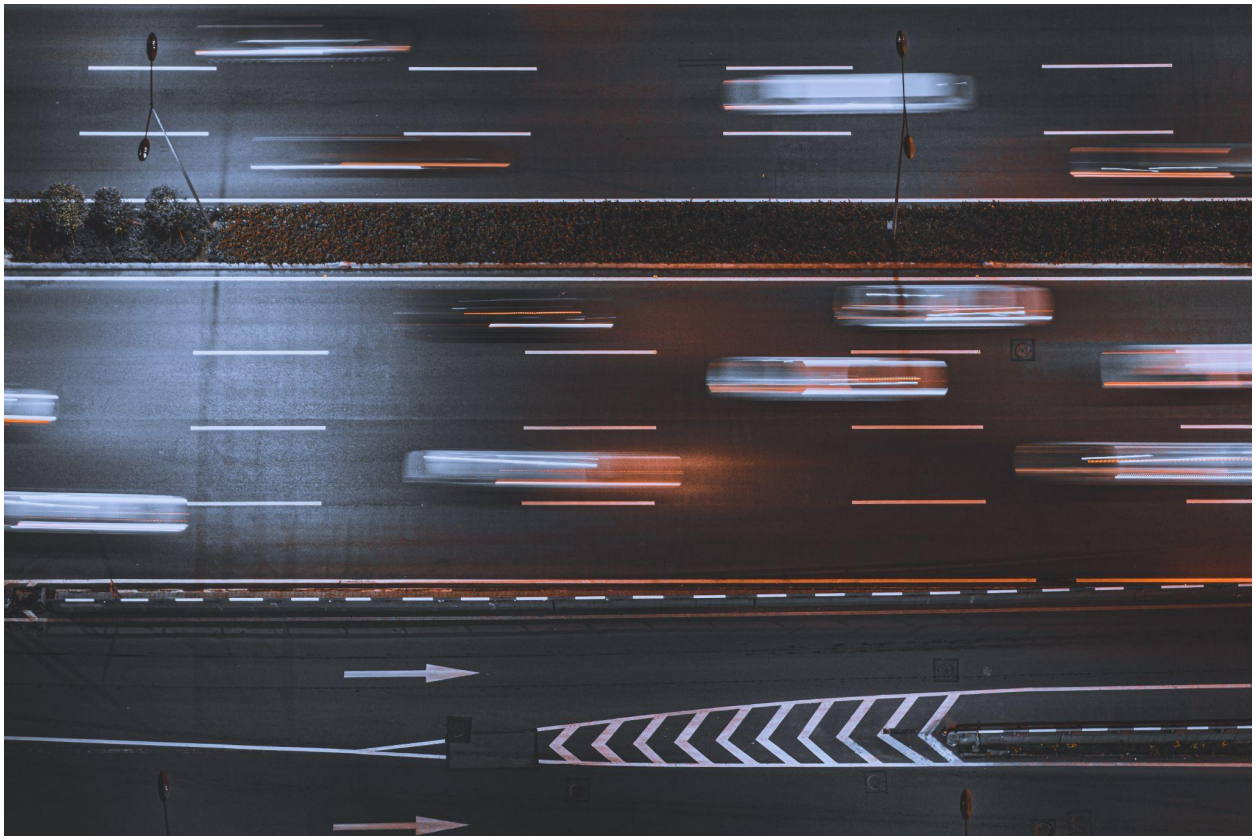

Basic Communication Manager Design

V1.00

—

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sprints.ai

Table of Content

Introduction

BCM (Basic Communication Manager) This module provides supervision and direction to all serial communication protocols with the highest possible throughput .

Detailed Requirements

Specifications

1. The BCM has the capability to send and receive any data with maximum length of 65535 bytes (Maximum of unsigned two bytes variable).
2. It can use any communication protocol with the support of Send, Receive or both.
3. Implement bcm_Init use the below table. This function will initialize the corresponding serial communication protocol.

Function Name	bcm_init
Syntax	enu_bcm_status_t bcm_init (str_bcm_instance_t* ptr_str_bcm_instance)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	ptr_str_bcm_instance: Address of the BCM Instance
Parameters (out):	None
Parameters (in, out):	None
Return:	2 (NULL_POINTER)
	1 (CHANNEL_ERROR)
	0 (BCM_OKAY)

4. Implement bcm_deinit use the below table. This function will uninitialize the corresponding BCM instance, (instance: is the communication channel).

