EGYP**FWD** 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

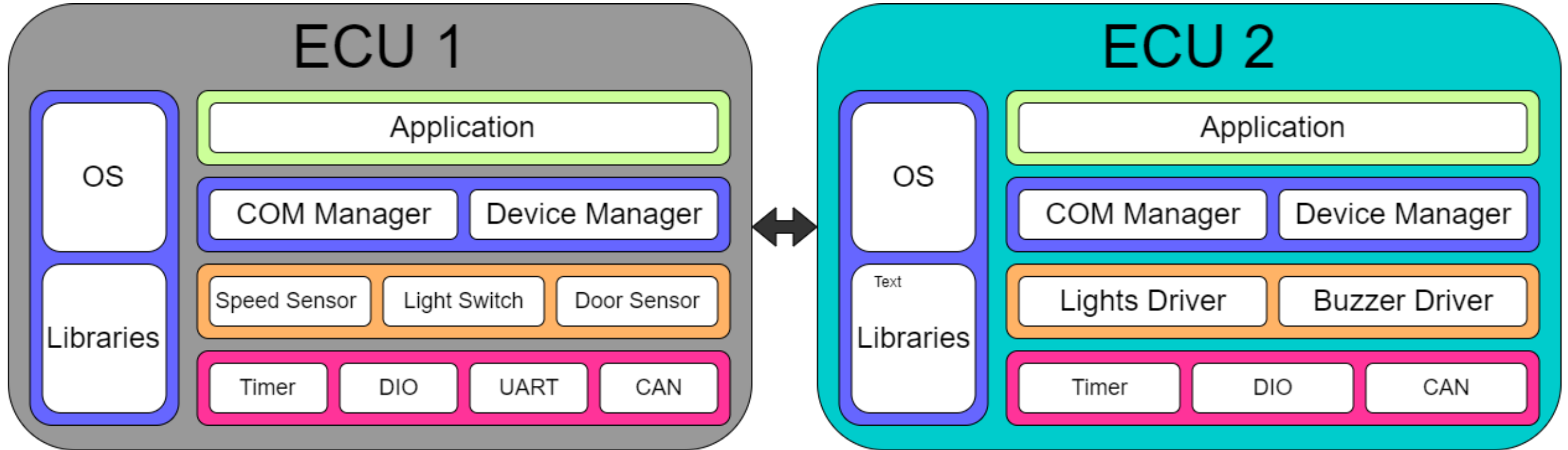**Embedded Software Design Masterclass.**

