UDACITY

Ministry of Communications and Information Technology

egyptfwd

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Automotive Door Control System Design

Part 1

Static Design

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Specify ECU1 components and modules:

For ECU1:

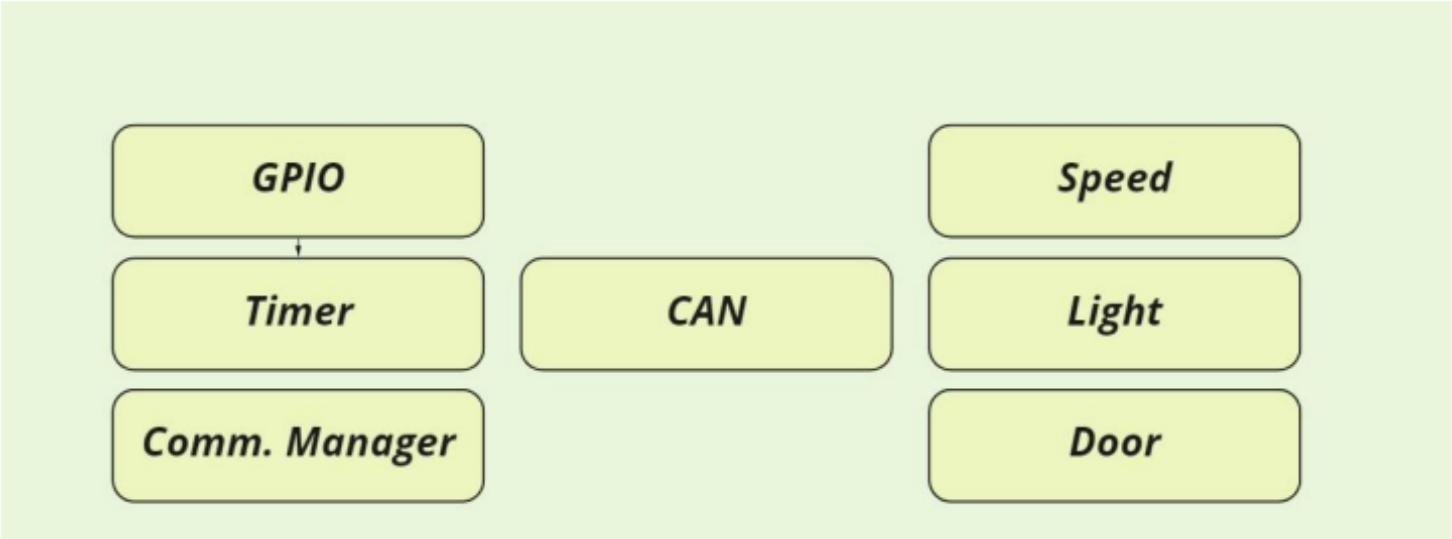


Figure 1- Specify ECU1 components and modules

- **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).**
- **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.**

For ECU2:

