and pin
	pinMode	the mode of the pin
	pinValue	the initial value of the pin
	pinDirection	the direction of the pin
Description	pin configuration used for initializing a pin	

Name	Gpio_ChannelType	
Type	Struct	
Elements	port	channel port
	pin	channel pin
Description	pin configuration used for initializing a pin	

ADC APIs:

Function name	ADC_Init		
Arguments	Inputs	pinConfig	DIO_pinConfig *
		array of pins configuration	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize ports according to the configurations in DIO_Config.c		

Function name	ADC_Read		
Arguments	Inputs	channel	Gpio_ChannelType
		the channel to be read	
	Output	uint8	channel value
	Input/Output	N/A	
Return	uint32	pin value	
Description	Reads the value of a certain pin in a port (channel)		

Timer APIs:

Function name	Timer_Init		
Arguments	Inputs	timerConfig	Timer_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize a timer		

Function name	Timer_start		
Arguments	Inputs	channel	uint_8
		Timer channel to be stated	
		time	Uint_32
		The time for the timer	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Starts a given timer with a given time		

Function name	Timer_stop		
Arguments	Inputs	channel	uint_8
		Timer channel to be stopped	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Stops a given timer		

CAN APIs:

Function name	CAN_Init		
Arguments	Inputs	config	CAN_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize the CAN communication		

Function name	CAN_sendData		
Arguments	Inputs	data	uint8
		The data to be sent	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Sends data over CAN bus		

Function name	CAN_receiveData		
Arguments	Inputs	id	uint8
		Data ID	
	Output	N/A	
	Input/Output	N/A	
Return	uint8	Data received	
Description	Recieves data from the CAN bus		

Door Sensor APIs:

Function name	DoorSensor_Init		
Arguments	Inputs	config	Door_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize the door sensor		

Function name	DoorSensor_ReadValue		
Arguments	Inputs	channel	Uint8
		The door sensor to be read value from	
	Output	N/A	
	Input/Output	N/A	
Return	uint8	Sensor value	
Description	Reads the value of the door sensor		

Light Switch APIs:

Function name	LightSW_Init		
Arguments	Inputs	config	LightSW_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize the light switch		

Function name	LightSW_ReadValue		
Arguments	Inputs	channel	Uint8
		The light switch to be read value from	
	Output	N/A	
	Input/Output	N/A	
Return	Uint8	Switch state	
Description	Reads the state of the light switch		

Speed Sensor APIs:

Function name	SpeedSensor_Init		
Arguments	Inputs	config	Speed_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize the speed sensor		

Function name	SpeedSensor_ReadValue		
Arguments	Inputs	channel	Uint8
		The speed sensor to be read value from	
	Output	N/A	
	Input/Output	N/A	
Return	Uint32	Sensor value	
Description	Reads the value of the speed sensor		

2.2.3 Folder Structure

/ECU1/MCAL/
/ECU1/MCAL/Inc/
/ECU1/HAL/
/ECU1/HAL/Inc/
/ECU1/APP/
/ECU1/APP/Inc
/ECU1/Config
/ECU1/Service
/ECU1/Common

2.3 ECU 2

2.3.1 Component and Modules

MCAL		ECU Abstraction Layer	
DIO APIs	• Initialize • read • write	**Lights APIs**	• Initialize • on • off
Timer APIs	• Initialize • Start • Stop	**Buzzer APIs**	• Initialize • on • off
CAN APIs	• Initialize • Send • Receive		

2.3.2 APIs Description

DIO APIs:

Function name	**DIO_Init**		
Arguments	Inputs	pinConfig	DIO_pinConfig *
		array of pins configuration	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize ports according to the configurations in DIO_Config.c		

Function name	**DIO_Read**		
Arguments	Inputs	channel	Gpio_ChannelType
		the channel to be read	
	Output	uint8	channel value
	Input/Output	N/A	
Return	uint8	pin value	
Description	Reads the value of a certain pin in a port (channel)		

Function name	**DIO_Write**		
Arguments	Inputs	channel	Gpio_ChannelType
		the channel to be read	
	Output	N/A	
	Input/Output		
Return	uint8	pin value	
Description	Reads the value of a certain pin in a port (channel)		

Name	DIO_pinConfig	
Type	Struct	
Elements	channel	channel port and pin
	pinMode	the mode of the pin
	pinValue	the initial value of the pin
	pinDirection	the direction of the pin
Description	pin configuration used for initializing a pin	

Name	Gpio_ChannelType	
Type	Struct	
Elements	port	channel port
	pin	channel pin
Description	pin configuration used for initializing a pin	

Timer APIs:

Function name	Timer_Init		
Arguments	Inputs	timerConfig	Timer_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize a timer		

Function name	Timer_start		
Arguments	Inputs	channel	uint_8
		Timer channel to be stated	
		time	Uint_32
		The time for the timer	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Starts a given timer with a given time		

