

LED V2 System Design

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Detailed Requirements

Read System Requirements Specifications

1. *Description*

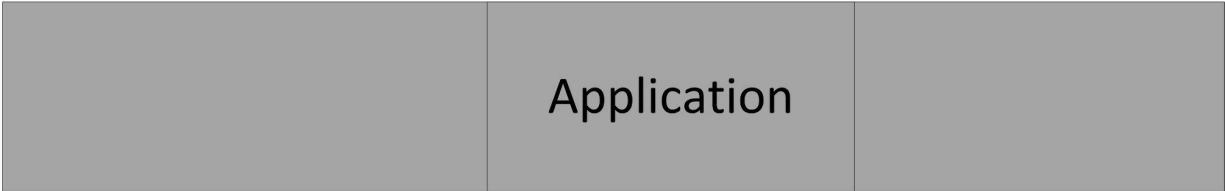
1. *Hardware Requirements*

1. *Four LEDs (LED0, LED1, LED2, LED3)*
2. One button (BUTTON0)

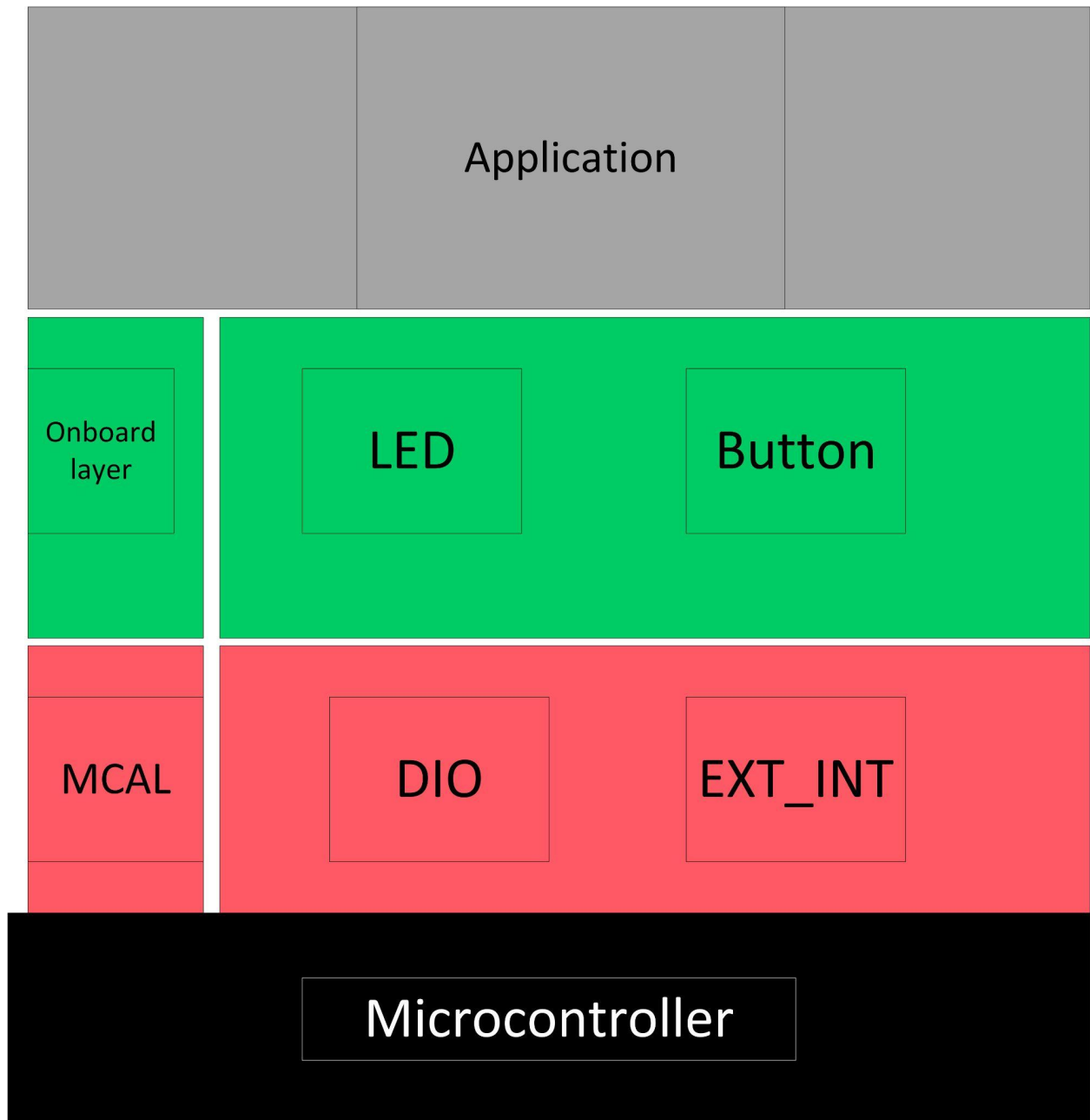
2. *Software Requirements*

1. Initially, all LEDs are OFF
2. Once BUTTON1 is pressed, LED0 will be ON
3. Each press further will make another LED is ON
4. At the fifth press, LED0 will changed to be OFF
5. Each press further will make only one LED is OFF
6. This will be repeated forever
7. The sequence is described below
 1. Initially (OFF, OFF, OFF, OFF)
 2. Press 1 (ON, OFF, OFF, OFF)
 3. Press 2 (ON, ON, OFF, OFF)
 4. Press 3 (ON, ON, ON, OFF)
 5. Press 4 (ON, ON, ON, ON)
 6. Press 5 (OFF, ON, ON, ON)
 7. Press 6 (OFF, OFF, ON, ON)
 8. Press 7 (OFF, OFF, OFF, ON)
 9. Press 8 (OFF, OFF, OFF, OFF)
 10. Press 9 (ON, OFF, OFF, OFF)
8. USE EXTERNAL INTERRUPTS

Layered architecture



System modules



APIs

MCAL APIs

External Interrupt API :

Type definitions:

- EXT_INT_ID_TYPE