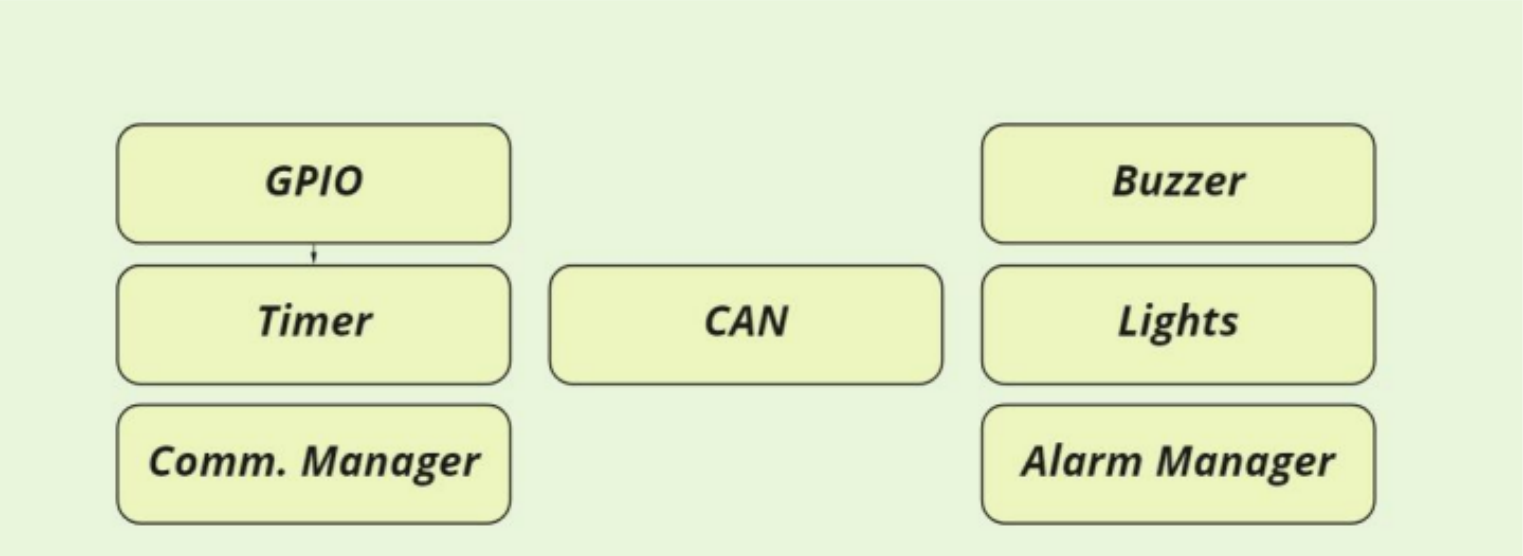
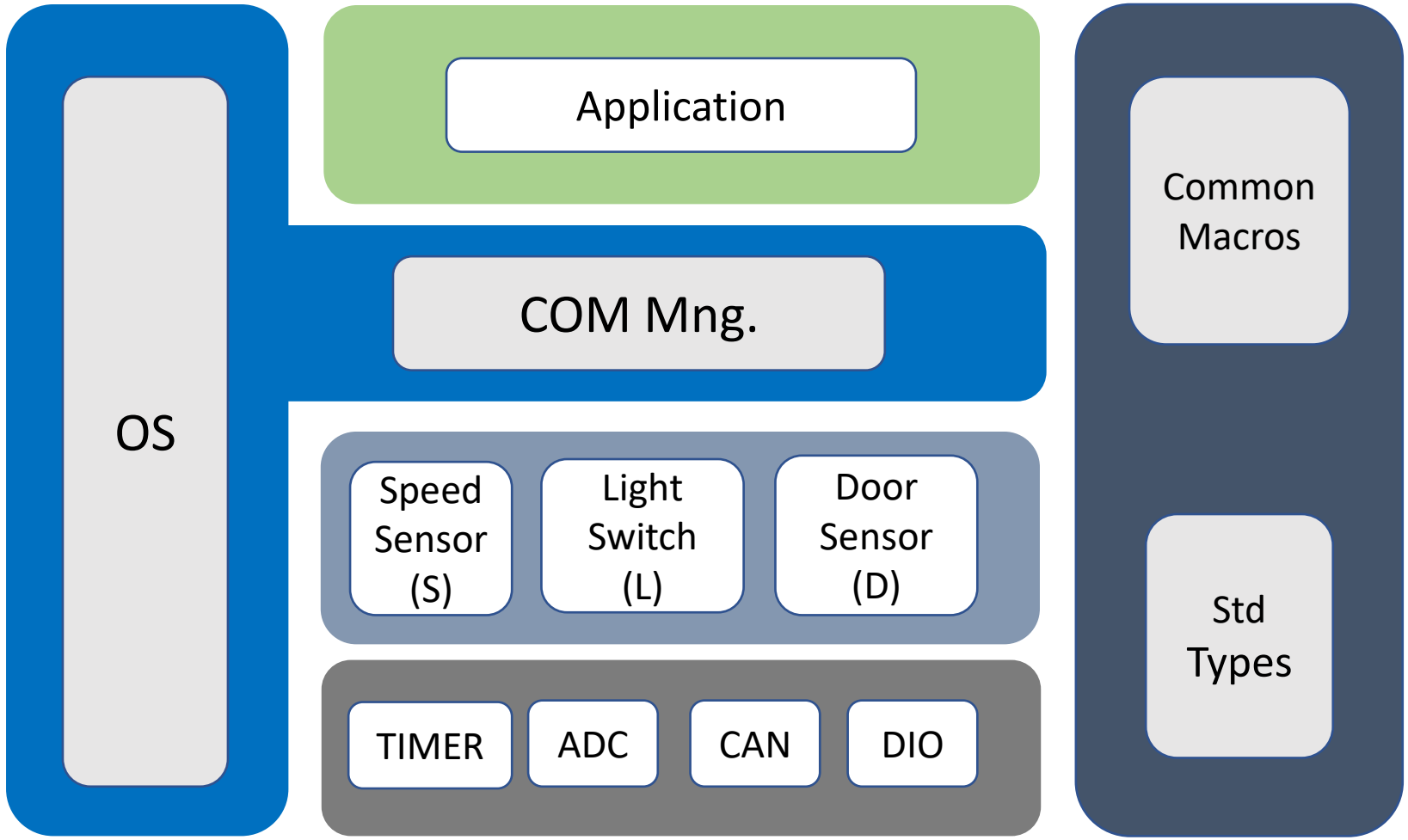


