

Automotive Door Control System Design

Part 1

Static Design

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ECU1:

ECU1 has 7 modules.



ECU1 will send status messages periodically to ECU 2 through the CAN protocol, Status messages will be sent using Basic Communication Module (BCM) module, Door state message will be sent every 10ms to ECU 2, Light switch state message will be sent every 20ms to ECU 2, Speed state message will be sent every 5ms to ECU 2.

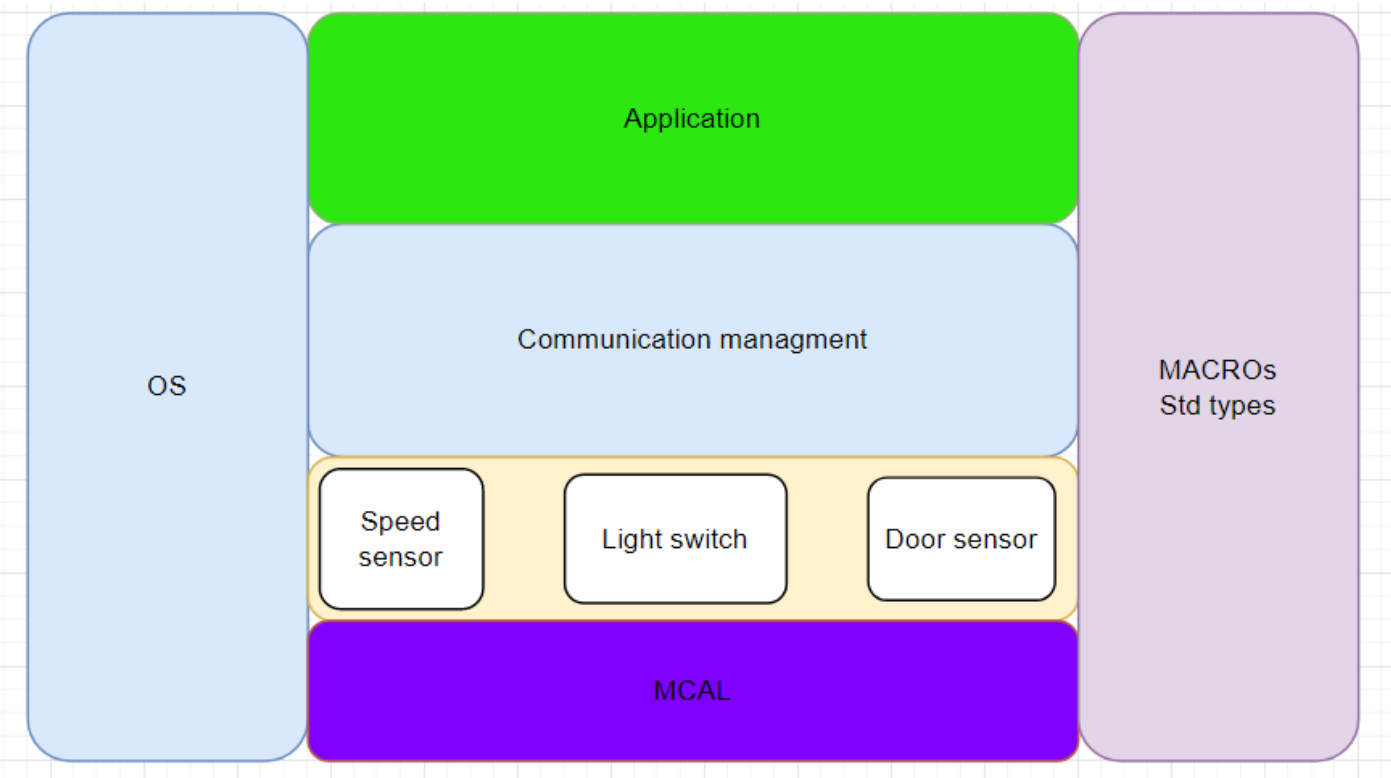
ECU2:



ECU 2 has 6 modules.

If the door is opened while the car is moving → Buzzer ON, Lights OFF, If the door is opened while the car is stopped → Buzzer OFF, Lights ON, If the door is closed while the lights were ON → Lights are OFF after 3 seconds
If the car is moving and the light switch is pressed → Buzzer OFF, Lights ON, If the car is stopped and the light switch is pressed → Buzzer ON, Lights ON.