Name	EXT_INT_ID_TYPE	
Type	Enumeration	
Range	INT_0_ID	0x00
	INT_1_ID	0x01
	INT_2_ID	0x02
Description	EXT_INT_ID_TYPE	
Available via	EXT_INT.h	

- EXT_INT_MODE_TYPE

Name	EXT_INT_MODE_TYPE	
Type	Enumeration	
Range	EXT_INT_FALLING_EDGE	0x00
	EXT_INT_RISING_EDGE	0x01
Description	EXT_INT_MODE_TYPE	
Available via	EXT_INT.h	

- EXT_INT_ERR_TYPE

Name	EXT_INT_ERR_TYPE	
Type	Enumeration	
Range	EXT_INT_ERR_OK	0x00
	EXT_INT_ERR_OutOfRange	0x01
Description	EXT_INT_ERR_TYPE	
Available via	EXT_INT.h	

Services affecting the hardware unit:

- eXT_INT_Enable

Service name	eXT_INT_Enable					
Syntax	EXT_INT_ERR_TYPE eXT_INT_Enable(EXT_INT_ID_TYPE id, EXT_INT_MODE_TYPE mode);					
Parameters (in)	id	Interrupt ID				
	mode	Rising edge or falling edge				
Return	<table><tr><td rowspan="2">EXT_INT_ERR_TY PE</td><td>EXT_INT_ERR_OK</td></tr><tr><td>EXT_INT_ERR_OutOfRange</td></tr></table>			EXT_INT_ERR_TY PE	EXT_INT_ERR_OK	EXT_INT_ERR_OutOfRange
EXT_INT_ERR_TY PE	EXT_INT_ERR_OK					
	EXT_INT_ERR_OutOfRange					
Description	This Function enable an external interrupt					

- This function shall return EXT_INT_ERR_OutOfRange if id or mode is invalid.