Function Name	bcm_deinit
Syntax	enu_bcm_status_t bcm_deinit (str_bcm_instance_t* ptr_str_bcm_instance);
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	ptr_str_bcm_instance: Address of the BCM Instance
Parameters (out):	None
Parameters (in, out):	None
Return:	2 (NULL_POINTER)
	0 (BCM_OKAY)

5. Implement bcm_send that will send only 1 byte of data over a specific BCM instance

Function Name	bcm_send
Syntax	enu_bcm_status_t bcm_send(str_bcm_instance_t* ptr_str_bcm_instance, uint8_t uint8_arg_byte);
Sync/Async	Asynchronous
Reentrancy	Reentrant
Parameters (in):	ptr_str_bcm_instance: Address of the BCM Instance uint8_arg_byte : byte
Parameters (out):	None
Parameters (in, out):	None
Return:	2 (NULL_POINTER)
	1 (CHANNEL_ERROR)
	0 (BCM_OKAY)

6. Implement bcm_send_n will send more than one byte with a length n over a specific BCM instance

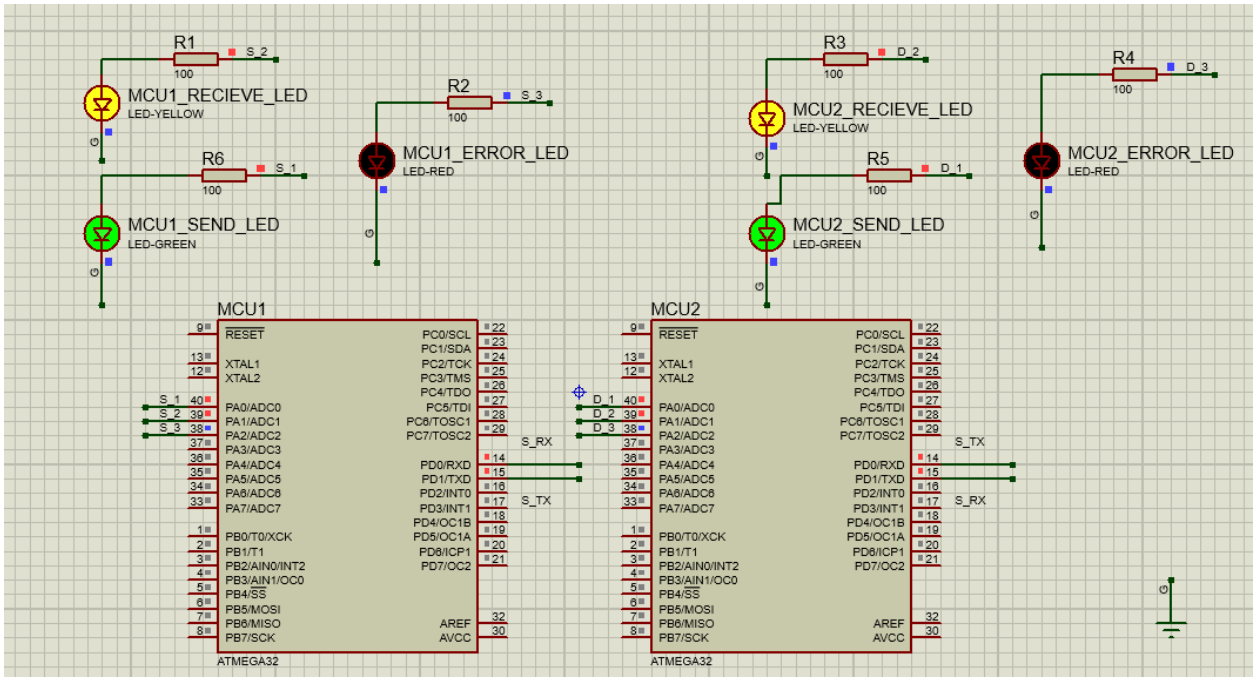
Function Name	bcm_send_n
Syntax	enu_bcm_status_t bcm_send_n (str_bcm_instance_t* ptr_str_bcm_instance, uint8_t *ptr_arg_bytes, uint8_t uint8_arg_size);
Sync/Async	Asynchronous
Reentrancy	Reentrant
Parameters (in):	ptr_str_bcm_instance: Address of the BCM Instance ptr_arg_byte : Address of the array of bytes uint8_arg_size : size of array
Parameters (out):	None
Parameters (in, out):	None
Return:	2 (NULL_POINTER)
	1 (CHANNEL_ERROR)
	0 (BCM_OKAY)

7. Implement bcm_dispatcher will execute the periodic actions and notifies the user with the needed events over a specific BCM instance

Function Name	bcm_dispatcher
Syntax	enu_bcm_status_t bcm_dispatcher (str_bcm_instance_t* ptr_str_bcm_instance);
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	ptr_str_bcm_instance: Address of the BCM Instance
Parameters (out):	None
Parameters (in, out):	None
Return:	3 (SEND_OPERATION_DONE)
	4 (REC_OPERATION_DONE)
	0 (BCM_OKAY)

