Ministry of Communications and Information Technology

egypt fwd initiative

مستقبلنا رقمي

Automotive door control system design

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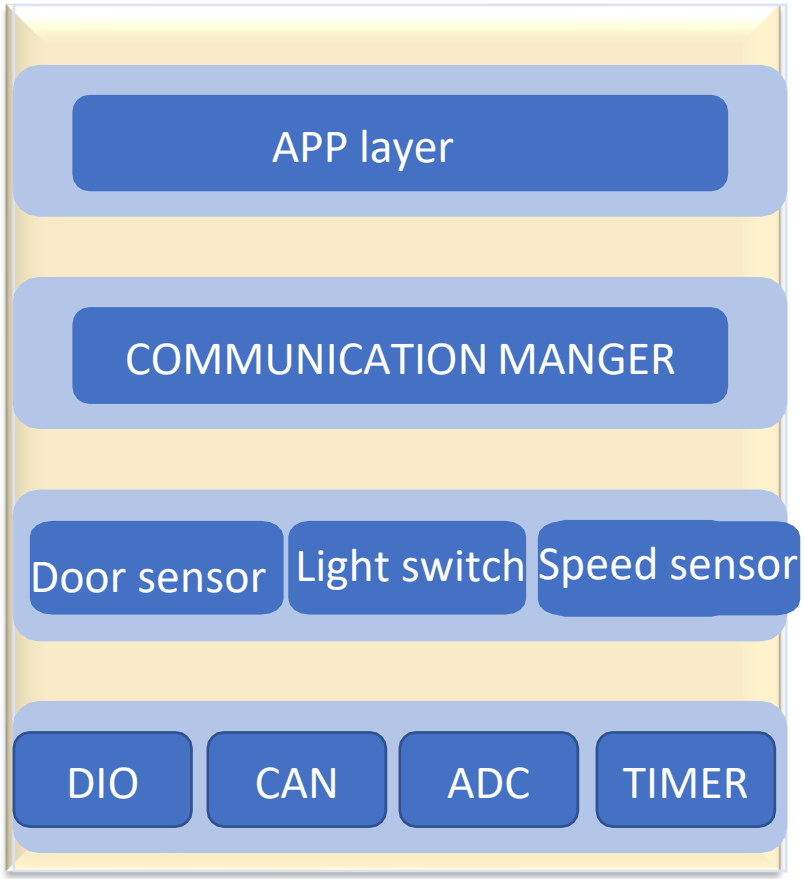
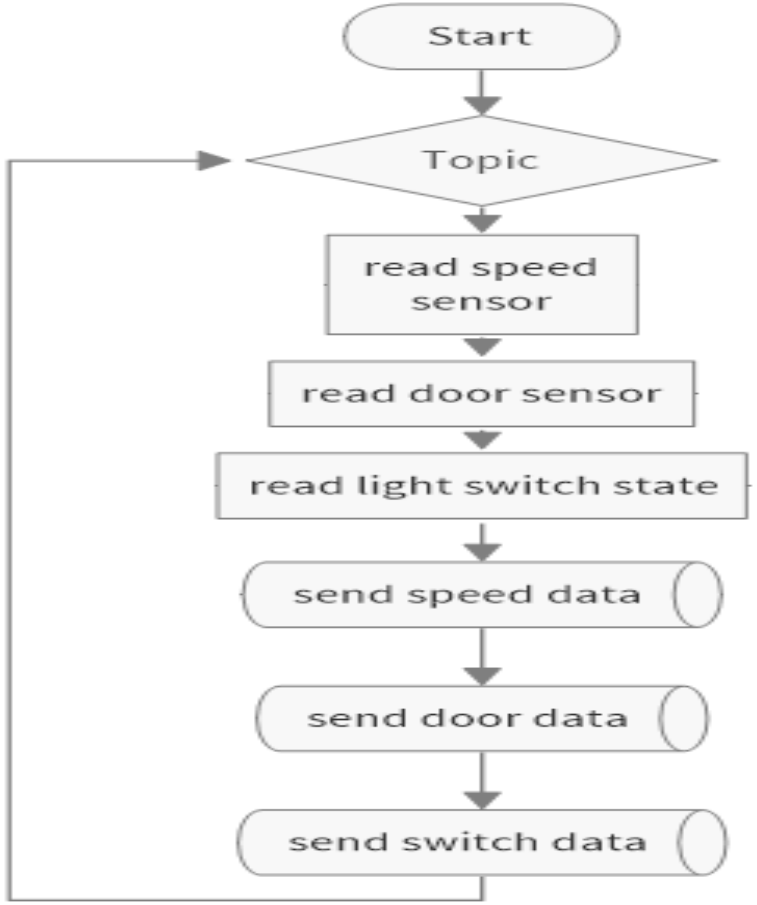
ECU 1


