Automatic door control static design

PROJECT 3: ADVANCED EMBEDDED SYSTEMS NANODEGREE

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UDACITY | FWD

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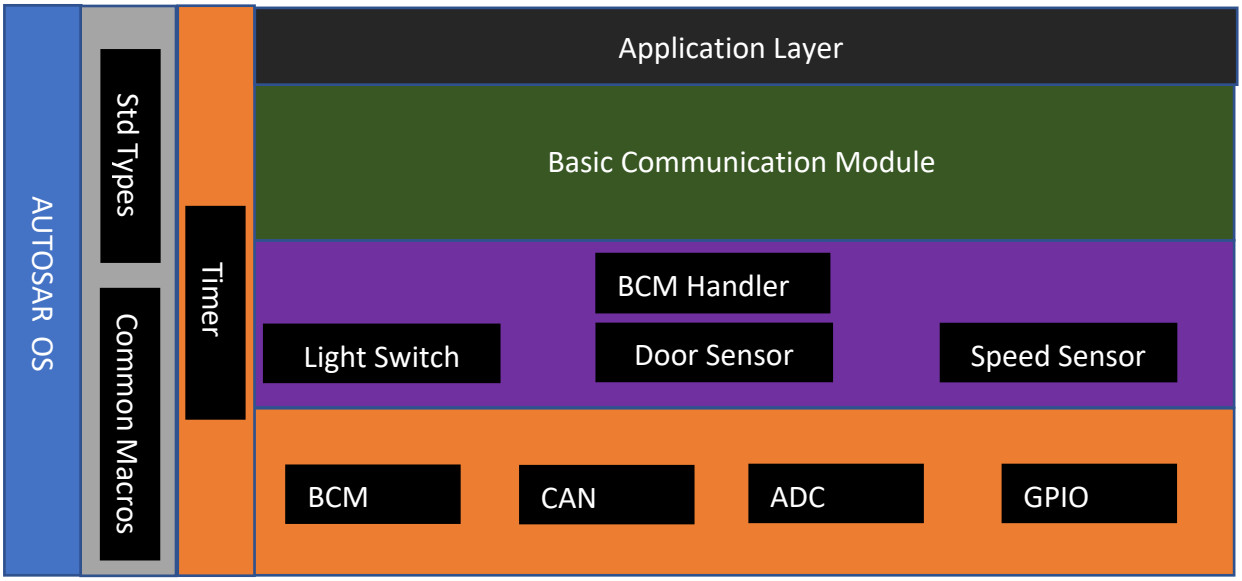


	Application Layer
	Service Layer
	HALL -> On board layer
	HALL-> MCAL Layer
	Library
	Operating System

2- Detailed APIs

1- GPIO

Typedef	PIN_NUM
Type	Enum
Description	This is an enumeration of n+1 members representing pins numbered from 0 to n.
Typedef	PORT_NUM
Type	Enum
Description	Contains the number of the port from 0 to n depending on the type of the microcontroller
Typedef	GPIO_Error
Type	Enum
Description	Contains error types that could happen during setting, reading or writing in a pin or port
Typedef	PIN_DIR
Type	Enum
Description	Contains the pin direction input/Output
Typedef	PIN_Level
Type	Enum
Description	Contains the Level of the pin High/Low
Typedef	PIN_Type
Type	Enum
Description	Contains the pin PULLDOWN/PULLUP
Typedef	PIN_Config
Type	Struct
Description	Contains all the mentioned enumerators in order to initialize the pin

Function Name	GPIO_Pin_init
Arguments	PIN_Config
Return Values	GPIO_Error
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Configures the given pin

Function Name	GPIO_Pin_Read
Arguments	Port_NUM,Pin_Num
Return Values	PIN_Level
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Gets the level of the pin high/Low

Function Name	GPIO_Pin_Write
Arguments	Port_NUM,Pin_Num,PIN_Level
Return Values	void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Writes to a pin high/low

2- Timer

Typedef	Timer_Num
Type	Enum
Description	Contains the names of timers within the microcontroller

Typedef	Timer_Mode
Type	Enum
Description	Contains the modes of the timer ex: overflow and compare moddes