Prepared by

Yahia Emad Ahmed Derbala
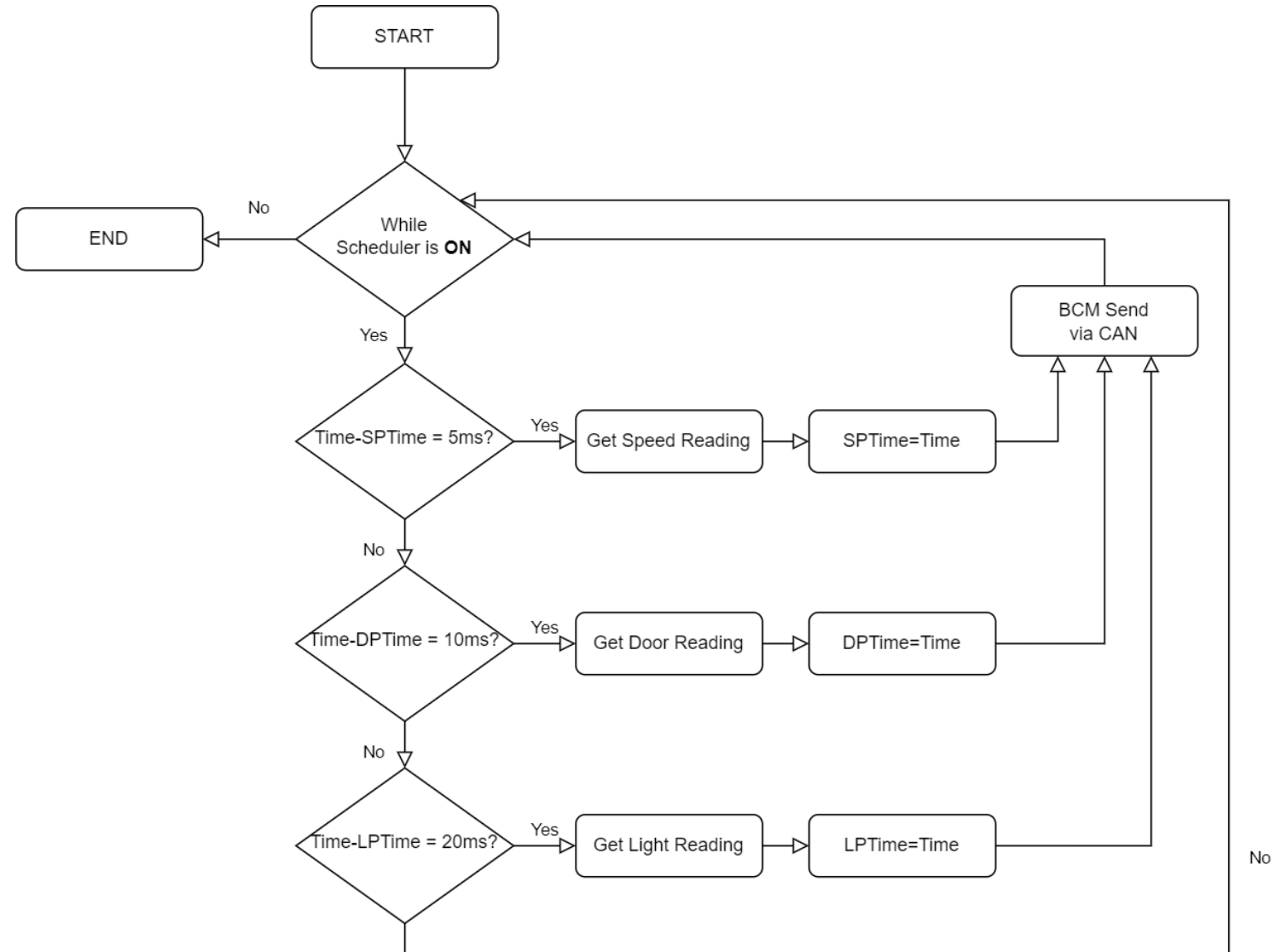
