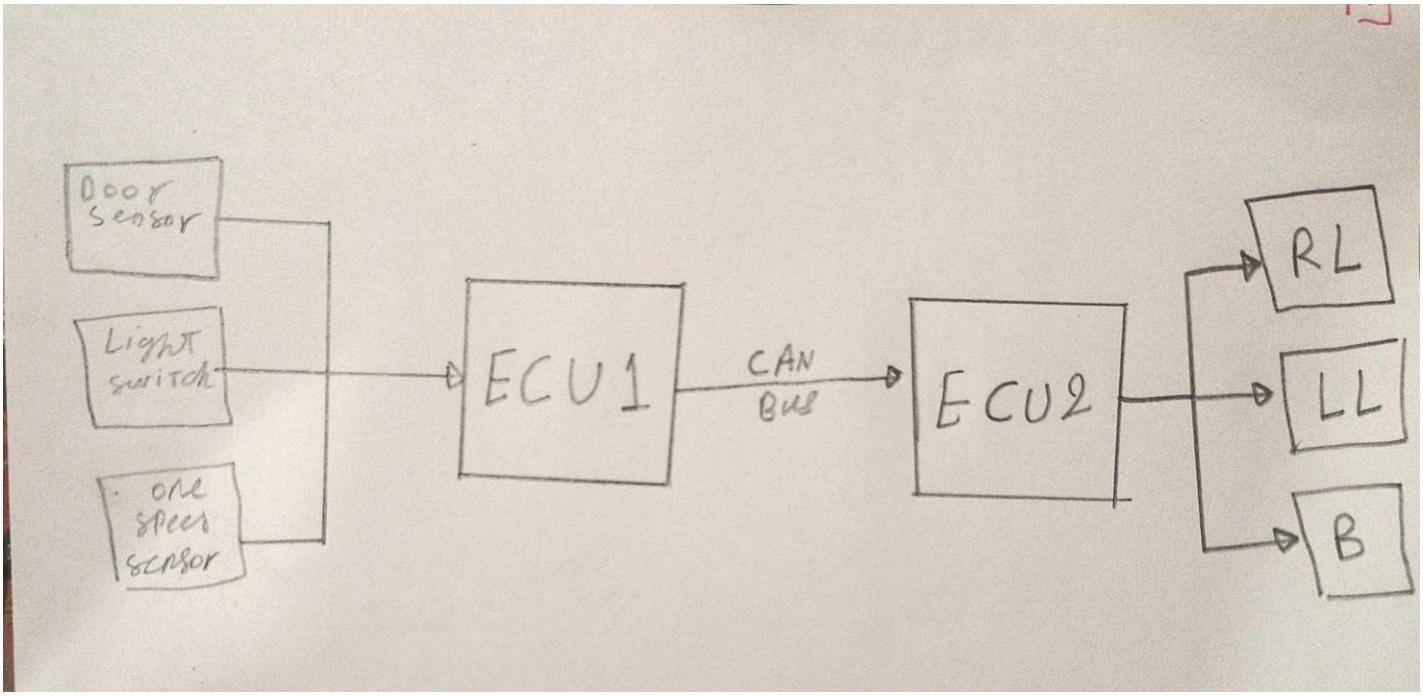
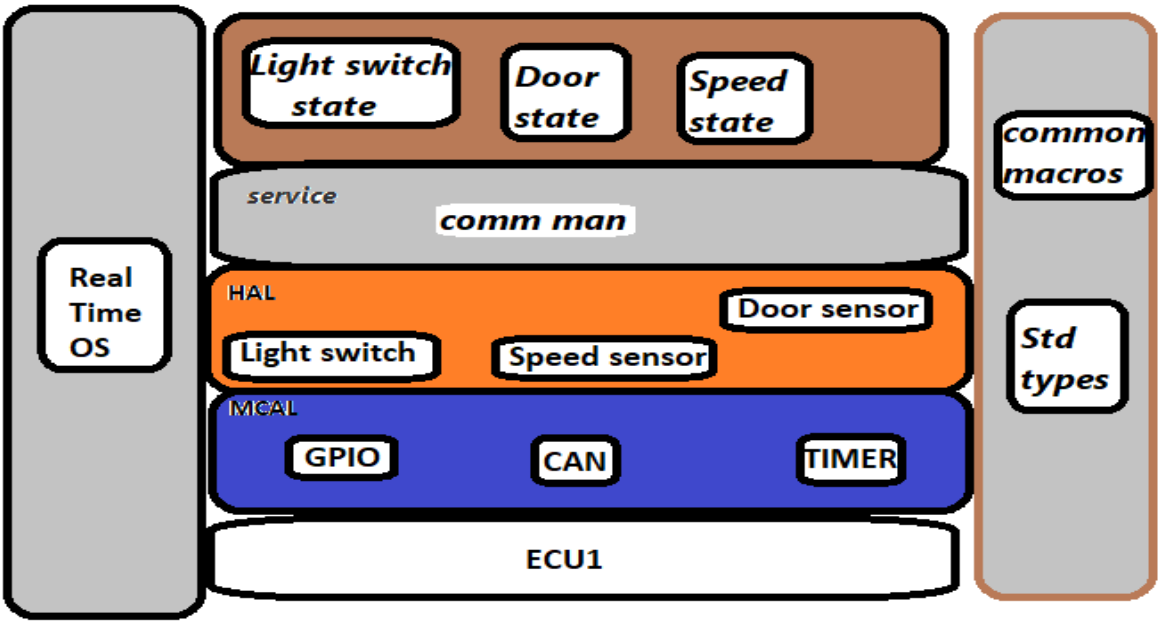
schematic (Block Diagram)



