







EGYPFWD Initiative

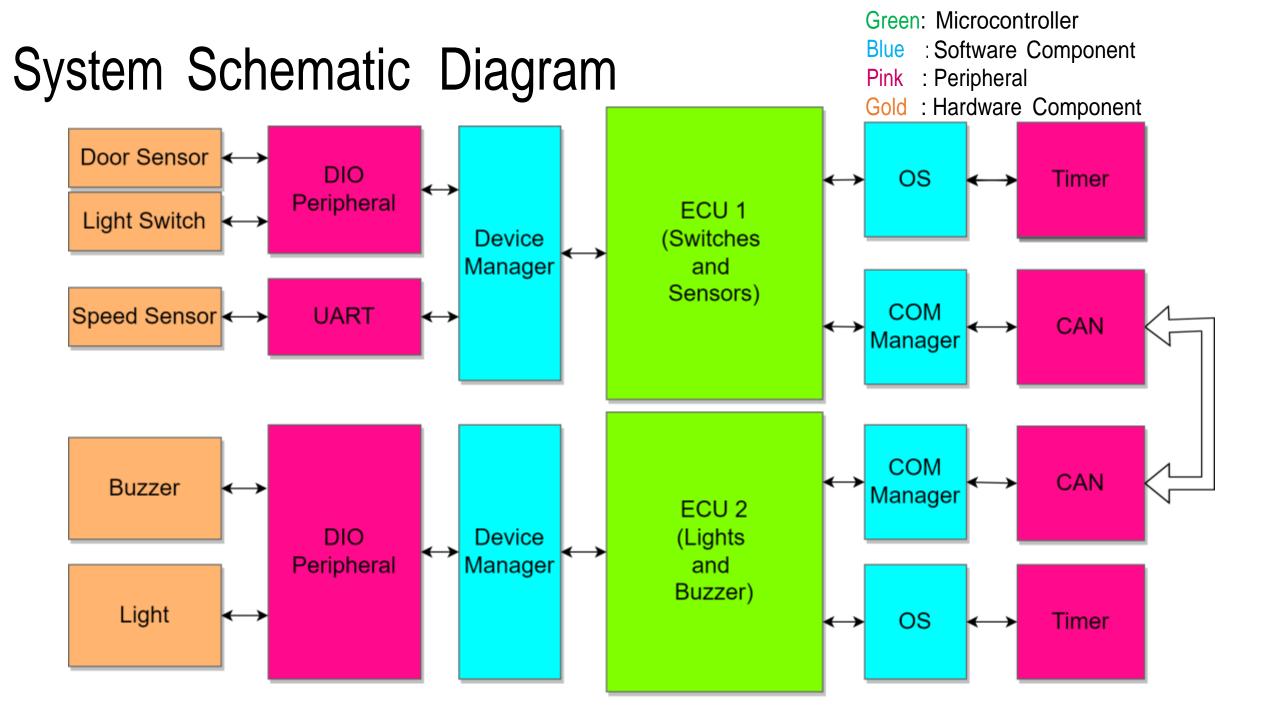
Advanced Embedded Systems Nanodegree, Embedded Software Design Masterclass by SPRINTS Egypt.