Function name	Timer_stop		
Arguments	Inputs	channel	uint_8
		Timer channel to be stopped	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Stops a given timer		

CAN APIs:

Function name	CAN_Init		
Arguments	Inputs	config	CAN_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize the CAN communication		

Function name	CAN_sendData		
Arguments	Inputs	data	uint8
		The data to be sent	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Sends data over CAN bus		

Function name	CAN_receiveData		
Arguments	Inputs	id	uint8
		Data ID	
	Output	N/A	
	Input/Output	N/A	
Return	uint8	Data received	
Description	Receives data from the CAN bus		

Light APIs:

Function name	Light_Init		
Arguments	Inputs	config	Light_configType
		Configuration structure	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Initialize the lights		

Function name	Light_On		
Arguments	Inputs	channel	Uint8
		The light to be turned on	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Turns on the light given		

Function name	Light_Off		
Arguments	Inputs	channel	Uint8
		The light to be turned on	
	Output	N/A	
	Input/Output	N/A	
Return	E_OK	0	
	E_NOK	1	
Description	Turns off the light given		

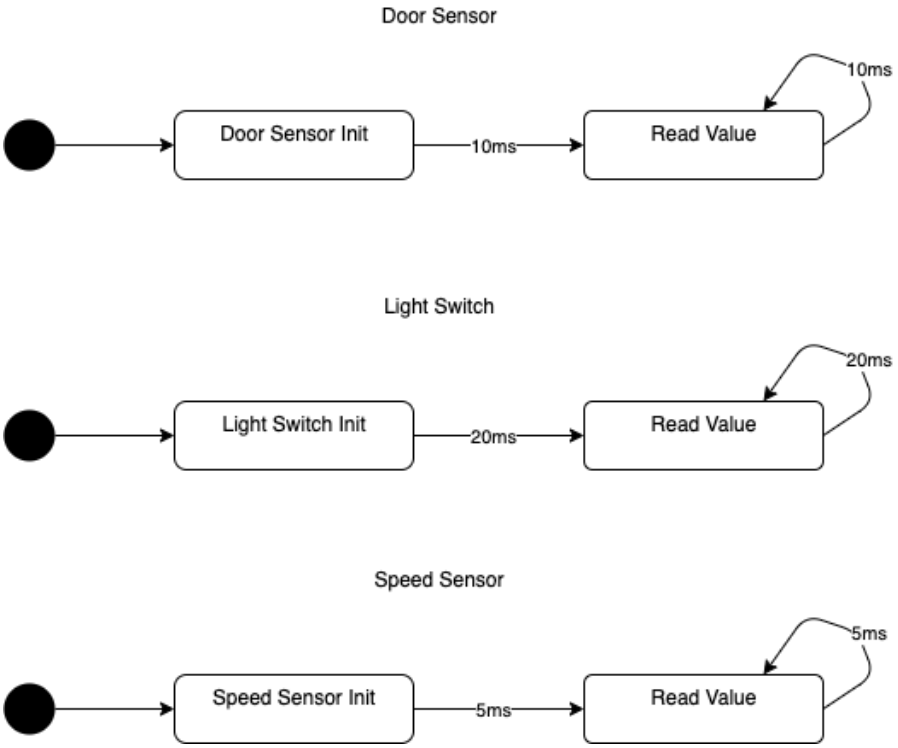
2.3.3 Folder Structure

/ECU2/MCAL/
/ECU2/MCAL/Inc/
/ECU2/HAL/
/ECU2/HAL/Inc/
/ECU2/APP/
/ECU2/APP/Inc
/ECU2/Config
/ECU2/Service
/ECU2/Common