DIO API :

Type definitions:

- Dio_ChannelType

Name	Dio_ChannelType
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Type	Enumeration
Range	Shall contain all pins ID
Description	Dio_ChannelType
Available via	DIO_Config.h

- Dio_PortType

Name	Dio_PortType
Type	Enumeration
Range	Shall contain all ports ID
Description	Dio_PortType
Available via	DIO_Config.h

- DIO_Errors

Name	DIO_Errors		
Type	Enumeration		
Range	DIO_E_OK	0x00	DIO error OK
	DIO_InvalidPin	0x01	DIO error, invalid pin number.
Description	DIO Errors		
Available via	DIO.h		

- Dio_LevelType

Name	Dio_LevelType
Type	Enumeration

Range	STD_LOW	0x00	Physical state 0V
	STD_HIGH	0x01	Physical state 5V or 3.3V.
Description	Dio_LevelType		
Available via	DIO.h		

- Dio_DIRType

Name	Dio_DIRType		
Type	Enumeration		
Range	STD_INPUT	0x00	Set pin as input pin
	STD_OUTPUT	0x01	Set pin as output pin
Description	Dio_DIRType		
Available via	DIO.h		

Services affecting the hardware unit:

- Dio_ReadChannel

Service name	Dio_ReadChannel		
Syntax	DIO_Errors Dio_ReadChannel(Dio_ChannelType ChannelId, Dio_LevelType* level);		
Parameters (in)	ChannelId	Channel ID	
	level	Pointer to store the level	STD_HIGH
			STD_LOW
Return	DIO_Errors	DIO_E_OK	
		DIO_InvalidPin	

Description	This Function gets the level of the pin
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- This function shall return DIO_InvalidPin if pin number is invalid.

- Dio_WriteChannel

Service name	Dio_WriteChannel		
Syntax	DIO_Errors Dio_WriteChannel(Dio_ChannelType ChannelId, Dio_LevelType level);		
Parameters (in)	ChannelId	Channel ID	
	level	Value to be set	STD_HIGH
			STD_LOW
Return			
	DIO_Errors	DIO_E_OK	
		DIO_InvalidPin	
Description	This Function gets the level of the pin		

- This function shall return DIO_InvalidPin if pin number is invalid.

- Dio_ChannelSetDIR

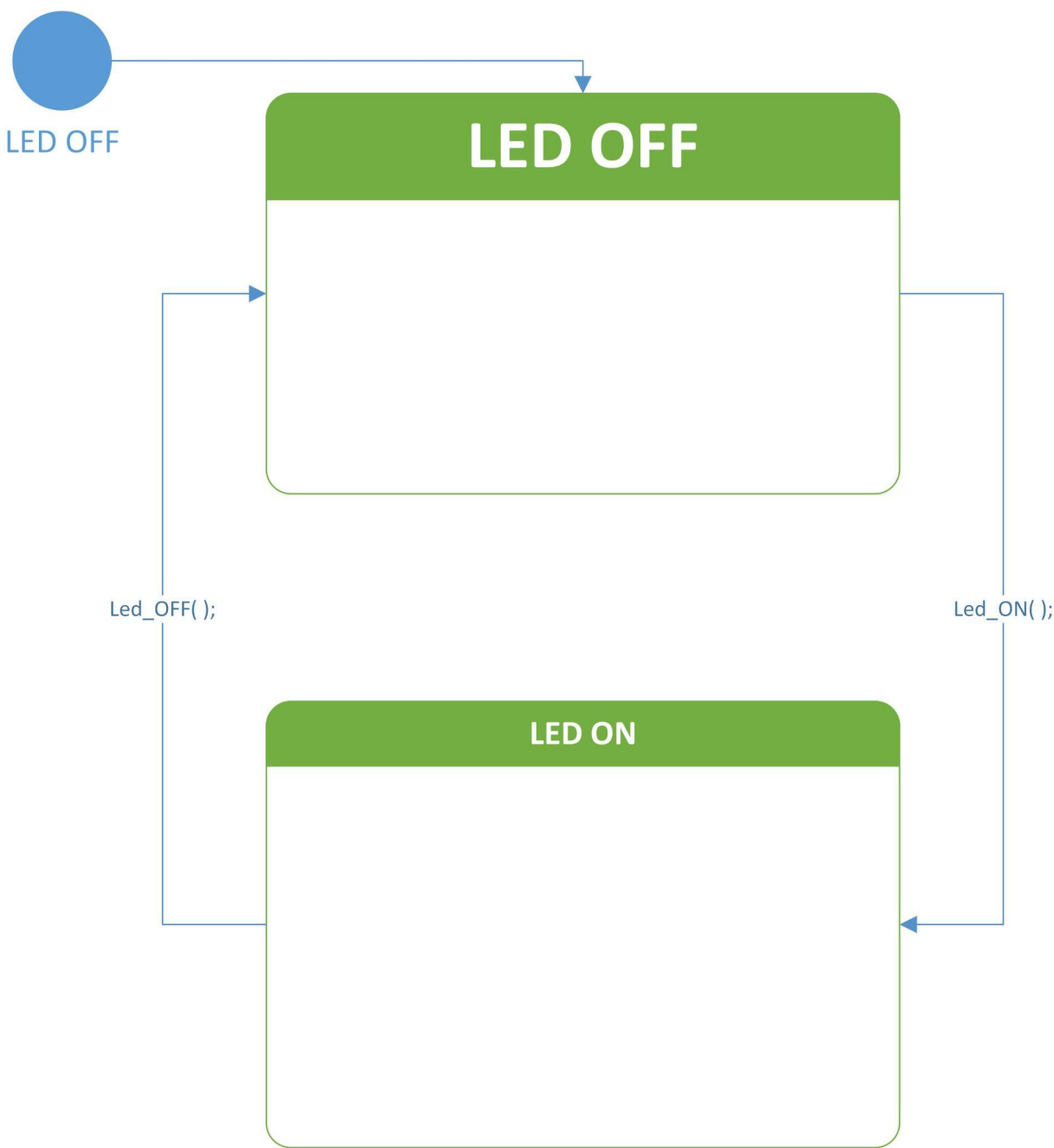
Service name	Dio_ChannelSetDIR		
Syntax	DIO_Errors Dio_ChannelSetDIR(Dio_ChannelType ChannelId, Dio_DIRType dir);		
Parameters (in)	ChannelId	Channel ID	
	dir	Value to be set	STD_INPUT
			STD_OUTPUT
Return	DIO_Errors	DIO_E_OK	
		DIO_InvalidPin	
Description	This Function sets the Direction of the pin		