Static Design Analysis

ECU1

1. Make the layered architecture



2. Specify ECU components and modules

A. MCAL layer :

1- GPIO module 2-Timer Module 3- CAN Module

B. HAL layer:

1- Door Module 2-Light Switch Module 3-Speed Sensor

C. Service Layer:

1- comm man (communication manger)

D. App Layer:

1-Door State Module 2-Light Switch state Module 3-Speed Sensor State Module

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3.Provide full detailed APIs for each module as well as a detailed description for the used typedefs

****** MCAL layer ******

1- GPIO

➔ ***init_DIO(Void)***

Name	init_DIO
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	DIO initialization

➔ ***Dio_Write(Dio_port Port , Dio_PinNumber PinNumber , Dio_Level level)***

Name	Dio_Write
Inputs	Port number & pin number & pin state
Return Value	---
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Write in pin

➔ ***Dio_Read (Dio_port Port , Dio_PinNumber PinNumber)***

Name	init_Read
Inputs	Port number & pin number
Return Value	Dio_Level
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Read state of pin

detailed description for the used typedefs

*Typedef Enum{ LOW=0, HIGH=1} Dio_Level; // states of pins

* Typedef char Dio_PinNumber; // (save pin number in 8 bits variables)

*Typedef Enum{PORTA,PORTB,PORTC,PORTD,PORTE,PORTF} Dio_port;

2- CAN

➔ init_CAN(Void)

Name	init_CAN
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	CAN initialization

➔ CAN_transmit (int CAN_Num, char* Data)

Name	CAN_transmit
Inputs	Which channel & data
Return Value	Std_ReturnType
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Transmit using Can

➔ CAN_ Recieve (int CAN_Num)

Name	CAN_ Recieve
Inputs	Which channel
Return Value	Std_ReturnType
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	receive using Can

detailed description for the used typedefs

typedef uint32_t Can_Channel_Num; // which can channel we will use

typedef uint32_t Can_Data; //data sent using can

3- Timer

➔ *init_Timer(Void)*

Name	init_Timer
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Timer initialization

➔ *Timer_Start (Timer_Number Timer_Num, Timer_value Time)*

Name	Timer_Start
Inputs	Timer number & Time
Return Value	---
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Make timer count

➔ *Timer_Stop (Timer_Number Timer_Num)*

Name	Timer_Stop
Inputs	Timer number
Return Value	---
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Make timer stop count

➔ *Timer_GetTime (Timer_Number Timer_Num)*

Name	Timer_GetTime
Inputs	Timer number
Return Value	Timer_value
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Get time now

detailed description for the used typedefs

*Typedef Enum{ T1 = T1PR, T2 = T2PR} Timer_Number;