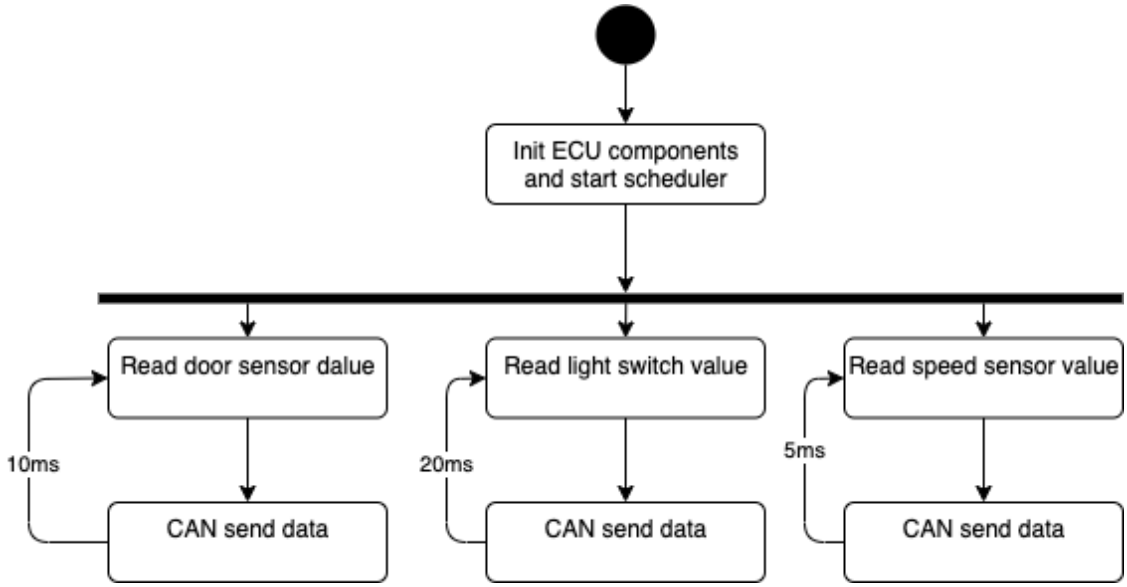
3 DYNAMIC DESIGN

3.1 ECU 1

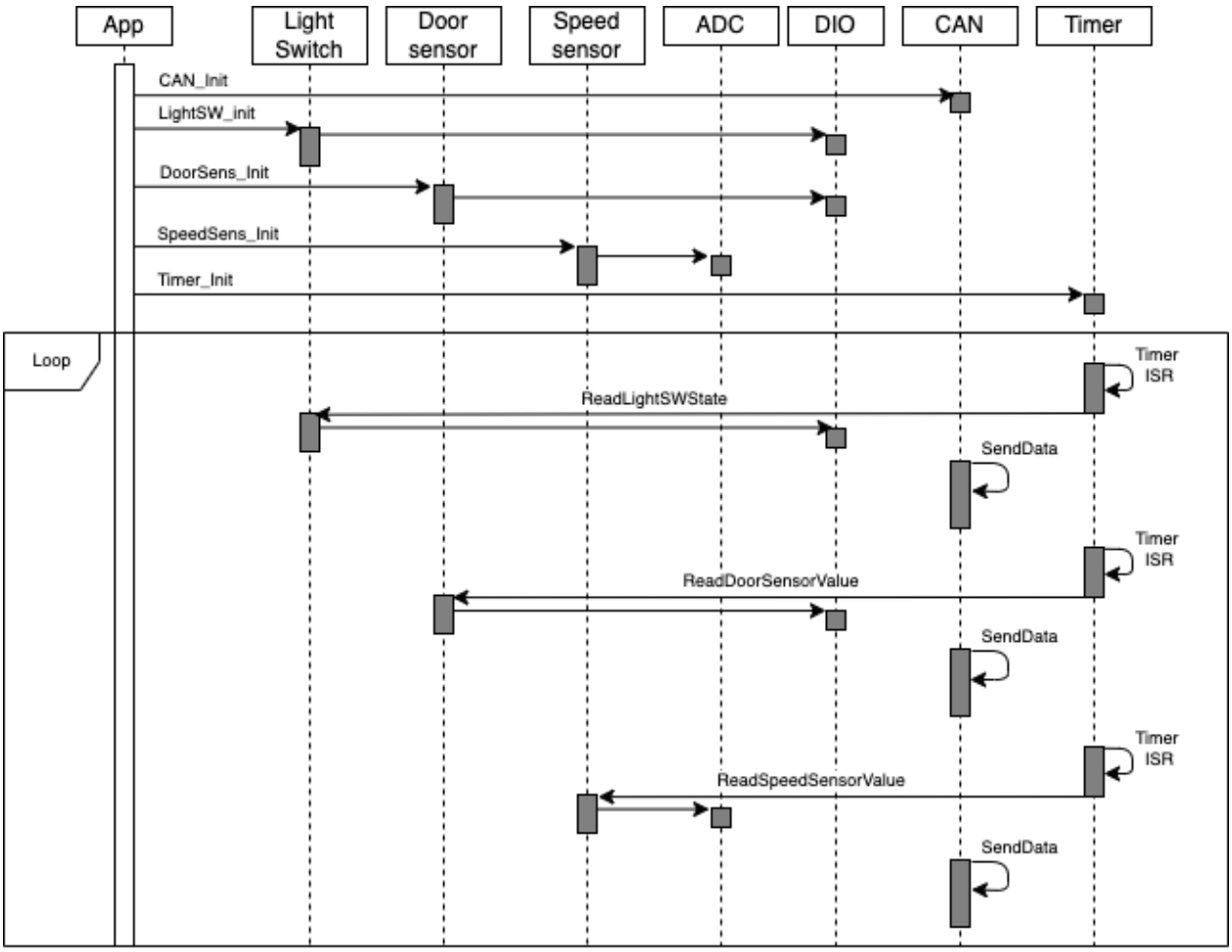
3.1.1 ECU components state machines



3.1.2 ECU state machine



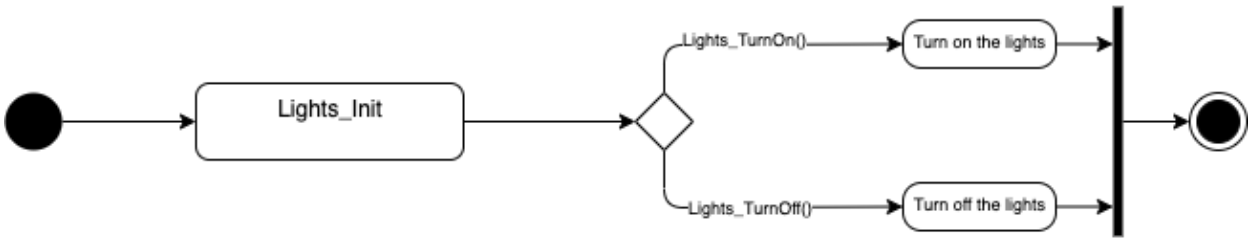
3.1.3 ECU sequence diagram