- This function shall return DIO_InvalidPin if pin number is invalid.

Onboard APIs

LED API:

State machine :



Type definitions:

- LED_Config_Type

Name	LED_Config_Type
Type	Structure
Description	This is the type of the external data structure containing the overall configuration data for the LED API
Available via	led_types.h

- LED_STATE_type

Name	LED_STATE_type		
Type	Enumeration		
Range	LED_OFF	0x00	LED OFF STATE
	LED_ON	0x01	LED ON STATE
Description	LED State Enum		
Available via	led.h		

- LED_ERROR_type

Name	LED_ERROR_type		
Type	Enumeration		
Range	LED_OK	0x00	ERROR OK
	LED_UNDEFINED	0x01	LED ID not defined
Description	LED Error Enum		
Available via	led.h		

- LED_ID_type

Name	LED_ID_type
Type	Enumeration

Range	LED_1	0x01	LED 1
	LED_2	0x02	LED 2
	LED_3	0x03	LED 3
	LED_4	0x04	LED 4
Description	LED ID Enum		
Available via	led.h		

Services affecting the hardware unit:

- led_Init

Service name	led_Init		
Syntax	<pre>void led_Init(void);</pre>		
Return	None		
Description	This Function Initialize the LED module		

- led_OFF

Service name	led_OFF		
Syntax	<pre>LED_ERROR_type led_OFF(LED_ID_type led);</pre>		
Parameters (in)	led	LED_1	0x01
		LED_2	0x02
		LED_3	0x03
		LED_4	0x04

Return	LED_ERROR_type	LED_OK	0x00
		LED_UNDEFINED	0x01
Description	This Function Sets a LED OFF.		

