Ministry of Communications and Information Technology

egypt fwd initiative

مستقبلنا رقمي

UDACITY

# *Embedded Systems Advanced Nanodegree Program*

## Automotive Door Control System Design (Static Design)

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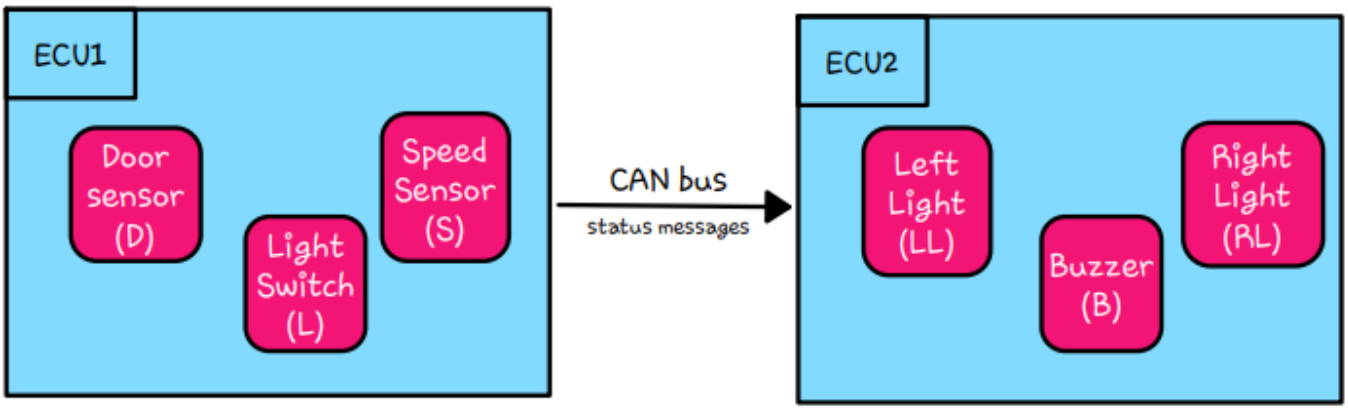
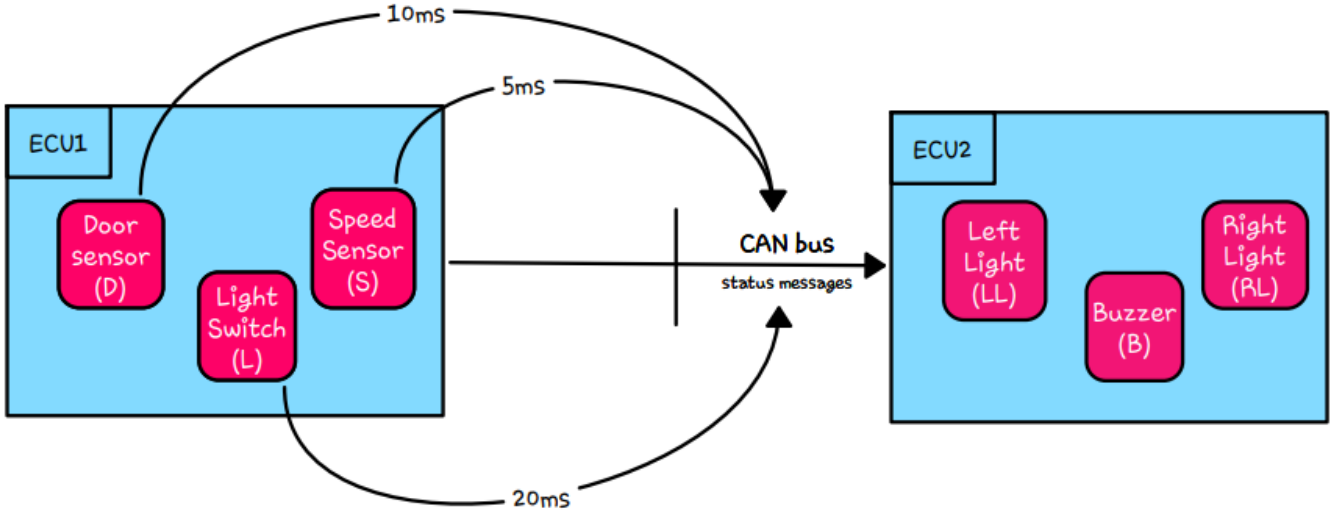
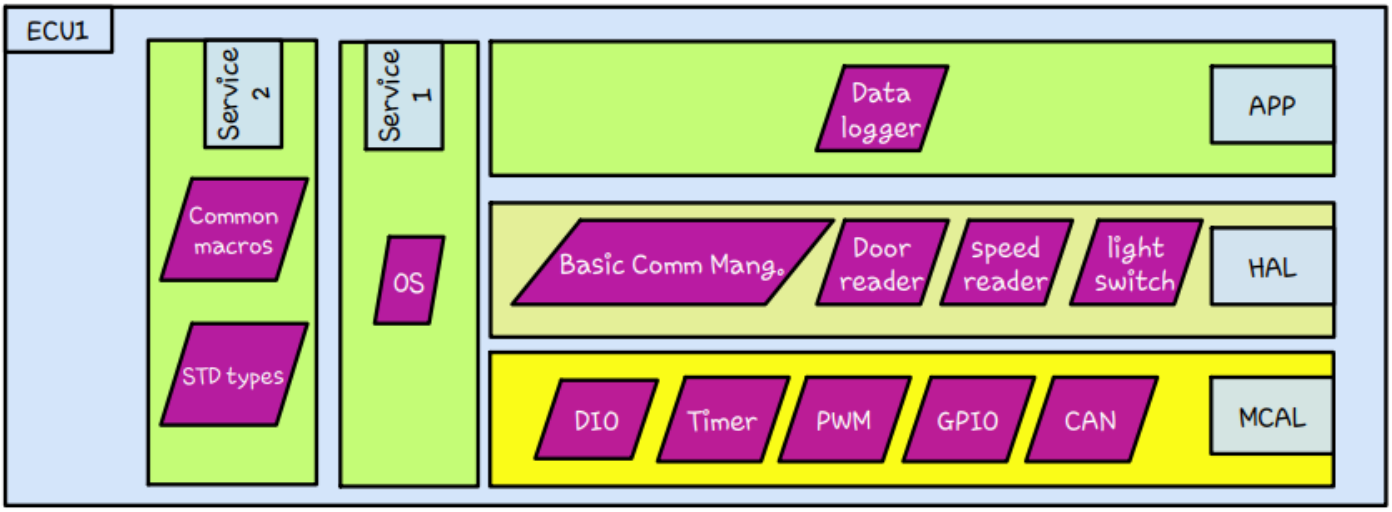
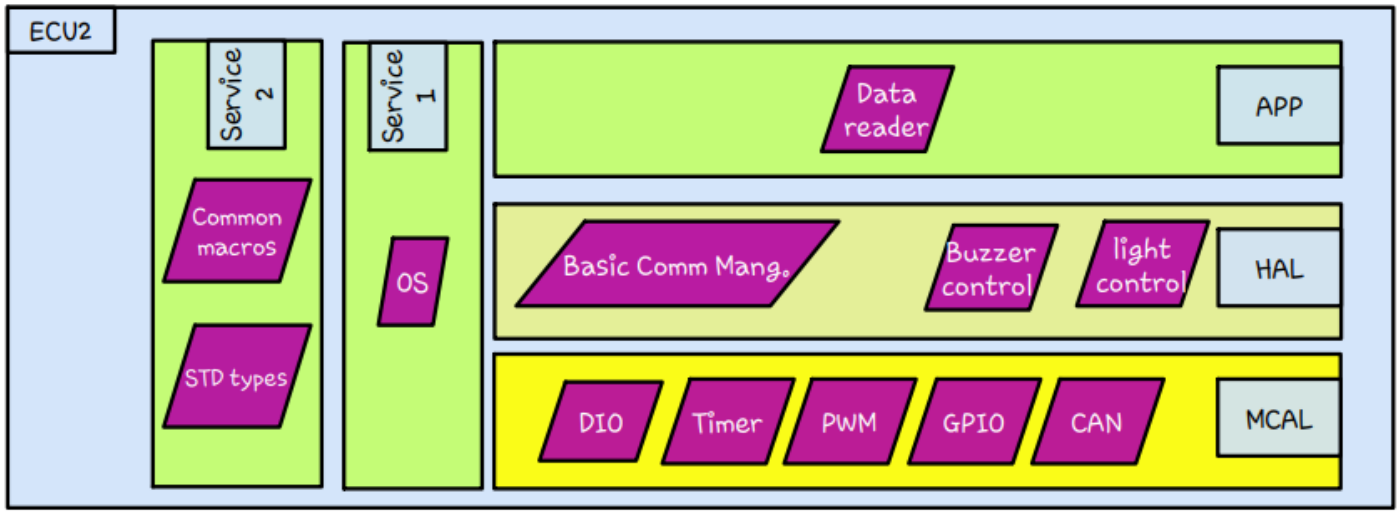
# Static Design