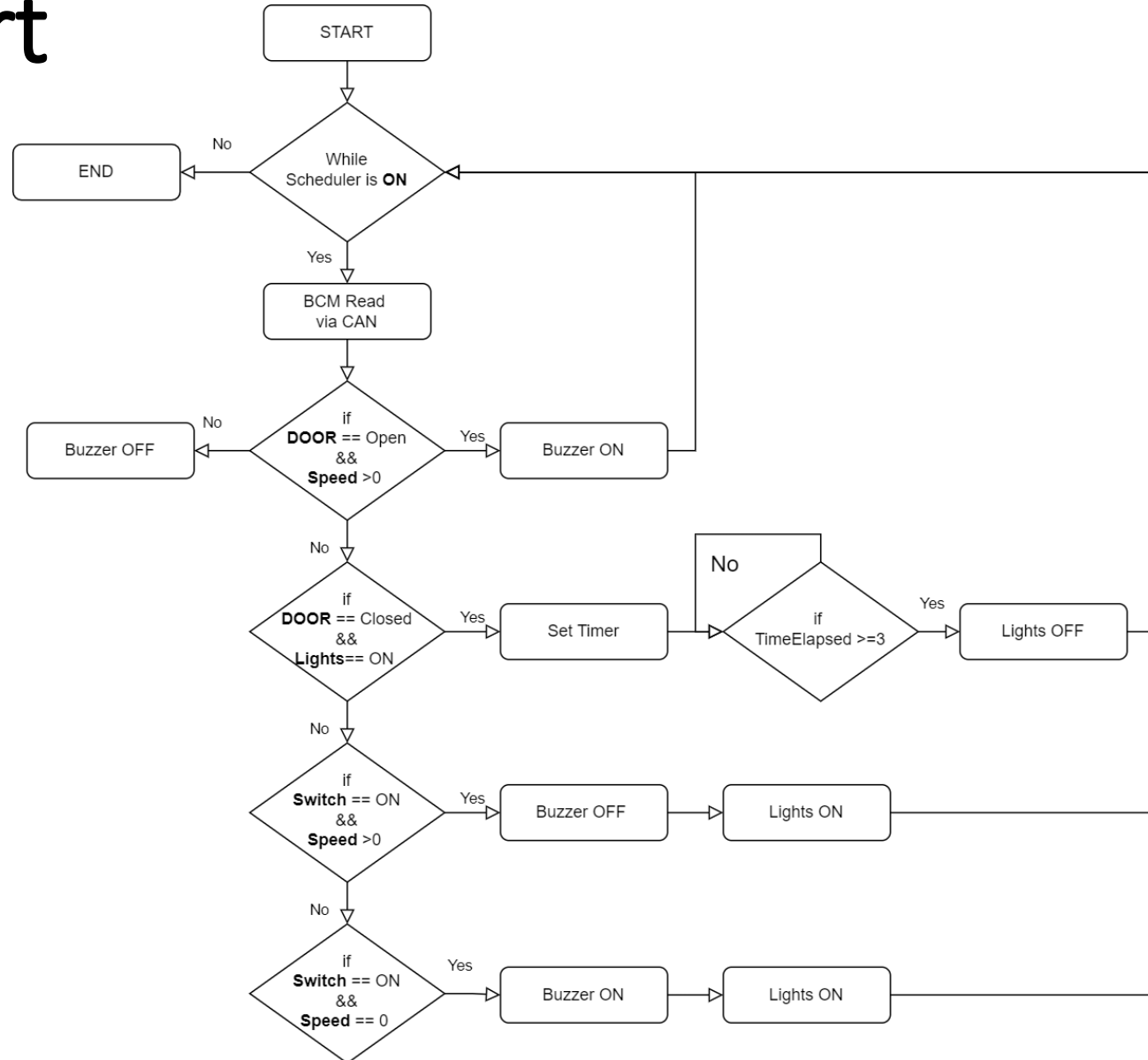yahderbala@gmail.com