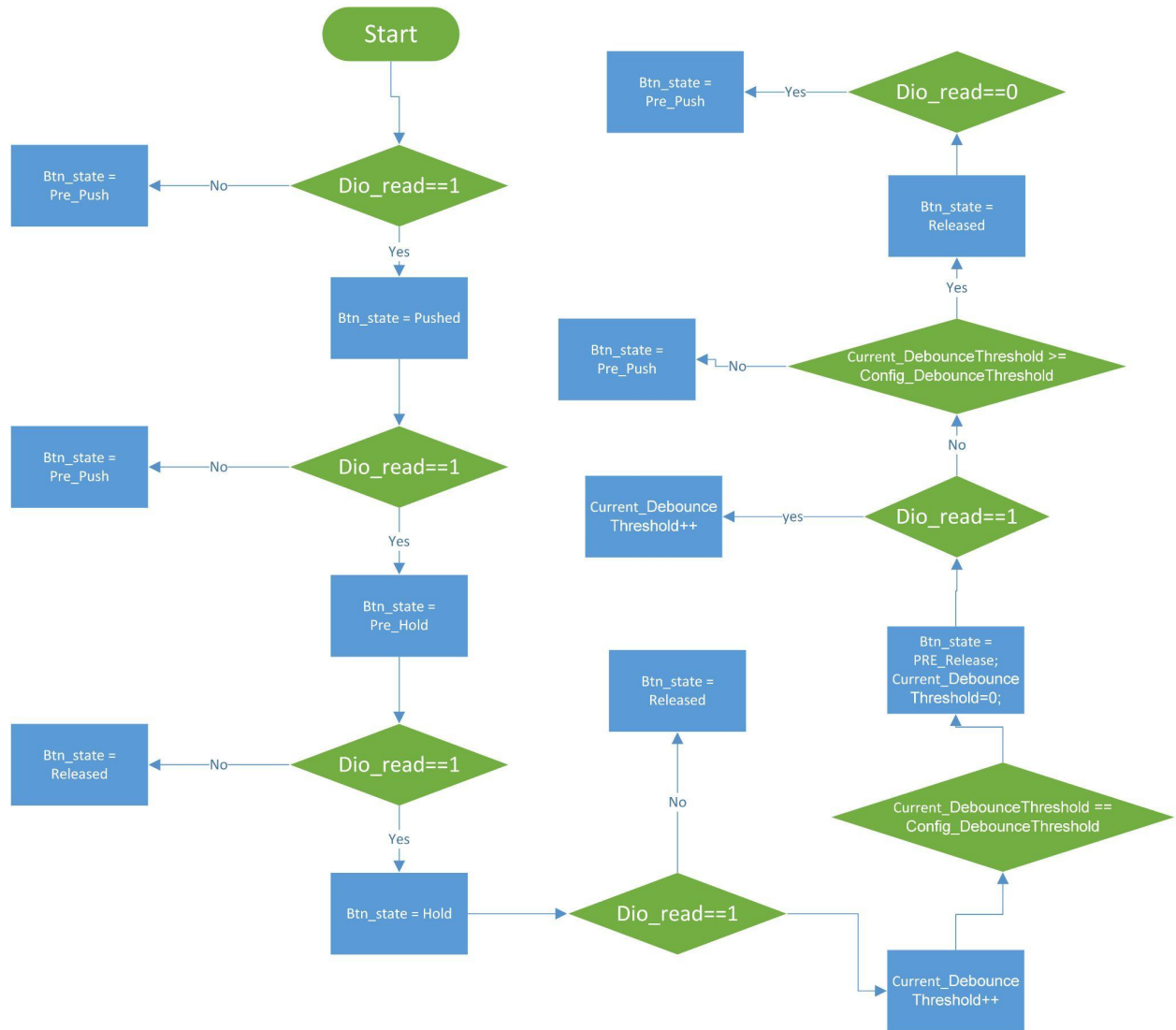
- led_ON

Service name	led_ON		
Syntax	LED_ERROR_type led_ON(LED_ID_type led);		
Parameters (in)	led	LED_1	0x01
		LED_2	0x02
		LED_3	0x03
		LED_4	0x04
Return	LED_ERROR_type	LED_OK	0x00
		LED_UNDEFINED	0x01
Description	This Function Sets a LED ON.		