ECU1
Service 2
Common macros
STD types
Service 1
OS
Data logger
APP
Basic Comm Mang.
Door reader
speed reader
light switch
HAL
DIO
Timer
PWM
GPIO
CAN
MCAL


ECU2
Service 2
Common macros
STD types
Service 1
OS
Data reader
APP
Basic Comm Mang.
Buzzer control
light control
HAL
DIO
Timer
PWM
GPIO
CAN
MCAL

# ECU1 APIs

| DIO | |
|---|---|
| Function Name | **DIO_Init()** |
| Parameters | **DIO_PORT, DIO_CHANNEL, DIO_PINLEVEL** |
| Return | **No_Return** |
| Description | **Initialize the DIO module** |

| DIO | |
|---|---|
| Function Name | **DIO_Read()** |
| Parameters | **DIO_PORT, DIO_CHANNEL** |
| Return | **DIO_PINLEVEL** |
| Description | **Read pin value** |

| DIO | |
|---|---|
| Function Name | **DIO_Write()** |
| Parameters | **DIO_PORT, DIO_PINLEVEL** |
| Return | **No return** |
| Description | **Write pin level to a DIO pin** |

| DIO_PORT | |
|---|---|
| Type | **Enum** |
| Range | **Port A to Port F** |
| Description | **Port number in uC** |
| DIO_CHANNEL | |
| Type | **Enum** |
| Range | **PIN 0 to PIN 7** |
| Description | **Pin number in Port** |
| DIO_PINLEVEL | |
| Type | **Enum** |
| Range | **0 ,1** |
| Description | **Pin level is 0 or 1** |

| TIMER | |
|---|---|
| Function Name | **TIMER_Init()** |
| Parameters | ***TimConfig_PTR<br>"TIMER_CONFIG_type"** |
| Return | **No_Return** |
| Description | **Initialize the TIMER module** |

| TIMER | |
|---|---|
| Function Name | **TIMER_Start()** |
| Parameters | **TIMER_CHANNEL_type,<br>TIMER_VALUE_type** |
| Return | **No_Return** |
| Description | **Start Timer Channel** |

| TIMER | |
|---|---|
| Function Name | **TIMER_Stop()** |
| Parameters | **TIMER_CHANNEL_type** |
| Return | **No_Return** |
| Description | **Stop Timer Channel** |

| TIMER_CONFIG_type | |
|---|---|
| Type | **Struct** |
| Range | **Based on timer registers** |
| Description | **Include all the needed timer configurations to be set** |
| TIMER_CHANNEL_type | |
| Type | **Enum** |
| Range | **Based on the timer module in the ECU** |
| Description | **Timer channels** |
| | |
| TIMER_VALUE_type | |
| Type | **uint8_t** |
| Range | **Based on timer registers** |
| Description | **Timer ticks value to be set** |

| CAN | |
|---|---|
| Function Name | **CAN_Init()** |
| Parameters | ***CANConfig_PTR<br>"CAN_CONFIG_type"** |
| Return | **No_Return** |
| Description | **Initializes the CAN Module** |

| CAN | |
|---|---|
| Function Name | **CAN_Send()** |
| Parameters | **uint32_t** |
| Return | **No_Return** |
| Description | **Send data over CAN Module** |

| CAN | |
|---|---|
| Function Name | **CAN_Read()** |
| Parameters | **No param** |
| Return | **uint32_t** |
| Description | **Read data from CAN Module** |

| CAN_CONFIG_type | |
|---|---|
| Type | **uint8_t** |
| Range | **Based on timer registers** |
| Description | **Timer ticks value to be set** |

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| DOOR READER | |
|---|---|
| Function Name | **DOORREAD_Init()** |
| Parameters | **No param** |
| Return | **No_Return** |
| Description | **Initializes door reader module** |

| DOOR READER | |
|---|---|
| Function Name | **DOORREAD_ReadState ()** |
| Parameters | **No param** |
| Return | **1 >>open**<br>**0 >>closed** |
| Description | **read door state** |

| LIGHT SWITCH | |
|---|---|
| Function Name | **LIGHTREAD_Init()** |
| Parameters | **No param** |
| Return | **No_Return** |
| Description | **Initializes light switch reader module** |

| LIGHT SWITCH | |
|---|---|
| Function Name | **LIGHTREAD_ReadState ()** |
| Parameters | **No param** |
| Return | **1 >>on**<br>**0 >>off** |
| Description | **read light switch state** |

| SPEED READER | |
|---|---|
| Function Name | **SPEEDREAD_Init()** |
| Parameters | **No param** |
| Return | **No_Return** |
| Description | **Initializes speed sensor reader module** |

| SPEED READER | |
|---|---|
| Function Name | **SPEEDREAD_ReadValue ()** |
| Parameters | **No param** |
| Return | **Uint32_t** |
| Description | **read speed** |

| DATA LOGGER | |
|---|---|
| Function Name | **DATALOGGER _Start()** |
| Parameters | **T1,T2,T3,D1,D2,D3 “uint32_t”** |
| Return | **No return** |
| Description | **Start sending periodic data over CAN bus where T represent periodic Time in milli seconds and D represents data will be sent** |