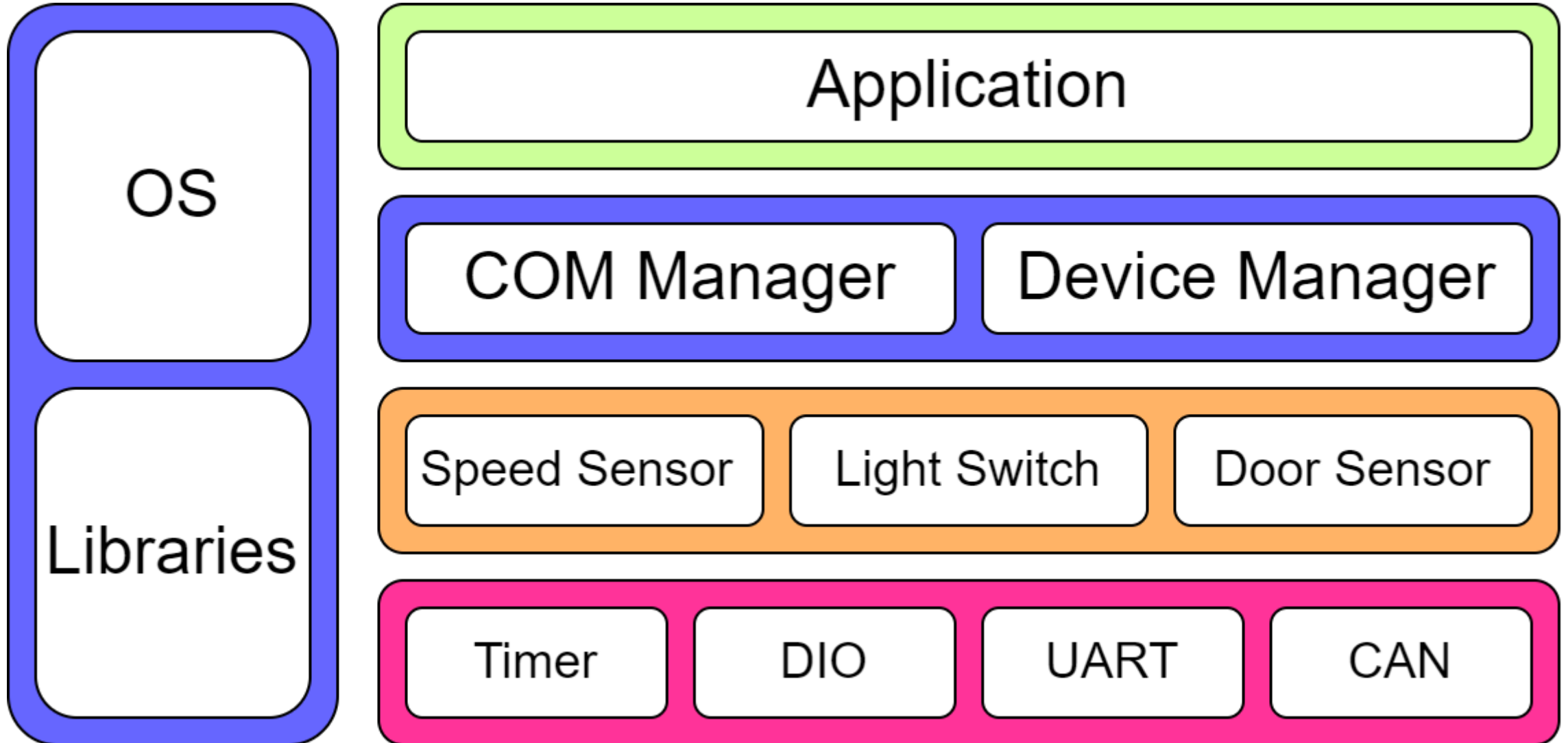LinkedIn

Github

System Schematic Diagram

ECU 1 Flowchart

ECU 2 Flowchart

Static Design of ECU 1

ECU 1 APIs : DIO

Typedef	Struct TimerCfg_t
Enum	Timer_Number
Enum	Timer_Mode
Enum	Prescaler
int	Preload

ECU 1 APIs : Timer

API Name	vTimer_Init()
Description	Initialize timer peripheral with provided config
Input Parameters	TimerCfg_t
Output Parameters	None

ECU 1 APIs : Timer

API Name	vTimer_Start()
Description	Start timer
Input Parameters	TimerCfg_t
Output Parameters	None

ECU 1 APIs : Timer

API Name	vTimer_Stop()
Description	Stop timer
Input Parameters	TimerCfg_t
Output Parameters	None

ECU 1 APIs : DIO

Typedef	Struct PinCfg_t
Enum	Pin_Number
Enum	Pin_Direction
Enum	Pin_Mode
Enum	Pin_Special_Function

Typedef	Enum Pin_Status
Description	Pin reading value

ECU 1 APIs : DIO

API Name	vDio_Init()
Description	Initialize dio peripheral with provided configs
Input Parameters	PinCfg_t["Number of pins"]
Output Parameters	None

ECU 1 APIs : DIO

API Name	vDio_Set()
Description	Set DIO pin high
Input Parameters	PinCfg_t
Output Parameters	None

ECU 1 APIs : DIO

API Name	vDio_Clear()
Description	Un-set DIO pin to low
Input Parameters	PinCfg_t
Output Parameters	None
Reentrancy	Non-Reentrant