Typedef	Timer_Prescaler
Type	Enum
Description	Contains the Prescaler options available in the microcontroller

Typedef	Timer_ConfigType
Type	Struct
Description	Contains the previous timer enumerations in order to initialize timer

Function Name	Timer_Init
Arguments	Timer_ConfigType
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Asynchronous
Description	1- Sets the required mode 2- Sets the required clock 3- Sets the required timer 4- Set the initial and compare values if needed

Function Name	Timer_DeInit
Arguments	*Timer_ConfigType
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Asynchronous
Description	Disables the required timer

3- CAN

Function Name	CAN_Init
Arguments	*Struct Can_Config
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Asynchronous
Description	Configures the CAN bus

Function Name	CAN_SendMessage
Arguments	Struct message
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Asynchronous
Description	Sends Status message via CAN bus

4- ADC

Typedef	ADC_Channelid
Type	Enum
Description	Contains the desired ADC pin to operate upon

Function Name	ADC_Init
Arguments	Void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Initializes ADC peripheral

Function Name	ADC_Readchannel
Arguments	ADC_channelid
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Gets the ADC value

5- Door sensor

Typedef	Door_State
Type	Enum
Description	This Enum members describes the possible door states: open , closed

Function Name	Door_Sensor_init
Arguments	Port_num,Pin_Num
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Initializes Door sensor pin as input

Function Name	Get_DoorState
Arguments	*DoorState
Return Values	Void
Reentrant/None reentrant	Reentrant
Sync/Async	Synchronous
Description	Stores the door state open/closed in doorstate enum

6- Light Switch

Typedef	Light_State
Type	Enum
Description	This Enum members describes the possible Light states: Pressed, not pressed

Function Name	Light_Switch_init
Arguments	Port_num,Pin_Num
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Initializes Door sensor pin as input

Function Name	GetLightSwitchstate
Arguments	Light_State
Return Values	Void
Reentrant/None reentrant	Reentrant
Sync/Async	Synchronous
Description	Gets the state of the light switch

7- Speed Sensor

Function Name	Speed_Sensor_init
Arguments	Port_num,Pin_Num
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Initializes the speed sensor to send data

Function Name	GetLightSwitchstate
Arguments	*Unsigned char speed
Return Values	Void
Reentrant/None reentrant	Reentrant
Sync/Async	Synchronous
Description	Gets the Speed detected by the speed sensor

8- BCM

Function Name	BCM_Init
Arguments	Struct BCM_init_config
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Configures the communication module communication protocol and speed
Function Name	Send_Message
Arguments	Struct Message
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Sends message to the communication module to be received by another module
Function Name	Receive_message
Arguments	* Struct Message
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Reads the message and stores it in the structure message

9- Application

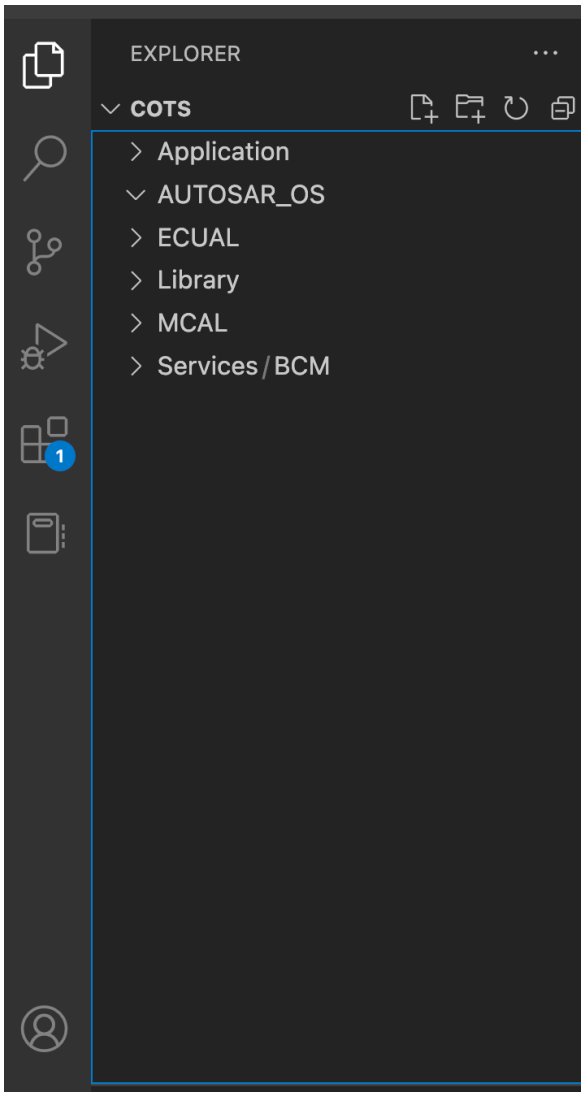
Function Name	App_init
Arguments	Void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Initializes the system modules and creates the system tasks then calls the scheduler before the super loop