APP layer
COMMUNICATION MANGER
Door sensor
Light switch
Speed sensor
DIO
CAN
ADC
TIMER

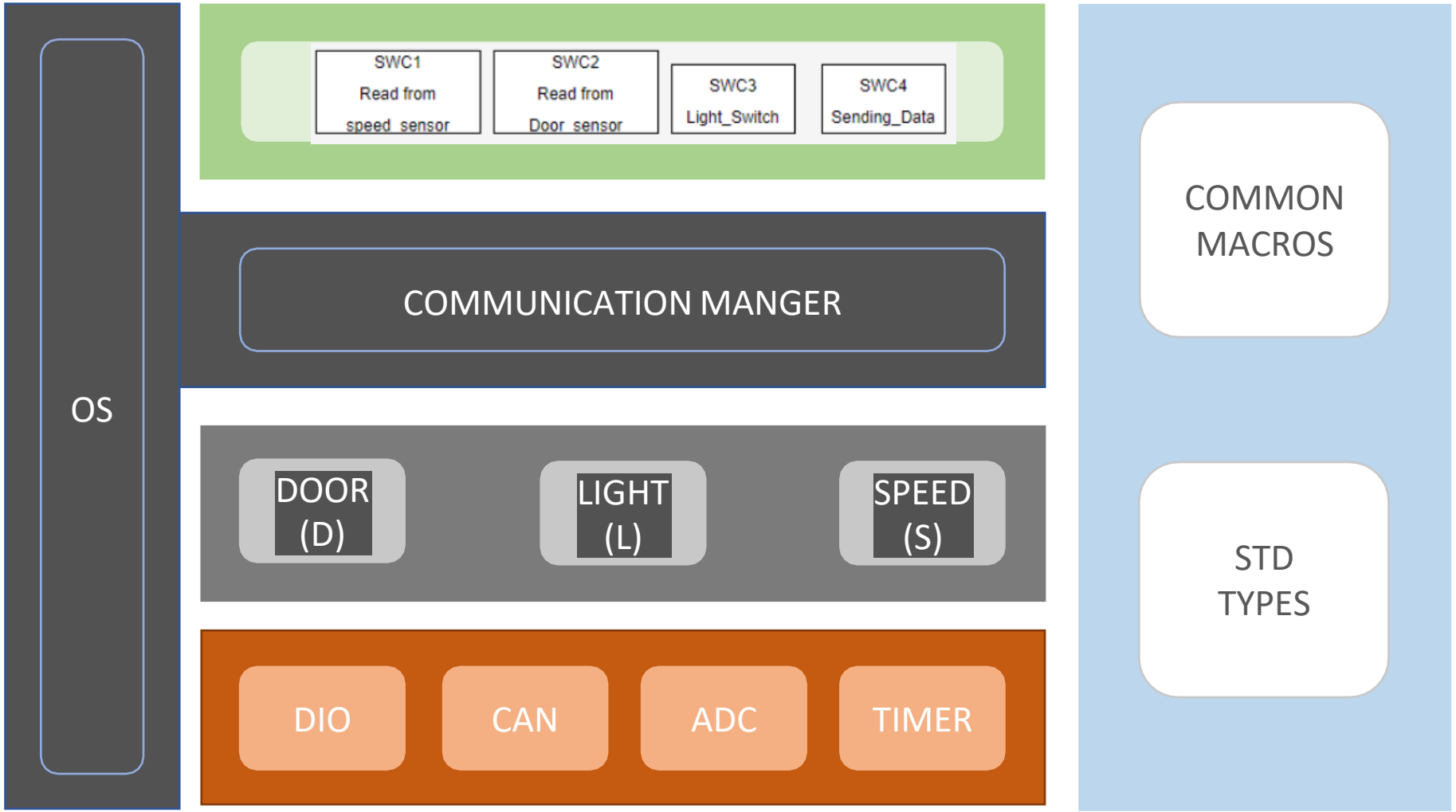
ECU 2


APP layer
COMMUNICATION MANGER
LR
LL
B
DIO
CAN
TIMER

Static Design


Start
Topic
read speed sensor
read door sensor
read light switch state
send speed data
send door data
send switch data