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# ECU 2 APIs

| DIO | |
|---|---|
| Function Name | **DIO_Init()** |
| Parameters | **DIO_PORT, DIO_CHANNEL, DIO_PINLEVEL** |
| Return | **No_Return** |
| Description | **Initialize the DIO module** |

| DIO | |
|---|---|
| Function Name | **DIO_Read()** |
| Parameters | **DIO_PORT, DIO_CHANNEL** |
| Return | **DIO_PINLEVEL** |
| Description | **Read pin value** |

| DIO | |
|---|---|
| Function Name | **DIO_Write()** |
| Parameters | **DIO_PORT, DIO_PINLEVEL** |
| Return | **No return** |
| Description | **Write pin level to a DIO pin** |

| DIO_PORT | |
|---|---|
| Type | **Enum** |
| Range | **Port A to Port F** |
| Description | **Port number in uC** |
| DIO_CHANNEL | |
| Type | **Enum** |
| Range | **PIN 0 to PIN 7** |
| Description | **Pin number in Port** |
| DIO_PINLEVEL | |
| Type | **Enum** |
| Range | **0 ,1** |
| Description | **Pin level is 0 or 1** |

| TIMER | |
|---|---|
| Function Name | **TIMER_Init()** |
| Parameters | ***TimConfig_PTR<br>"TIMER_CONFIG_type"** |
| Return | **No_Return** |
| Description | **Initialize the TIMER module** |

| TIMER | |
|---|---|
| Function Name | **TIMER_Start()** |
| Parameters | **TIMER_CHANNEL_type,<br>TIMER_VALUE_type** |
| Return | **No_Return** |
| Description | **Start Timer Channel** |

| TIMER | |
|---|---|
| Function Name | **TIMER_Stop()** |
| Parameters | **TIMER_CHANNEL_type** |
| Return | **No_Return** |
| Description | **Stop Timer Channel** |

| TIMER_CONFIG_type | |
|---|---|
| Type | **Struct** |
| Range | **Based on timer registers** |
| Description | **Include all the needed timer configurations to be set** |
| TIMER_CHANNEL_type | |
| Type | **Enum** |
| Range | **Based on the timer module in the ECU** |
| Description | **Timer channels** |
| | |
| TIMER_VALUE_type | |
| Type | **uint8_t** |
| Range | **Based on timer registers** |
| Description | **Timer ticks value to be set** |

| CAN | |
|---|---|
| Function Name | **CAN_Init()** |
| Parameters | ***CANConfig_PTR<br>"CAN_CONFIG_type"** |
| Return | **No_Return** |
| Description | **Initializes the CAN Module** |

| CAN | |
|---|---|
| Function Name | **CAN_Send()** |
| Parameters | **uint32_t** |
| Return | **No_Return** |
| Description | **Send data over CAN Module** |

| CAN | |
|---|---|
| Function Name | **CAN_Read()** |
| Parameters | **No param** |
| Return | **uint32_t** |
| Description | **Read data from CAN Module** |

| CAN_CONFIG_type | |
|---|---|
| Type | **uint8_t** |
| Range | **Based on timer registers** |
| Description | **Timer ticks value to be set** |

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| BUZZER CONTROL | |
|---|---|
| Function Name | **BUZZERCONT_Init()** |
| Parameters | **No param** |
| Return | **No_Return** |
| Description | **Initializes Buzzer control module** |

| BUZZER CONTROL | |
|---|---|
| Function Name | **BUZZERCONT _drive ()** |
| Parameters | **1 >> on**<br>**0 >> off** |
| Return | **No return** |
| Description | **Drive buzzer on or off** |

| LIGHT CONTROL | |
|---|---|
| Function Name | **LIGHTCONT_Init()** |
| Parameters | **1 >> right light**<br>**0 >> left light** |
| Return | **No_Return** |
| Description | **Initializes light control module** |

| LIGHT CONTROL | |
|---|---|
| Function Name | **LIGHTCONT _drive ()** |
| Parameters | **1.**<br>**1 “on” or 0 “off”**<br>**2.**<br>**1 “right” or 0 “left”** |
| Return | **No return** |
| Description | **Drive left or right light on or off** |

| DATA READER | |
|---|---|
| Function Name | **DATAREAD_START()** |
| Parameters | *** Struct "ReceivedData_type"** |
| Return | **struct** |
| Description | **Read data sent from ECU1 and save it in ReceivedData_type struct** |

| ReceivedData_type | |
|---|---|
| Type | **Struct** |
| Range | **-** |
| Description | **Contains variables for expected data received from CAN bus** |