// choose which timer we will work (timer 1 or timer 2 …)

* Typedef int Timer_Value; // (store the timer value in 32 bits)

**** HAL layer ****

1- Light switch

➔ Init _Light_Switch (void)

Name	Init _Light_Switch
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Light Switch module initialization

➔ Light_Switch_State (void)

Name	Light_Switch_State
Inputs	-----
Return Value	Return state (ON or OFF)
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Check state of light switch if open or close

2- DOOR sensor

➔ Init _DOOR_ sensor (void)

Name	Init _DOOR_ sensor
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Door sensor module initialization

➔ *DOOR_ sensor_State (void)*

Name	*DOOR_ sensor_State*
Inputs	*-----*
Return Value	*Return state (ON or OFF)*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Check state of door if open or close*

3- DOOR sensor

➔ *Init _Speed_Sensor (void)*

Name	*Init _Speed_Sensor*
Inputs	*---*
Return Value	*---*
Reentrant Function ?	*NO*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Speed sensor module initialization*

➔ *Speed_ sensor_State (void)*

Name	*Speed_ sensor_State*
Inputs	*-----*
Return Value	*Return state (1 or 0)*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Check if car moving or not*

***** Service layer *****

1- Comm manger

➔ *init_Comm_mang (void)*

Name	*init_Comm_mang*
Inputs	*---*
Return Value	*---*
Reentrant Function ?	*NO*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Communication manger module initialization*

➔ *Comm_mang_send (char* data)*

Name	*Comm_mang_send*
Inputs	*Pointer to data*
Return Value	*Std_ReturnType*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Transmat data to can protocol*

➔ *Comm_mang_Recieve (void)*

Name	*Comm_mang_Recieve*
Inputs	*---*
Return Value	*Std_ReturnType*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Recieve data to can protocol*

******* App layer *******

➔ *Send_Door_state (char * data)*

Name	*Send_Door_state*
Inputs	*Pointer to data*
Return Value	*Std_ReturnType*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Send door state throw can protocol*

➔ *Read_Door_state (void)*

Name	*Read_Door_state*
Inputs	*Pointer to data*
Return Value	*State(open or close)*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Read door sensor state*

➔ *Send_Speed_Sensor_state (char * data)*

Name	Send_Speed_Sensor_state
Inputs	Pointer to data
Return Value	Std_ReturnType
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Send car state throw can protocol

➔ *Read_Speed_Sensor_state (void)*

Name	Read_Speed_Sensor_state
Inputs	Pointer to data
Return Value	State (moving or not)
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Read speed sensor state