Automotive Door Control System Static Design

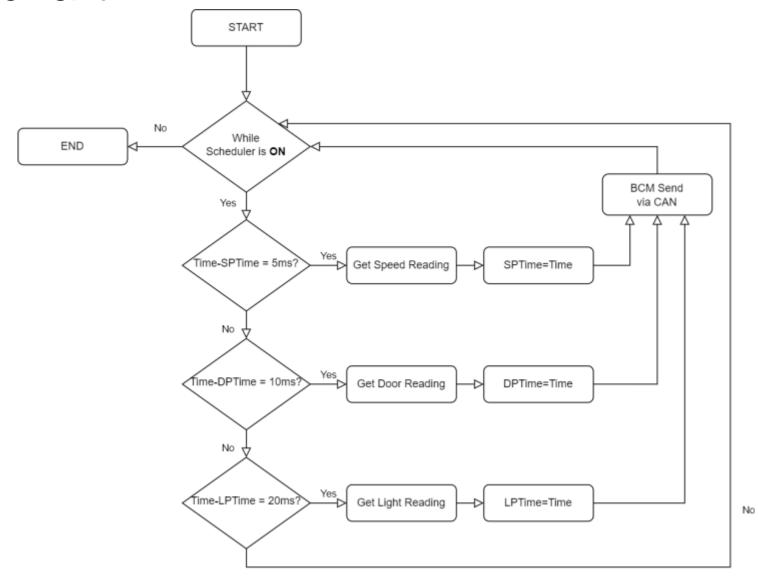
A Graduation Project submitted in partial Fulfillment of Embedded Software Design Masterclass.

Prepared by

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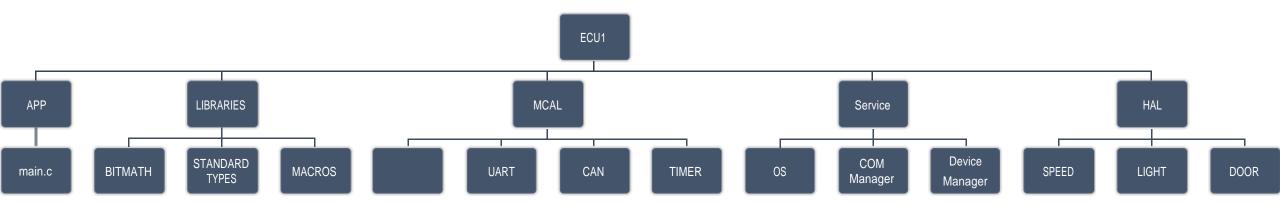
ECU 1 Flowchart



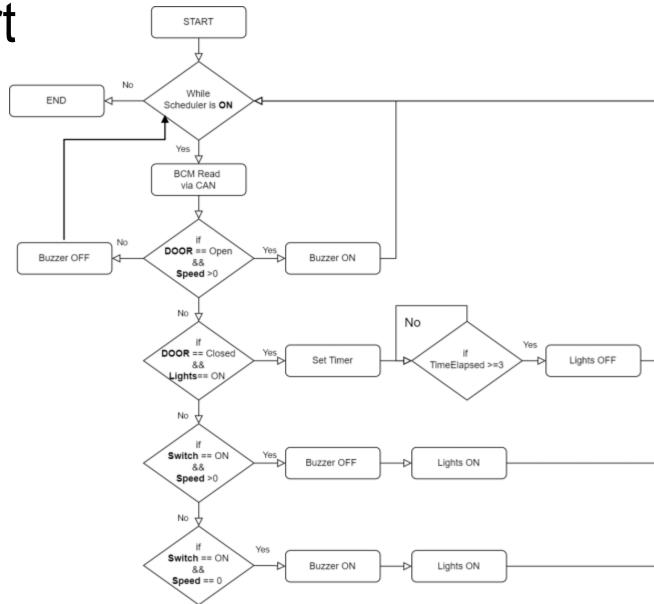
Static Design of ECU 1

Application OS **COM Manager** Device Manager Light Switch Speed Sensor **Door Sensor** Libraries DIO **UART** CAN Timer