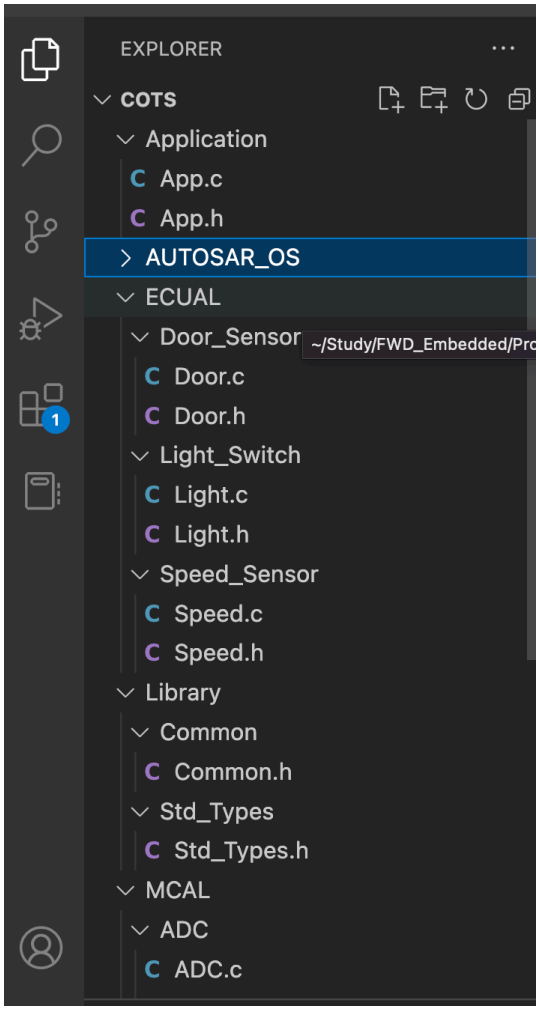
Function Name	Door_Sensor_Task
Arguments	Void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Reads the sensor state every 10ms

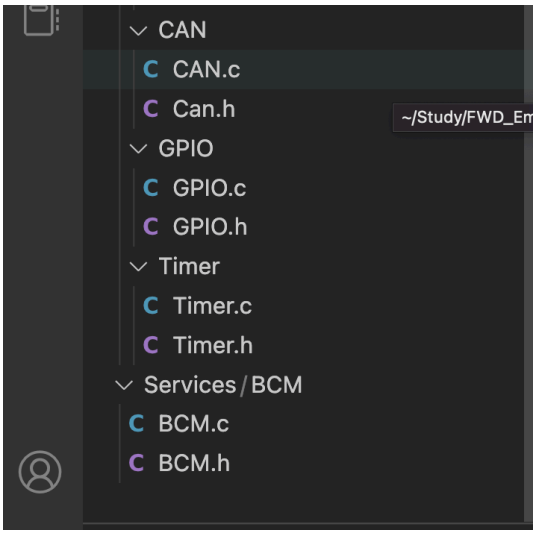
Function Name	Light_Switch_Task
Arguments	Void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Reads the light switch state every 20ms

Function Name	Speed_Sensor_Task
Arguments	Void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Reads the speed sensor value every 5ms