ECU1:



DIO APIs:

Function Name	DIO_Init()
API Type	Init
Parameters (INPUT)	DIO_Port
	DIO_Channel
	DIO_PinLevel
Parameters (OUTPUT)	None
Return	E_OK: 0
	E_NOK: 1
Description	initialization the Dio module

Function Name	DIO_Read()
API Type	Getter
Parameters (INPUT)	DIO_Port
	DIO_Channel
Parameters (OUTPUT)	DIO_PinLevel
Return	E_OK: 0

	E_NOK: 1
Description	Reading the value of the channel
Function Name	DIO_Write()
API Type	Setter
Parameters (INPUT)	DIO_Port
	DIO_Channel
Parameters (OUTPUT)	DIO_PinLevel
Return	E_OK: 0
	E_NOK: 1
Description	Write on the channel low or high

Name	DIO_Port
Type	typedef enum
Range	{Port A to PortF }
Description	The decimal number for Port

Name	DIO_Channel
Type	typedef enum
Range	{ PIN0 to PIN7}
Description	The decimal number for Pin

Name	DIO_PinLevel	
Type	typedef enum	
Range	0	Low or Input Direction
	1	High or Output Direction
Description	The direction of the channel or the level on it.	

Timer APIs:

Function Name	TIMER_Inti()	
API Type	Init	
Parameters (INPUTS)	* ConfigPtr	TIMER_ConfigType
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	initialization the timer module	

for ECU 1 & ECU 2

Function Name	TIMER_Start()	
API Type	-	
Parameters (INPUTS)	Channel	TIMER_ChannelType
	Value	TIMER_ValueType
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Start the timer channel	

Function Name	TIMER_Stop()	
API Type	-	
Parameters (INPUTS)	Channel	TIMER_ChannelType
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Stop the timer channel	

Name	TIMER_ChannelType
Type	Uint8_t
Description	The channel of the timer

Name	TIMER_ValueType
Type	Uint8_t
Description	Type for reading and setting the timer value number of ticks

Name	TIMER_ConfigType
Type	Structure
Description	This structure is including the configuration

ADC APIs:

Function Name	ADC_Init()	
API Type	Init	
Parameters (INPUTS)	* ConfigPtr	ADC_ConfigType
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	initialization the ADC module	

Function Name	ADC_Read ()	
API Type	Init	
Parameters (INPUTS)	Channel	ADC_ChannelType
Parameters (OUTPUT)	None	
	E_OK	0
	E_NOK	1
Description	This API to read the value in ADC registers and return it.	

Name	ADC_ChannelType
Type	Uint8_t
Description	This the data of struct including config of ADC

Name	ADC_ConfigType
Type	structure

CAN APIs:

Function Name	CAN_Init()	
API Type	Init	
Parameters (INPUTS)	* ConfigPtr	CAN_ConfigType
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the CAN Module	

for ECU 1 & ECU 2

Function Name	CAN_Baudrate()	
API Type		
Parameters (INPUTS)	Controller	Uint8_t
Baudrate	Uint16_t	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Set the baudrate to CAN Module	

Function Name	CAN_SendData()	
API Type	-	
Parameters (INPUTS)	Data	Uint32_t
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Send the data by the CAN Module	

Function Name	CAN_ReceiveData()	
API Type	Getter	
Parameters (INPUTS)	void	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Receive data from CAN Module	

Name	CAN_ConfigType
Type	structure
Description	This Structure include the configuration set required for initializing the CAN

Door Sensor APIs:

Function Name	DoorSen_Init()	
API Type	Init	
Parameters (INPUTS)	None	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the door sensor module	

Function Name	DoorSen_ReadValue()	
API Type	Getter	
Parameters (INPUTS)	None	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Get the state of door sensor module	

Light Switch APIs:

Function Name	LightSW_Init()	
API Type	Init	
Parameters (INPUTS)	None	
Parameters (OUTPUT)	None	
Return	E_OK	0
E_NOK	1	
Description	Initializes the Light Switch module	

Function Name	LightSW_ReadValue()
API Type	Init
Parameters (INPUTS)	None
Parameters (OUTPUT)	None