ECU 1


OS
SWC1
Read from
speed_sensor
SWC2
Read from
Door_sensor
SWC3
Light_Switch
SWC4
Sending_Data
COMMUNICATION MANGER
DOOR
(D)
LIGHT
(L)
SPEED
(S)
DIO
CAN
ADC
TIMER
COMMON
MACROS
STD
TYPES

ECU 1

DIO

Function Name:	DIO_INIT		
Arguments	INPUTS	* ConfigPtr	Dio_ConfigType
		Pointer to post-build configuration data	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the module.		

Function Name:	DIO_WRITE		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		Level	Dio_LevelType
		Value to be written	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Set a level of a DIO_Pin		

Function Name:	DIO_READ		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Returns the value of the specified DIO Pin.		

Name	Dio_PinIdType	
Type	uint8	
Range		
Description	Numeric Id od Dio Pins	

Name	Dio_LevelType	
Type	uint8	
Range	0	Physical state 0V
	1	Physical state 5V or 3.3V
Description	These are the possible levels a DIO channel can have (input or output)	

Name	Dio_ConfigType
Type	Structure
Range	uint8
Description	This structure contains all post-build configurable parameters of the DIO driver. A pointer to this structure is passed to the DIO driver initialization function for configuration.

Timer

Function Name:	Timer_Start		
Arguments	INPUTS	Channel	Timer_ChannelType
		Numeric identifier of the GPT channel	
		Value	Timer_ValueType
		Target time in number of ticks.	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Starts a timer channel		

Function Name:	Timer_Stop		
Arguments	INPUTS	Channel	Timer_ChannelType
		Numeric identifier of the GPT channel	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Stops a timer channel		

Function Name:	Timer_INIT		
Arguments	INPUTS	* ConfigPtr	Timer_ConfigType
		Pointer to a selected configuration structure	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the hardware timer module.		

Name	Timer_ChannelType
Type	uint
Range	
Description	This is the type of the data structure including the configuration set requiredfor initializing the timer unit.

Name	Timer_ValueType
Type	uint8
Range	The range of this type is µC dependent (width of the timer register) and has to be described by the supplier.
Description	Type for reading and setting the timer values (in number of ticks).

Name	Timer_ConfigType
Type	Structure
Range	
Description	This is the type of the data structure including the configuration set required for initializing the timer unit.

ADC

Function Name:	ADC_INIT		
Arguments	INPUTS	* ConfigPtr	ADC_ConfigType
		Pointer to a selected configuration structure	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the hardware ADC module.		

Function Name:	ADC_readChannel		
Arguments	INPUTS	Channel	ADC_ChannelType
		ID of ADC Channel	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Returns the value of the specified ADC Channel		

Name	ADC_ChannelType
Type	uint8
Range	
Description	This is the type of the data structure including the configuration set requiredfor initializing the ADC .

Name	ADC_ConfigType
Type	Structure
Range	
Description	This is the type of the data structure including the configuration set requiredfor initializing the ADC.

CAN

Function Name:	CAN_INIT		
Arguments	INPUTS	* ConfigPtr	CAN_ConfigType
		Pointer to a selected configuration structure	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the hardware CAN module.		

Function Name:	CAN_Baudrate		
Arguments	INPUTS	Controller	uint8
		CAN Controller, whose baudrate shall be changed	
		Baudrate	uint16
		Requested baudrate in kbps	
	Output	None	None
	Input/Output	None	None
Return	E_OK	Service request accepted, baudrate change started	
	E_NOK	Service request not accepted	
Description	Set the baudrate of the CAN controller.		

Function Name:	CAN_SendData		
Arguments	INPUTS	data	uint32
		Data required to be send	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Send Data from the CAN controller.		

Function Name:	CAN_ReceiveData		
Arguments	INPUTS	void	None
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Receive Data from the CAN controller.		

Name	CAN_ConfigType
Type	Structure
Range	
Description	This is the type of the data structure including the configuration set requiredfor initializing the CAN.

Door Sensor

Function Name:	Door_INIT		
Arguments	INPUTS	Void	-
		-	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the Door sensor module.		