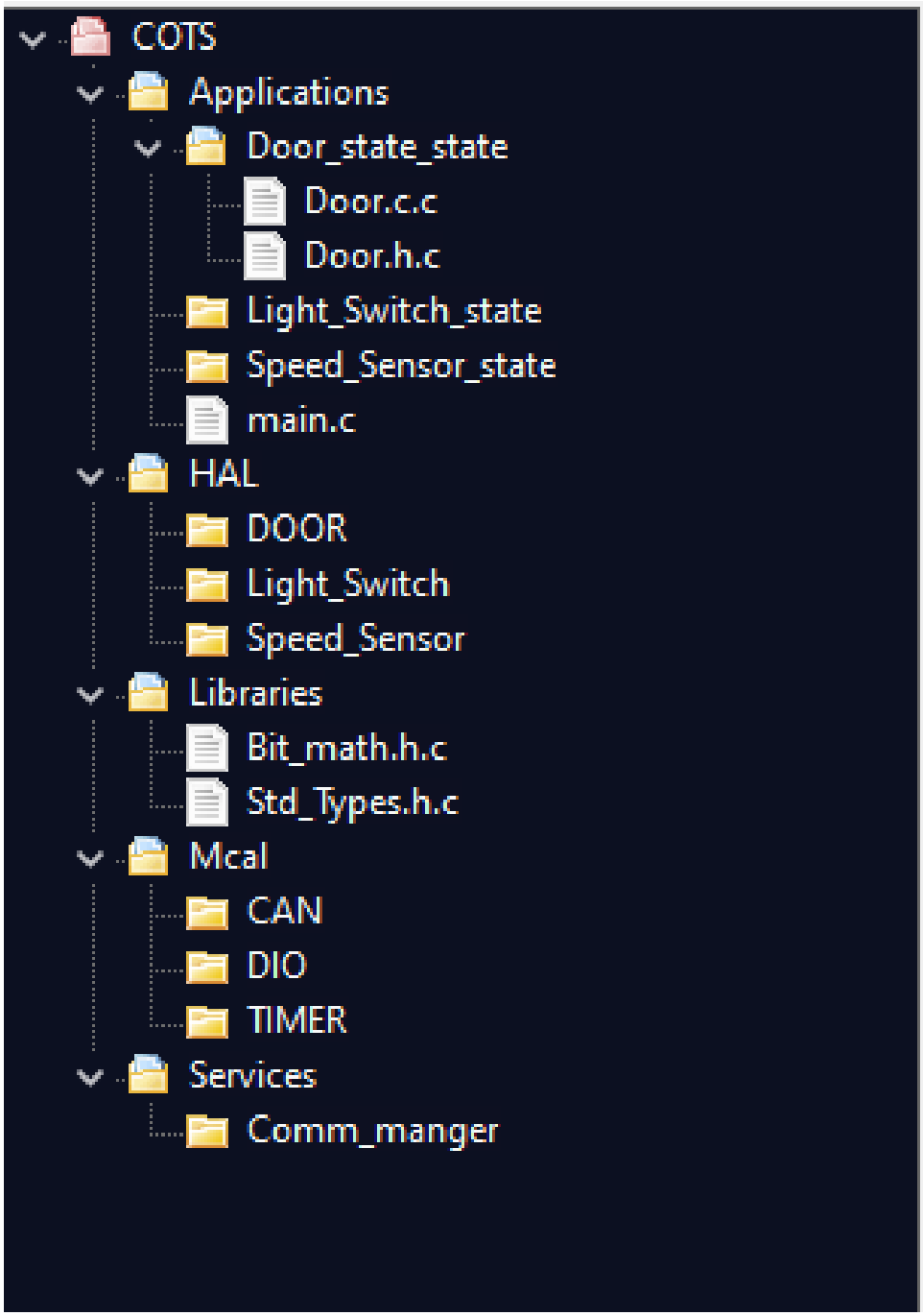
➔ *Send_Light_Switch_state (char * data)*

Name	Send_Light_Switch_state
Inputs	Pointer to data
Return Value	Std_ReturnType
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Send light switch state throw can protocol