3- Folder structure

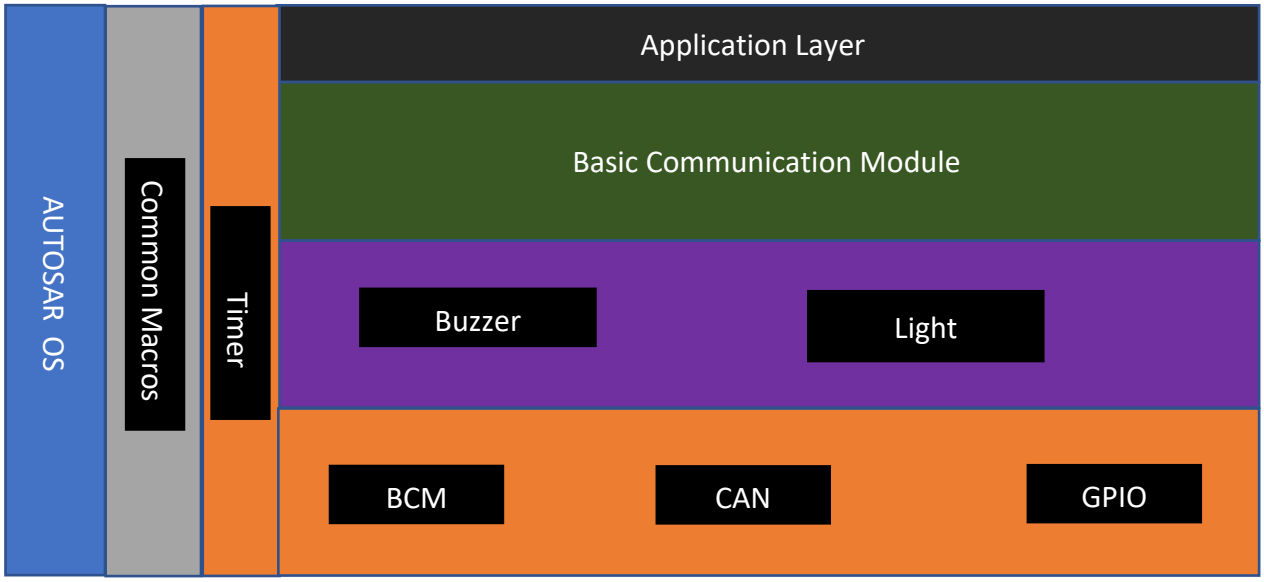






For ECU 2

1- Layered architecture



	Application Layer
	Service Layer
	HALL -> On board layer
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The timer, GPIO, modules are the same as ECU1

2- Detailed APIs

1- BCM

Function Name	BCM_Init
Arguments	*Struct BCM_init_config
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Configures the communication module communication protocol and speed
Function Name	Send_Message
Arguments	*Struct Message
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Sends message to the communication module to be received by another module
Function Name	Receive_message
Arguments	* Struct Message
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Reads the message and stores it in the structure message

2- CAN

Function Name	CAN_Init
Arguments	*Struct Can_Config
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Asynchronous
Description	Configures the CAN bus

Function Name	CAN_ReceiveMessage
Arguments	*Struct message
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Asynchronous
Description	Receive Status message using CAN bus

3- Buzzer

Function Name	InitializeBuzzer
Arguments	Pin_NUM, Port_NUM
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Configure Buzzer pin as output

Function Name	BuzzerControl
Arguments	Pin_Level
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Turn buzzer on or off depending on the door and car status

4- Light

Typedef	Light_Select
Type	Enum
Description	This Enum selects the Left or right Light

Function Name	InitializeLight
Arguments	Light_Select,Pin_Num,Port_NUM
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Configure Light pin as output

Function Name	LightControl
Arguments	Pin_Level,Light_Select
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Turn Light on or off depending on the door and car status

5- Application

Function Name	App_init
Arguments	void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Initializes ECU2 modules and calls app start function

Function Name	App_init
Arguments	void
Return Values	Void
Reentrant/None reentrant	None Reentrant
Sync/Async	Synchronous
Description	Checks the status message and sets each module depending on the received message From ECU1

3- Folder Structure