Function Name:	Door_GetState		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	DOOR_IS_OPEN	
	E_NOK	DOOR_IS_CLOSED	
Description	Get a State of a Door sensor on DIO_Pin		

Light Switch

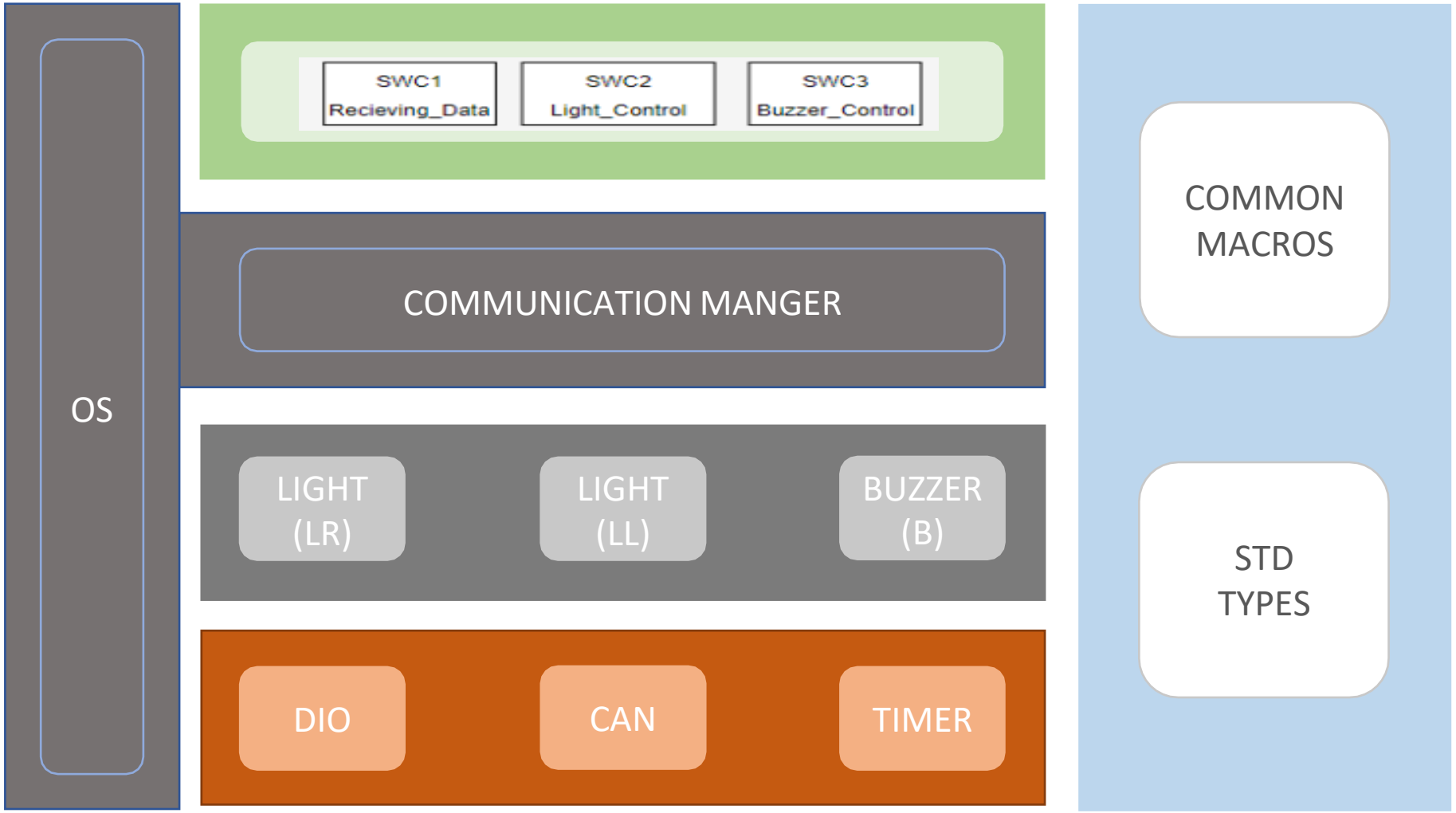
Function Name:	Light_INIT		
Arguments	INPUTS	Void	-
		-	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the Light Switch module.		

Function Name:	Light_GetState		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	LIGHT_ON	
	E_NOK	LIGHT_OFF	
Description	Get a State of a Light Switch on DIO_Pin		

Speed Sensor

Function Name:	Speed_INIT		
Arguments	INPUTS	Void	-
		-	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the Speed Sensor module.		