ECU 1 APIs : DIO

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

ECU 1 APIs : UART

Typedef	Struct UartCfg_t
Enum	UART_Mode
Enum	Baudrate
Enum	RX_Pin
Enum	TX_Pin
Typedef	Char UART_Msg[]
Description	Message string to be used for sending and receiving

ECU 1 APIs : UART

API Name	vUart_Init()
Description	Initialize UART peripheral with config
Input Parameters	UartCfg_t
Output Parameters	None

ECU 1 APIs : UART

API Name	vUart_Send()
Description	Send from UART peripheral
Input Parameters	UartCfg_t
Output Parameters	None

ECU 1 APIs : UART

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

ECU 1 APIs : CAN

Typedef	Struct CANCfg_t
Enum	CAN_Mode
Enum	Baudrate
Typedef	Char CAN_Msg[]
Description	Message string to be used for sending and receiving

ECU 1 APIs : CAN

API Name	vCAN_Init()
Description	Initialize CAN peripheral with config
Input Parameters	CANCfg_t
Output Parameters	None

ECU 1 APIs : CAN

API Name	vCAN_Send()
Description	Send data over CANBUS
Input Parameters	CANCfg_t
Output Parameters	None

ECU 1 APIs : CAN

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

ECU 1 APIs : Speed Sensor

Typedef	Struct SpeedCfg_t
Enum	Sensor_Type
Enum	TX_Pin
Enum	RX_Pin
Typedef	Char Speed_Msg[]
Description	Message string to be used for sending and receiving

ECU 1 APIs : Speed Sensor

API Name	vSpeed_Init()
Description	Initialize a speed sensor with the given config
Input Parameters	SpeedCfg_t
Output Parameters	None

ECU 1 APIs : Speed Sensor

API Name	xSpeed_GetReading()
Description	Get speed reading from sensor
Input Parameters	SpeedCfg_t
Output Parameters	Speed_Msg

ECU 1 APIs : Light Sensor

Typedef	Struct LightCfg_t
Enum	Sensor_Type
Enum	Pin

Typedef	Enum Light_Status
Description	Light sensor reading

ECU 1 APIs : Light Sensor

API Name	vLight_Init()
Description	Initialize a light sensor with the given config
Input Parameters	LightCfg_t
Output Parameters	None

ECU 1 APIs : Light Sensor

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

ECU 1 APIs : Door Sensor

Typedef	Struct DoorCfg_t
Enum	Sensor_Type
Enum	Pin

Typedef	Enum Door_Status
Description	Door sensor reading

ECU 1 APIs : Door Sensor

API Name	vDoor_Init()
Description	Initialize a Door sensor with the given config
Input Parameters	DoorCfg_t
Output Parameters	None

ECU 1 APIs : Door Sensor

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

ECU 1 APIs : COM Manager

Typedef	Struct COM_Device_t
Enum	COM_Protocol
Enum	Channel
char	COM_Msg[]

ECU 1 APIs : COM Manager

API Name	vCom_Init()
Description	Initialize a Communication manager
Input Parameters	COM_Device_t
Output Parameters	None

ECU 1 APIs : COM Manager

API Name	vCom_Send()
Description	Send message using communication manager
Input Parameters	COM_Device_t
Output Parameters	None

ECU 1 APIs : COM Manager

API Name	vCom_Receive()
Description	Receive message using communication manager
Input Parameters	COM_Device_t
Output Parameters	COM_Device_t

ECU 1 APIs : Device Manager

| Typedef	Struct Device_t
Enum	Device_ID
Enum	Interface_Type
char	Device_Msg[]

ECU 1 APIs : Device Manager

API Name	vDevice_Init()
Description	Initialize device manager
Input Parameters	Device_t
Output Parameters	None

ECU 1 APIs : Device Manager

API Name	vCom_Receive()
Description	Receive device reading using device manager
Input Parameters	Device_t
Output Parameters	Device_t