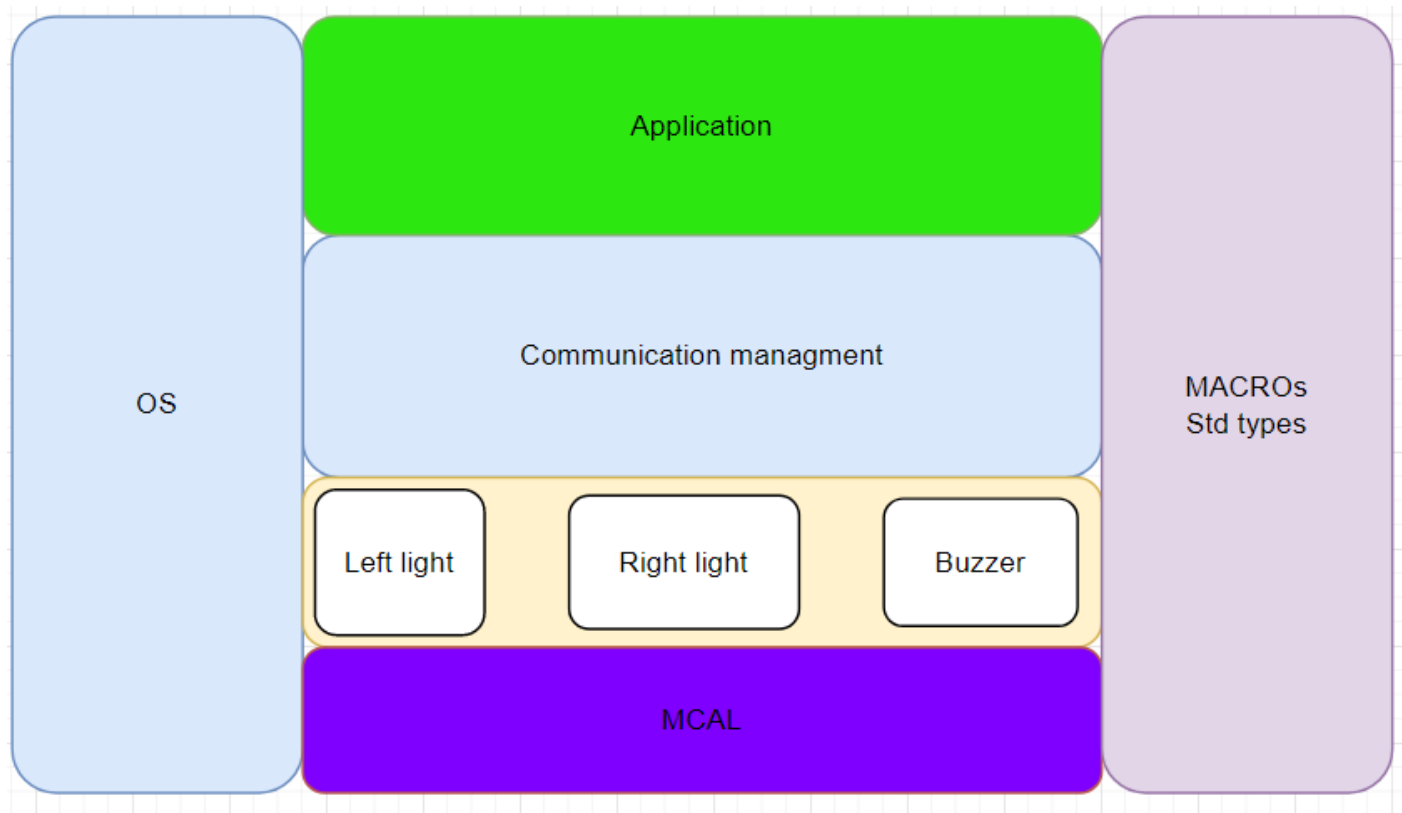
Return	E_OK	0
E_NOK	1	
Description	Get the state of Light Switch module	

Speed Sensor APIs:

Function Name	SpeedSen_Init()	
API Type	Init	
Parameters (INPUTS)	None	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the timer module	

Function Name	SpeedSen_ReadValue()	
API Type	Init	
Parameters (INPUTS)	None	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Get the state of Speed Sensor module	

ECU 2 :-



Light Right(LR) APIs:

Function Name	LR_Init()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the Light Right	

Function Name	LR_ON()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	make Light right on	

Function Name	LR_OFF()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Make Light right off	

Light Left (LL) APIs:

Function Name	LL_Init()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the Light lift	

Function Name	LL_ON()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Make Light lift on	

Function Name	LL_OFF()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Make Light lift off	

Buzzer (B) APIs:

Function Name	Buzzer_Init()	
API Type	Init	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the Buzzer module (make the pin output)	

Function Name	Buzzer_ON()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Turn on the buzzer	

Function Name	Buzzer_OFF()	
API Type	-	
Parameters (INPUTS)	DIO_Port , DIO_Pin	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Turn off the buzzer	