Function Name:	Speed_GetValue		
Arguments	INPUTS	Channel	ADC_ChannelType
		ID of ADC Channel	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	CAR_IS_MOVING	
	E_NOK	CAR_NOT_MOVING	
Description	Get a State of a Speed Sensor on ADC Channel		


OS
SWC1
Recieving_Data
SWC2
Light_Control
SWC3
Buzzer_Control
COMMUNICATION MANGER
LIGHT
(LR)
LIGHT
(LL)
BUZZER
(B)
DIO
CAN
TIMER
COMMON
MACROS
STD
TYPES

ECU 2

DIO

Function Name:	DIO_INIT		
Arguments	INPUTS	* ConfigPtr	Dio_ConfigType
		Pointer to post-build configuration data	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the module.		

Function Name:	DIO_WRITE		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		Level	Dio_LevelType
		Value to be written	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Set a level of a DIO_Pin		

Function Name:	DIO_READ		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Returns the value of the specified DIO Pin.		

Name	Dio_PinIdType	
Type	uint8	
Range		
Description	Numeric Id od Dio Pins	

Name	Dio_LevelType	
Type	uint8	
Range	0	Physical state 0V
	1	Physical state 5V or 3.3V
Description	These are the possible levels a DIO channel can have (input or output)	

Name	Dio_ConfigType
Type	Structure
Range	uint8
Description	This structure contains all post-build configurable parameters of the DIO driver. A pointer to this structure is passed to the DIO driver initialization function for configuration.

Timer

Function Name:	Timer_Start		
Arguments	INPUTS	Channel	Timer_ChannelType
		Numeric identifier of the GPT channel	
		Value	Timer_ValueType
		Target time in number of ticks.	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Starts a timer channel		

Function Name:	Timer_Stop		
Arguments	INPUTS	Channel	Timer_ChannelType
		Numeric identifier of the GPT channel	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Stops a timer channel		

Function Name:	Timer_INIT		
Arguments	INPUTS	* ConfigPtr	Timer_ConfigType
		Pointer to a selected configuration structure	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the hardware timer module.		

Name	Timer_ChannelType
Type	uint
Range	
Description	This is the type of the data structure including the configuration set requiredfor initializing the timer unit.

Name	Timer_ValueType
Type	uint8
Range	The range of this type is µC dependent (width of the timer register) and has to be described by the supplier.
Description	Type for reading and setting the timer values (in number of ticks).

Name	Timer_ConfigType
Type	Structure
Range	
Description	This is the type of the data structure including the configuration set required for initializing the timer unit.

CAN

Function Name:	CAN_INIT		
Arguments	INPUTS	* ConfigPtr	CAN_ConfigType
		Pointer to a selected configuration structure	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Initializes the hardware CAN module.		

Function Name:	CAN_Baudrate		
Arguments	INPUTS	Controller	uint8
		CAN Controller, whose baudrate shall be changed	
		Baudrate	uint16
		Requested baudrate in kbps	
	Output	None	None
	Input/Output	None	None
Return	E_OK	Service request accepted, baudrate change started	
	E_NOK	Service request not accepted	
Description	Set the baudrate of the CAN controller.		

Function Name:	CAN_SendData		
Arguments	INPUTS	data	uint32
		Data required to be send	
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Send Data from the CAN controller.		

Function Name:	CAN_ReceiveData		
Arguments	INPUTS	void	None
		None	None
		None	
	Output	None	None
	Input/Output	None	None
Return	E_OK	None	
	E_NOK	None	
Description	Receive Data from the CAN controller.		

Name	CAN_ConfigType
Type	Structure
Range	
Description	This is the type of the data structure including the configuration set requiredfor initializing the CAN.

Light Right (LR)

Function Name:	LR_On		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Turn Right light on		

Function Name:	LR_Off		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Turn Right light OFF		

Light Left (LL)

Function Name:	LL_On		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Turn Left light on		

Function Name:	LL_Off		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Turn Left light OFF		

Buzzer (B)

Function Name:	B_On		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Turn Buzzer on		

Function Name:	B_Off		
Arguments	INPUTS	PinId	Dio_PinIdType
		ID of DIO PIN	
		-	-
		-	
	Output	None	None
	Input/Output	None	None
Return	E_OK	0	
	E_NOK	1	
Description	Turn Buzzer OFF		