Static Design of ECU 2
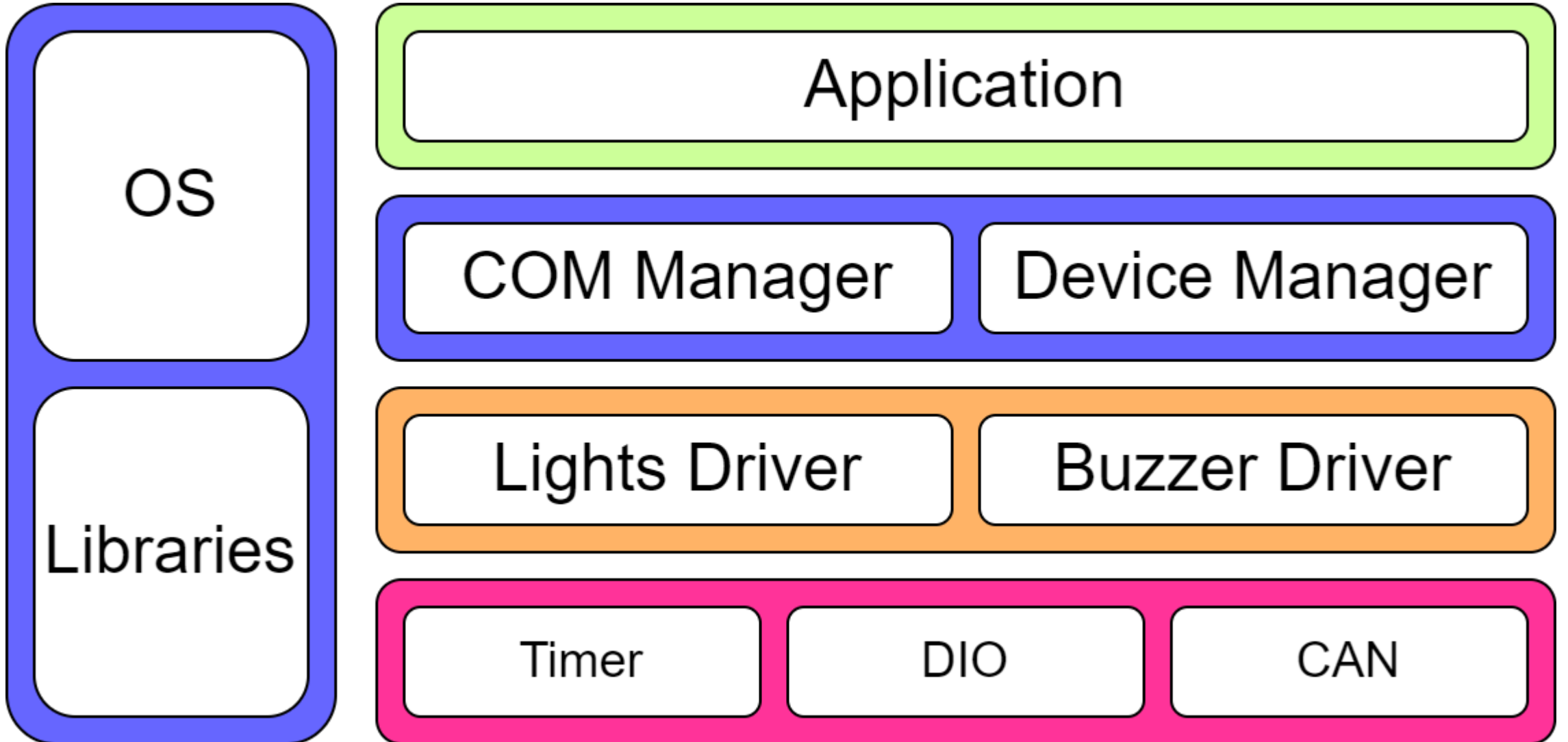
ECU 2 APIs : DIO

Typedef	Struct TimerCfg_t
Enum	Timer_Number
Enum	Timer_Mode
Enum	Prescaler
int	Preload

ECU 2 APIs : Timer

API Name	vTimer_Init()
Description	Initialize timer peripheral with provided config
Input Parameters	TimerCfg_t
Output Parameters	None