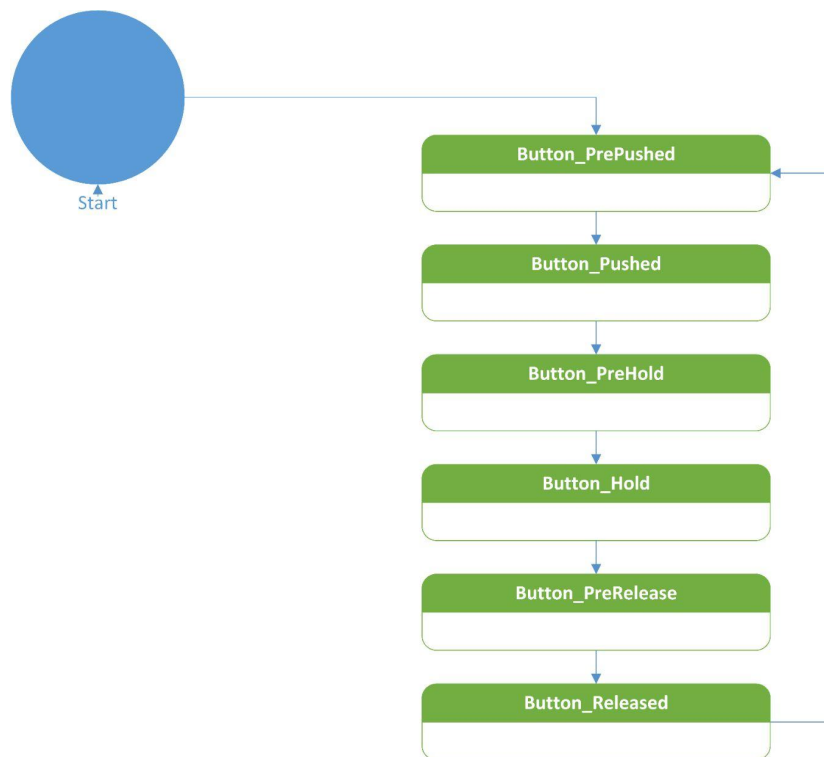
Button API:

Flowchart :

button_Main_Task flowchart



State machine :



Type definitions:

- Button_configType

Name	Button_configType		
Type	Structure		
Description	This is the type of the external data structure containing the overall configuration data for the Button API		
Available via	Button_Types.h		

- Button_LevelType

Name	Button_LevelType		
Type	Enumeration		
Range	BT_PUSH_LEVEL	0x00	Push Level
	BT_RELEASE_LEVEL	0x01	Release Level

Description	Button Level Enum
Available via	Button_Types.h

- Button_StateType

Name	Button_StateType		
Type	Enumeration		
Range	BT_PRE_PUSH	0x00	Pre Push Level
	BT_PUSHED	0x01	Pushed Level
	BT_PRE_HOLD	0x02	Pre Hold Level
	BT_HOLD	0x03	Hold Level
	BT_PRE_RELEASE	0x04	Pre Release Level
	BT_RELEASED	0x05	Released Level
	BT_UNDEFINED	0x06	Undefined
Description	Button state Enum		
Available via	Button.h		

- Button_IdType

Name	Button_IdType					
Type	Enumeration					
Range	<table><tr><td>Button_Start</td><td>0x00</td><td>Start Button</td></tr></table>			Button_Start	0x00	Start Button
Button_Start	0x00	Start Button				
Description	Button ID Enum					
Available via	Button.h					

Services affecting the hardware unit:

- getButtonState

Service name	getButtonState										
Syntax	Button_StateTyp getButtonState(Button_IdType enmButtonId);										
Parameters (in)	enmButtonId	Start 0x00									
Return	<table><tr><td rowspan="7">Button_StateTyp</td><td>BT_PRE_PUSH</td></tr><tr><td>BT_PUSHED</td></tr><tr><td>BT_PRE_HOLD</td></tr><tr><td>BT_HOLD</td></tr><tr><td>BT_PRE_RELEASE</td></tr><tr><td>BT_RELEASED</td></tr><tr><td>BT_UNDEFINED</td></tr></table>			Button_StateTyp	BT_PRE_PUSH	BT_PUSHED	BT_PRE_HOLD	BT_HOLD	BT_PRE_RELEASE	BT_RELEASED	BT_UNDEFINED
Button_StateTyp	BT_PRE_PUSH										
	BT_PUSHED										
	BT_PRE_HOLD										
	BT_HOLD										
	BT_PRE_RELEASE										
	BT_RELEASED										
	BT_UNDEFINED										
Description	This Function gets the Button state.										