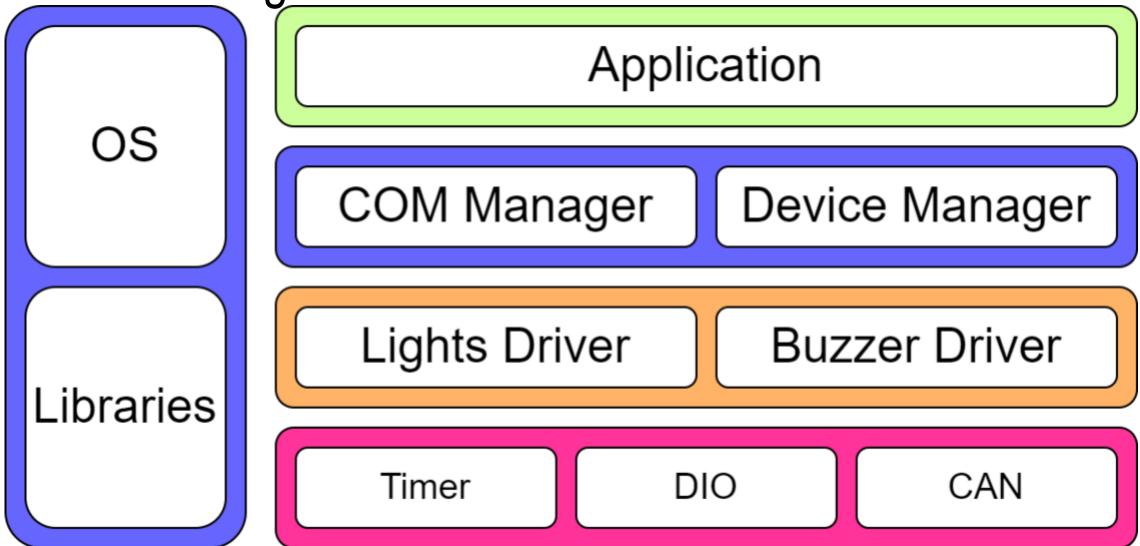
Folder Structure of ECU 1



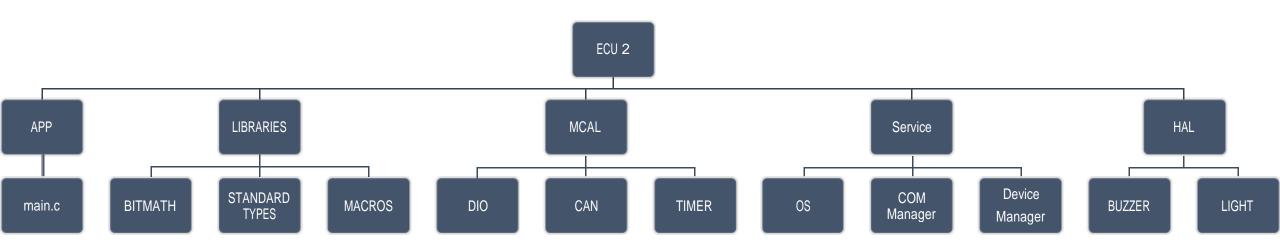
ECU 2 Flowchart



Static Design of ECU 2



Folder Structure of ECU 2



Typedef	Struct TimerCfg_t	Range
Enum	Timer_Mode	Mode_16→Mode_32→Mode_64
Enum	Timer_Number	Timer_0 → Timer_24 (depends on mode)
Enum	Prescaler	Prescaler_8→Prescaler_16
int	Preload	$0\rightarrow 2Timer_Mode$
Typedef	enum ACK_t	ACK_OK ACK_ERROR

API Name	ACK_t xTimer_Init(TimerCfg_t Timer)
Description	Initialize timer peripheral with provided config
Input Parameters	TimerCfg_t
Output Parameters	ACK_t

API Name	ACK_t vTimer_Start(TimerCfg_t Timer)
Description	Start timer
Input Parameters	TimerCfg_t
Output Parameters	ACK_t

API Name	ACK_t vTimer_Stop(TimerClg_t Timer)
Description	Stop timer
Input Parameters	TimerCfg_t
Output Parameters	ACK_t

Typedef	Struct PinCfg_t	RANGE
Enum	Pin_Number	Pin_0 → Pin_43
Enum	Pin_Direction	Pin_Input→ Pin_Output
Enum	Pin_Mode	Pin_High→Pin_Low
Enum	Pin_Special_Function	Pin_*FunctionName*
Typedef	Enum Pin_Status	RANGE
Description	Pin reading value	Pin_High→Pin_Low
Typedef	enum ACK_t AC	K_OK ACK_ERROR