➔ *Read_Light_Switch_state (void)*

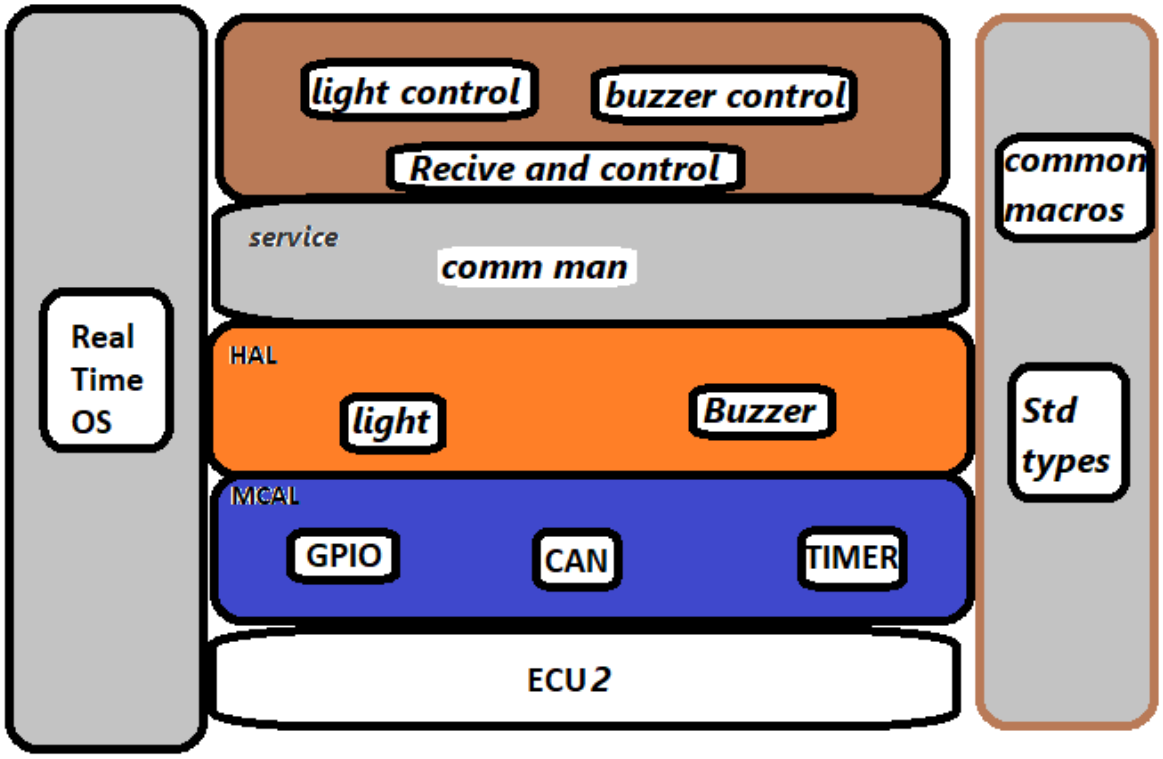
Name	Read_Light_Switch_state
Inputs	Pointer to data
Return Value	State(ON/OFF)
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Read light switch state

4- Prepare your folder structure according to the previous points



ECU2

1. Make the layered architecture



2. Specify ECU2 components and modules

A. MCAL layer :

1- GPIO module 2-Timer Module 3- CAN Module

B. HAL layer:

1- light Module 2- buzzer Module

C. Service Layer:

1- comm man (communication manger)

D. App Layer:

1-light control Module 2-buzzer control Module

3.Provide full detailed APIs for each module as well as a detailed description for the used typedefs

***** MCAL & Service layer in ECU1 and ECU2 are the same***

**** HAL layer ****

1- Light Module

➔ *Init _Light(void)*

Name	Init _Light
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Light module initialization

➔ *Light_* switch *(Light_Dir ID , Light_state mode)*

Name	Light_switch
Inputs	Direction(left or right) & mode(on or off)
Return Value	----
Reentrant Function ?	Yes
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Control light state

typedef Enum{left,right} Light_Dir; //choose left or right light

typedef Enum{Ligth_on,Light_off} Light_state; // state of the light

2- Buzzer Module

➔ *Init _Buzzer (void)*

Name	Init _Buzzer
Inputs	---
Return Value	---
Reentrant Function ?	NO
Synchronous Function ?	Yes
Recursion Function ?	NO
Description	Buzzer module initialization

➔ *Buzzer_switch (buzzer_state mode)*

Name	*Buzzer_switch*
Inputs	*mode(on or off)*
Return Value	*----*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Control buzzer state*

typedef Enum{buzzer_on,buzzer_off} buzzer_state; // state of the buzzer

***** App layer *****

1. Lights control module

➔ *light_control (Light_Dir ID , Light_state mode)*

Name	*light_control*
Inputs	*mode(on or off)/which led*
Return Value	*-----*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Control light mode*

2. Buzzer control module

➔ *Buzzer_control (buzzer_state mode)*

Name	*Buzzer_control*
Inputs	*mode(on or off)*
Return Value	*----*
Reentrant Function ?	*Yes*
Synchronous Function ?	*Yes*
Recursion Function ?	*NO*
Description	*Control buzzer mode*

3. Receive and control module

➔ ***Receive_mode (buzzer_state mode)***

Name	***Receive _control***
Inputs	***Pointer to data***
Return Value	***----***
Reentrant Function ?	***Yes***
Synchronous Function ?	***Yes***
Recursion Function ?	***NO***
Description	***Control buzzer mode***

// this module receive state and choose what changes will happen in system and send messages for light control and buzzer control

4- Prepare your folder structure according to the previous points