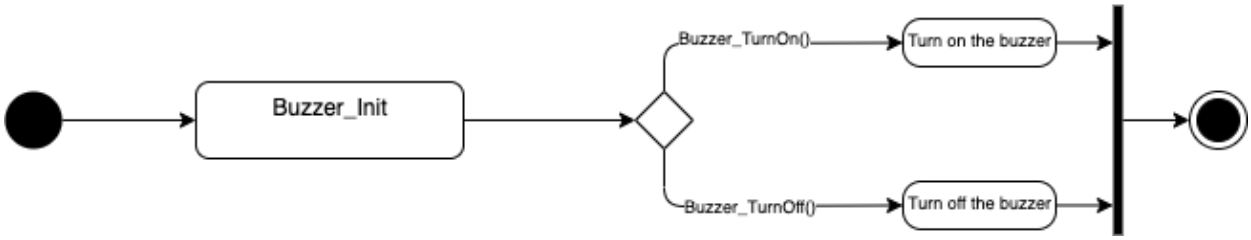
3.2 ECU 2

3.2.1 ECU components state machines

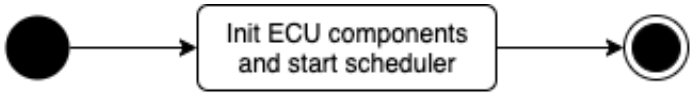
Lights

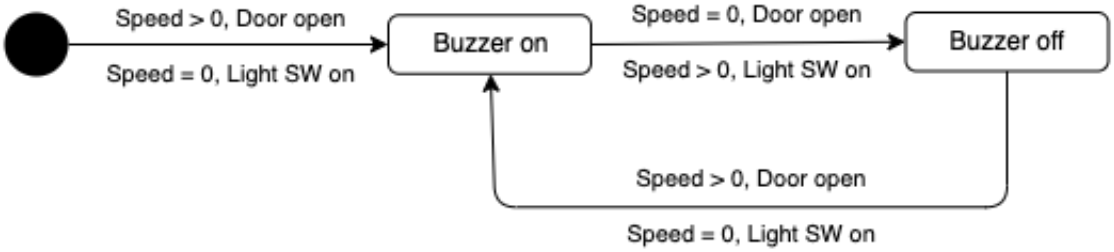


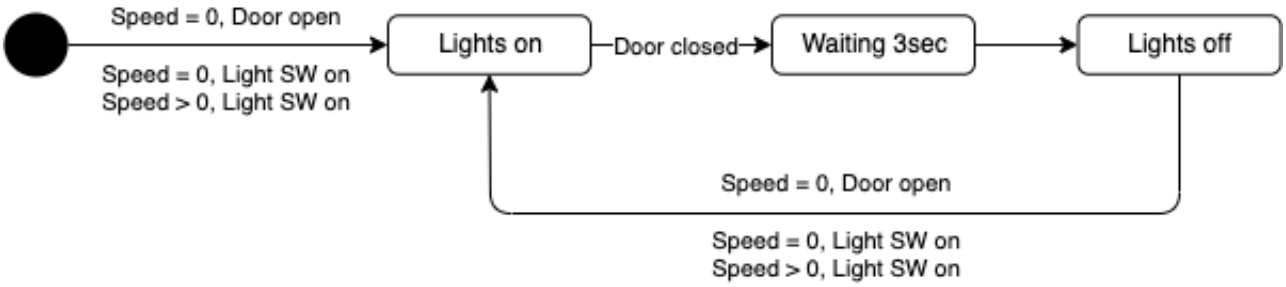
Buzzer



3.2.2 ECU state machine







3.2.3 ECU sequence diagram