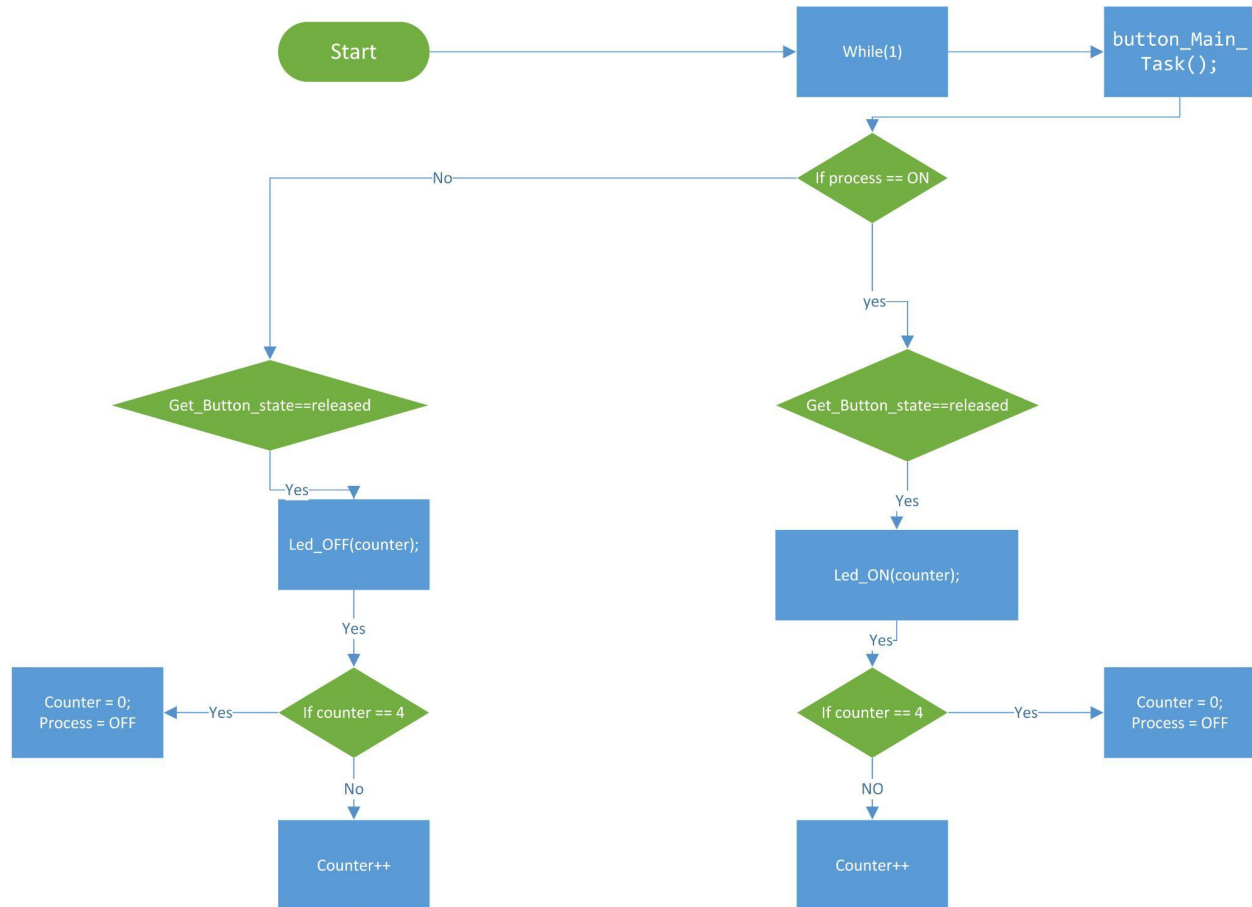
- button_Main_Task

Service name	button_Main_Task
Syntax	void button_Main_Task(void);
Parameters (in)	NONE
Return	NONE
Description	This Function update all button states Shall call periodic

App APIs:

App API:

Flowchart :



Services affecting the hardware unit:

- appStart

Service name	appStart
Syntax	void appStart(void);
Parameters (in)	NONE
Return	NONE
Description	This Function Start the application.