API Name	ACK_t xDio_Init(PinCfg_t Pins[])
Description	Initialize dio peripheral with provided configs
Input Parameters	PinCfg_t["Number of pins"]
Output Parameters	ACK_t

API Name	ACK_t xDio_Set(PinCfg_t Pin)
Description	Set DIO pin high
Input Parameters	PinCfg_t
Output Parameters	ACK_t

API Name	ACK_t xDio_Clear(PinCtg_t Pin)
Description	Un-set DIO pin to low
Input Parameters	PinCfg_t
Output Parameters	ACK_t

API Name	Pin_Status xDio_Get(PinCfg_t Pin)
Description	Get DIO pin status
Input Parameters	PinCfg_t
Output Parameters	Pin_Status

	Typedef	Struct UartCfg_t
Enum	UART_Mode	UART_HW→UART_SW
Enum	Baudrate	9600→115200
Enum	RX_Pin	Pin 0→Pin 43
Enum	TX_Pin	FIII_U→FIII_43
		Typedef Char UA
Description Message string to be used for sending and receiving		
Typedef	enum ACK_t	ACK_OK ACK_ERROR

API Name	ACK_t xUart_Init(UartCfg_t UART)
Description	Initialize UART peripheral with config
Input Parameters	UartCfg_t
Output Parameters	ACK_t

API Name	ACK_txUart_Send(UartCfg_t UART)
Description	Send from UART peripheral
Input Parameters	UartCfg_t
Output Parameters	ACK_t

API Name	ACK_txUart_Receive(UartCfg_t UART)
Description	Receive from UART peripheral
Input Parameters	UartCfg_t
Output Parameters	UART_Msg

Typedef	Struct CANCfg_t	RANGE		
Enum	CAN_Mode	CAN_Mode1→C	AN_ModeX	
Enum	Baudrate	9600→115200		
			Typedef	Char C
Description Message string to be used for sending and receiving				

API Name	ACK_t xCAN_Init(CANCig_t CAN)
Description	Initialize CAN peripheral with config
Input Parameters	CANCfg_t
Output Parameters	ACK_t

API Name	ACK_t xCAN_Send(CANCig_t CAN)
Description	Send data over CANBUS
Input Parameters	CANCfg_t
Output Parameters	ACK_t

API Name	CAN_Msg xCAN_Receive(CANCig_t CAN)
Description	Receive data over CANBUS
Input Parameters	CANCfg_t
Output Parameters	CAN_Msg

Typedef	Struct COM_Device_t	RANGE
Enum	COM_Protocol	CAN/ UART/ I2C
Enum	Channel	Channel_0→Channel_3
char	COM_Msg[]	
Suppose years to date. No the relation to conduct a conduct of the field and a conduct of the field an	enum	The first range are to depart. Not the last control assets a passe of the first agency to describe the first and t

** Number out in date 1% in included and const. a seek of in it is provided to provide and const.	ACK_t COM_Device_t
Description	Initialize a Communication manager
Input Parameters	COM_Device_t
Output Parameters	ACK_t

API Name	ACK_t xCom_Send(COM_Device_t Manager)
Description	Send message using communication manager
Input Parameters	COM_Device_t
Output Parameters	ACK_t

API Name	ACK_t xCom_Receive(COM_Device_t Manager)
Description	Receive message using communication manager
Input Parameters	COM_Device_t
Output Parameters	COM_Device_t

ECU 1&2 APIs : Device Manager

The supplement of the State of the New York State of the	** ** ** ** ** ** ** ** ** ** ** ** **	
	Struct	
Enum	Device_ID	Device_0→Device_2 for ECU1 Device_0→Device 1 for ECU 2
**, Internal contributions of the first tens but bonded, should, or dead, shift for the particular contribution.	Number of the Section	N No Figure 1 (Albert 1 (A
Enum	Interface_Type	UART / DIO
The facilities result in digital. The Bire phone bear monel, result, or stand in the bire is parameter over	The Section of the Se	
char	Device_Msg[]	
X Statement and the Statement	enum	