ECU 2 APIs : Timer

API Name	vTimer_Start()
Description	Start timer
Input Parameters	TimerCfg_t
Output Parameters	None

ECU 2 APIs : Timer

API Name	vTimer_Stop()
Description	Stop timer
Input Parameters	TimerCfg_t
Output Parameters	None

ECU 2 APIs : DIO

Typedef	Struct PinCfg_t
Enum	Pin_Number
Enum	Pin_Direction
Enum	Pin_Mode
Enum	Pin_Special_Function

Typedef	Enum Pin_Status
Description	Pin reading value

ECU 2 APIs : DIO

API Name	vDio_Init()
Description	Initialize dio peripheral with provided configs
Input Parameters	PinCfg_t["Number of pins"]
Output Parameters	None

ECU 2 APIs : DIO

API Name	vDio_Set()
Description	Set DIO pin high
Input Parameters	PinCfg_t
Output Parameters	None

ECU 2 APIs : DIO

API Name	vDio_Clear()
Description	Un-set DIO pin to low
Input Parameters	PinCfg_t
Output Parameters	None
Reentrancy	Non-Reentrant

ECU 2 APIs : DIO

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

ECU 2 APIs : CAN

Typedef	Struct CANCfg_t
Enum	CAN_Mode
Enum	Baudrate
Typedef	Char CAN_Msg[]
Description	Message string to be used for sending and receiving

ECU 2 APIs : CAN

API Name	vCAN_Init()
Description	Initialize CAN peripheral with config
Input Parameters	CANCfg_t
Output Parameters	None

ECU 2 APIs : CAN

API Name	vCAN_Send()
Description	Send data over CANBUS
Input Parameters	CANCfg_t
Output Parameters	None

ECU 2 APIs : CAN

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

ECU 2 APIs : Light Actuator

Typedef	**Struct** LightCfg_t
Enum	Actuator_Type
Enum	Pin

ECU 2 APIs : Light Sensor

API Name	vLight_Init()
Description	Initialize a Light actuator with the given config
Input Parameters	LightCfg_t
Output Parameters	None

ECU 2 APIs : Light Actuator

API Name	xLight_SetAction()
Description	Set actuator action
Input Parameters	LightCfg_t
Output Parameters	None

ECU 2 APIs : Buzzer Actuator

Typedef	**Struct BuzzerCfg_t**
Enum	Actuator_Type
Enum	Pin

ECU 2 APIs : Buzzer Sensor

API Name	vBuzzer_Init()
Description	Initialize a Buzzer actuator with the given config
Input Parameters	BuzzerCfg_t
Output Parameters	None

ECU 2 APIs : Buzzer Actuator

API Name	xBuzzer_SetAction()
Description	Set actuator action
Input Parameters	BuzzerCfg_t
Output Parameters	None

ECU 2 APIs : COM Manager

Typedef	Struct COM_Device_t	
Enum	COM_Protocol	
Enum	Channel	
char	COM_Msg[]	

ECU 2 APIs : COM Manager

API Name	vCom_Init()
Description	Initialize a Communication manager
Input Parameters	COM_Device_t
Output Parameters	None

ECU 2 APIs : COM Manager

API Name	vCom_Send()
Description	Send message using communication manager
Input Parameters	COM_Device_t
Output Parameters	None

ECU 2 APIs : COM Manager

API Name	vCom_Receive()
Description	Receive message using communication manager
Input Parameters	COM_Device_t
Output Parameters	COM_Device_t

ECU 2 APIs : Device Manager

Typedef	Struct Device_t
Enum	Device_ID
Enum	Interface_Type
Enum	Device_Action

ECU 2 APIs : Device Manager

API Name	vDevice_Init()
Description	Initialize device manager
Input Parameters	Device_t
Output Parameters	None

ECU 2 APIs : Device Manager

API Name	vCom_Send()
Description	Send device action using device manager
Input Parameters	Device_t
Output Parameters	Device_t