Figure 2- Specify ECU2 components and modules

- **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**


Application
COM Mng.
OS
Speed Sensor (S)
Light Switch (L)
Door Sensor (D)
TIMER
ADC
CAN
DIO
Common Macros
Std Types

ECU 1

DIO APIs: for ECU 1 & ECU 2

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_Channel	
	DIO_PinLevel	
Parameters (OUTPUT)	None	
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: for ECU 1 & ECU 2

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	

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 set required for initializing the timer module

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	
Return	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
Description	

CAN APIs: for ECU 1 & ECU 2

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	

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
Range	
Description	Thie Structure include the configratioin set required for initializaing 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:

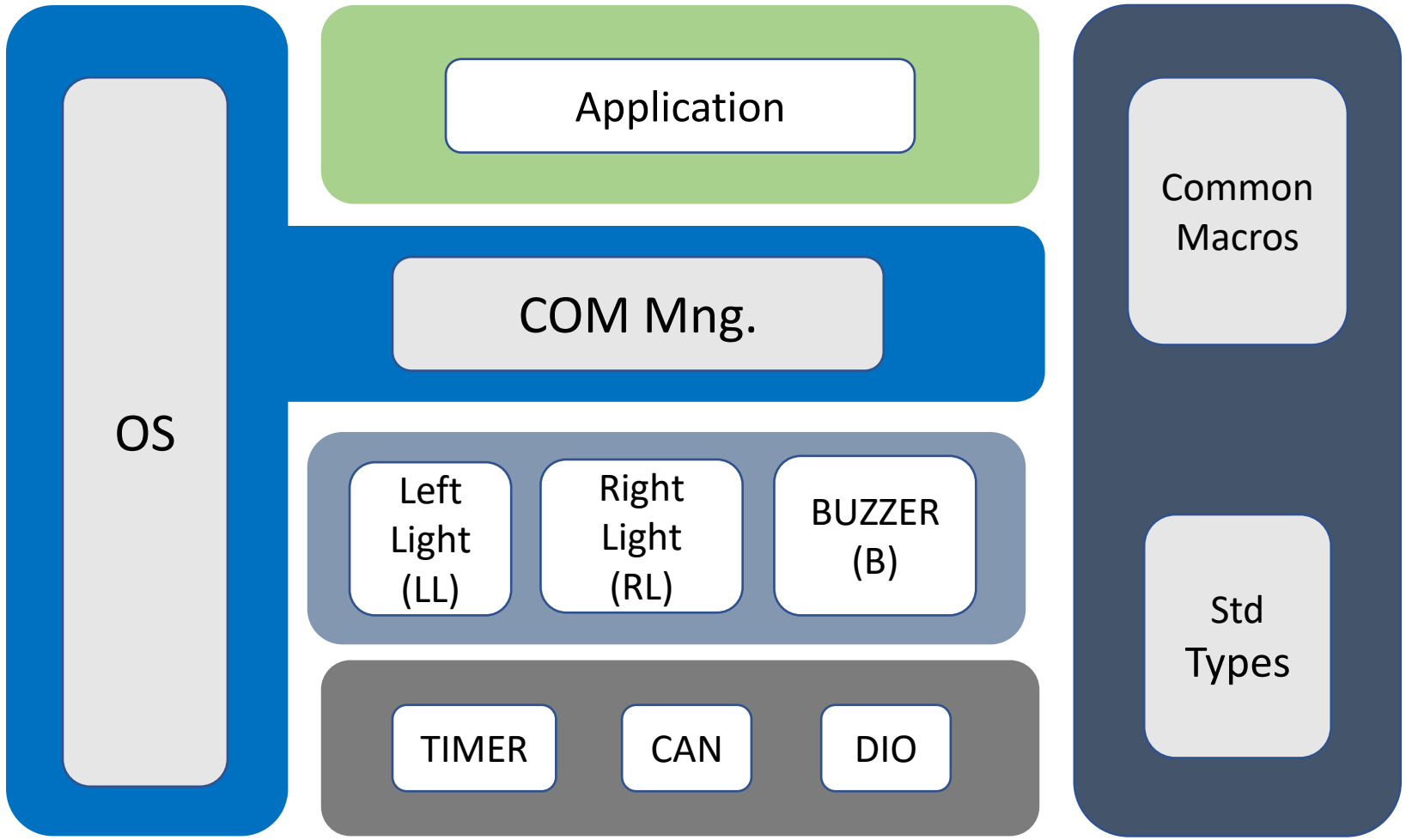
Function Name	LightSW_Init()	
API Type	Init	
Parameters (INPUTS)	None	
Parameters (OUTPUT)	None	
Return	E_OK	0
	E_NOK	1
Description	Initializes the Light Switch module	

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	


Application
COM Mng.
OS
Left Light (LL)
Right Light (RL)
BUZZER (B)
TIMER
CAN
DIO
Common Macros
Std Types

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	