ECU 1&2 APIs : Device Manager

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	ACK_t Device_t
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Description	Initialize device manager
X having each filed. Not in basis around, count, a seed safe for the process, cryst for a con-	
Input Parameters	Device_t
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Output Parameters	ACK_t

ECU 1&2 APIs : Device Manager

** In facility control digital. ** No limit has been dead, contact of dead of this part in the part in	** This fraggraph flower 1% for the large beautiful price of the state
	ACK_t Device_t
×	
Description	Receive device reading using device manager
To have made a special field in the control of course of states and the field and control of course for the course.	
Input Parameters	Device_t
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Output Parameters	Device_t

ECU 1 APIs : Speed Sensor

* Authorities and specific his increasing count, and add this approximate	Struct	TATA MARIAN AND MARIAN	The first and control delight. The first has been seed associated as the plant of t
Enum	Sensor_Type		Type_UART or Type_I2C
Enum	TX_Pin		Pin_0→Pin_43
Enum	RX_Pin		
** ** ** ** ** ** ** ** ** ** ** ** **	The results of the state of the	Notice of a process of the day of the first	Char
Description		Message string to be used for sendi	ng and receiving
		enum	



ECU 1 APIs : Speed Sensor

** New Construction Space ** No in Industrianal count of Statistics (Construction Construction County Institute	* Third flag points found it to this was been treat product about short this grant to broad the stratum.
	ACK_t SpeedCfg_t
×	
Description	Initialize a speed sensor with the given config
** In this count of the dead of the time below only a send of the first the protection	
Input Parameters	SpeedCfg_t
The billioning part's about To be to be to be to see or own of a find the bill to part bill part bill part billioning.	* This first age must be falser. This has grave most away, a state of the first age and a state of the state
Output Parameters	ACK_t

ECU 1 APIs : Speed Sensor

X Noting and Figure 11 N in his bordered, cross, a pass (or file 12 at 2 per 10 per 10 per 10 per	The final grant of States of the Name States of the
	Speed_Msg SpeedCfg_t
×	×
Description	Get speed reading from sensor
The final countries depend that is the temperature countries and the first and protection of the final countries.	
Input Parameters	SpeedCfg_t
* So becoming month object. So this included money, compact, a deared, shell the first and particular over 10 that find shell and a second financial format financial format financial fin	X Statistical points delicated. The data in the stress of statistic Statistical in the statistic Statistic Statistics Statist
Output Parameters	Speed_Msg

ECU 1 APIs : Light Sensor

Typedef	Struct LightCfg_t	Range
Enum	Sensor_Type	Type_UART / Type_DIO
Enum	Pin	Pin_0→Pin_43
Typedef	Enum Light_Status	
Description	n Light sensor reading	
Typedef	enum ACK_t	ACK_OK ACK_ERROR

ECU 1 APIs: Light Sensor

API Name	ACK_t xLight_Init(LightCfg_t Light)
Description	Initialize a light sensor with the given config
Input Parameters	LightCfg_t
Output Parameters	ACK_t

ECU 1 APIs: Light Sensor

API Name	Light_Status xLight_Read(LightCfg_t Light)
Description	Read a light sensor
Input Parameters	LightCfg_t
Output Parameters	Light_Status

ECU 1 APIs: Door Sensor

Sharman arts date. It is a beautiful along a date of the statement	Struct			
Enum	Sensor_Type		Type_UART / Type_DIO	
Enum	Pin		Pin_0→Pin_43	
**************************************	ethioria.	** ** ** ** ** ** ** ** ** ** ** ** **	Enum	
Description		Door sensor reading		
No. Marriago perio del des No. No. des desta de consultado de No. S. de Septembro.	AVIN AT TIME	enum	*** **********************************	

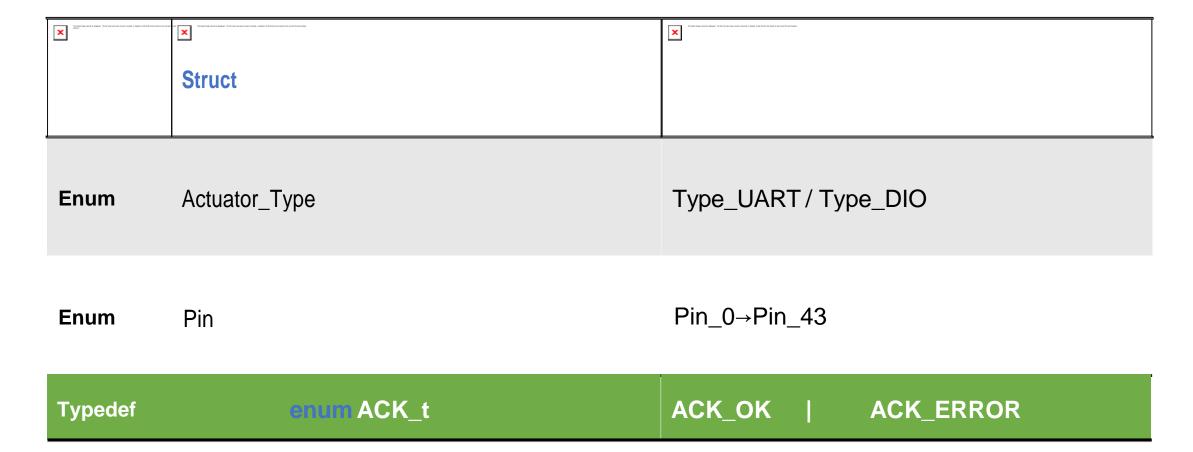
ECU 1 APIs : Door Sensor

** The hardware profess State ** To N. Co. Annotation of content of the Annotation of the Profession of the Profession of the Annotation o	** ** ** ** ** ** ** ** ** ** ** ** **
	ACK_t DoorCfg_t
×	
Description	Initialize a Door sensor with the given config
** The Management of States of The State International Control of States of The States	* ** *** *** *** *** *** *** *** *** *
Input Parameters	DoorCfg_t
As harmony cases a stand. With a laborate residue, a stand, a field in the part has constituted by	Numerous data for the contract of the contract
Output Parameters	ACK_t

ECU 1 APIs : Door Sensor

API Name	Door_Status xDoor_Read(DoorCfg_t Door)
Description	Read a Door sensor
Input Parameters	DoorCfg_t
Output Parameters	Door_Status

ECU 2 APIs : Light Actuator



ECU 2 APIs : Light Actuator

API Name	ACK_t xLight_Init(LightCfg_t LED)
Description	Initialize a Light actuator with the given config
Input Parameters	LightCfg_t
Output Parameters	ACK_t

ECU 2 APIs : Light Actuator

API Name	ACK_t xLight_SetAction(LightCtg_t LED)
Description	Set actuator action
Input Parameters	LightCfg_t
Output Parameters	ACK_t

ECU 2 APIs: Buzzer Actuator

Typedef	Struct BuzzerCfg_t	RANGE
Enum	Actuator_Type	Type_UART / Type_DIO
Enum	Pin	Pin_0→Pin_43

Typedef enum ACK_t	ACK_OK ACK_ERROR
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ECU 2 APIs: Buzzer Actuator

API Name	ACK_t Buzzer_Init(BuzzerCig_t Buzzer)
Description	Initialize a Buzzer actuator with the given config
Input Parameters	BuzzerCfg_t
Output Parameters	ACK_t

ECU 2 APIs: Buzzer Actuator

API Name	ACK_t xBuzzer_SetAction(BuzzerCig_t Buzzer)
Description	Set actuator action
Input Parameters	BuzzerCfg_t
Output Parameters	ACK_t