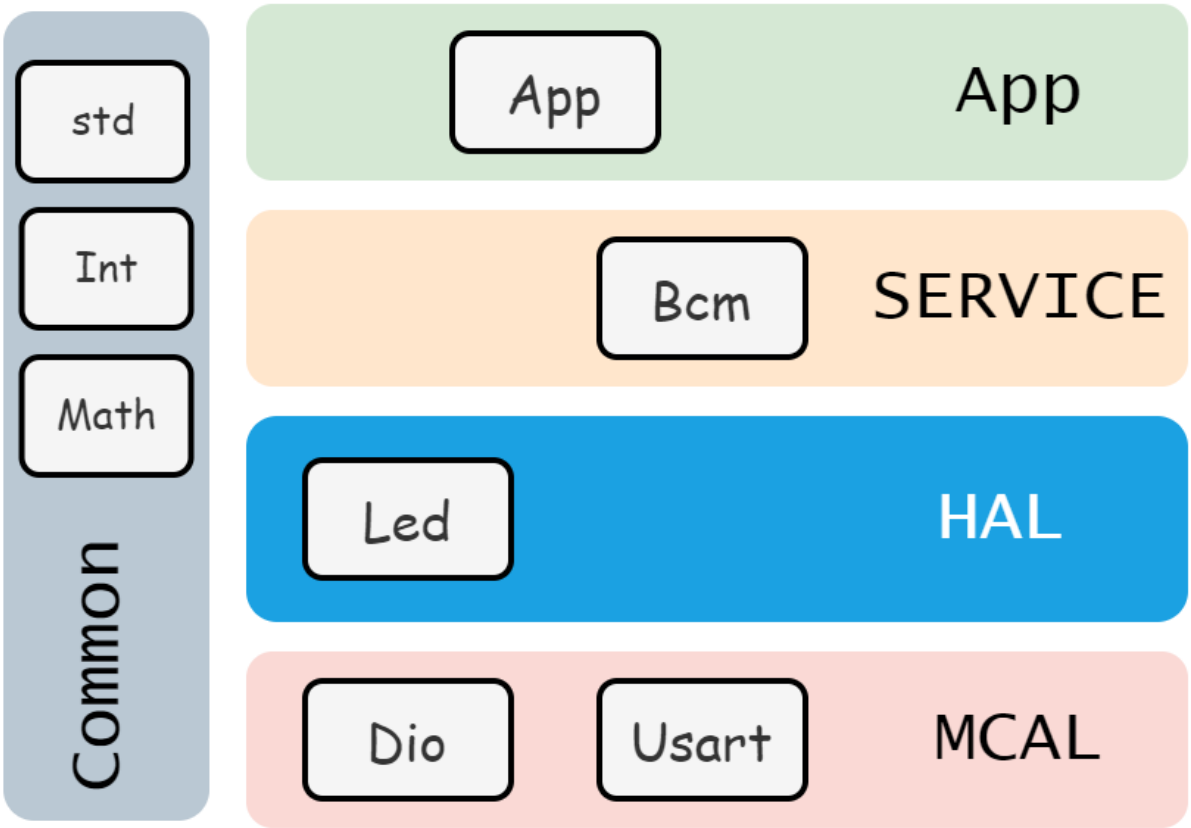
Module Testing

1. Send [BCM Operating] string from MCU_1 to MCU_2.
2. When MCU_1 finish sending, LED_0 in MCU_1 will be toggled.
3. When MCU_2 finish receiving the [BCM Operating] string, LED_1 in MCU_2 will be toggled.
4. MCU_2 will respond with a [Confirm BCM Operating] string to MCU_1.
5. When MCU_2 finish sending, LED_0 in MCU_2 will be toggled.
6. When MCU_1 finish receiving the [BCM Operating] string, LED_1 in MCU_1 will be toggled.



High Level Design

1. Layered architecture



2. Modules Descriptions

- **Dio** : Stands for Digital Input/Output. It is an interface component that allows the system to send digital signals to devices. Also read signals from others.
- **Usart** : The Universal Synchronous Asynchronous Receiver Transmitter (USART) module is one of the serial I/O modules for communication interfacing functions with other devices/units.
- **Led :** This Module Controls Leds state in the program
- Bcm : Manages Communication between program and different communication channels.
- **App :** Contain Applicatoin Logic.

3. Drivers Documentation

- **Dio**

```
/*
Description : This function initialize PIN and set it's direction
ARGS        : take PIN Number and PORT Number and Direction (INPUT,OUTPUT)
return      : return DIO_OK if the PIN initializes correctly, DIO_NOT_OK otherwise
*/
EN_DIO_ERROR DIO_init(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber,EN_DIO_DIRECTION direction);
/*Description : This function write on PIN and set it's level
ARGS        : take PIN Number and PORT Number and level (LOW,HIGH)
return      : return DIO_OK if the PIN level sets correctly, DIO_NOT_OK otherwise
*/
EN_DIO_ERROR DIO_write(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber,EN_DIO_LEVEL level);
```

```
/*
Description : This function toggles PIN level
ARGS        : take PIN Number and PORT Number
return      : return DIO_OK if the PIN toggles correctly, DIO_NOT_OK otherwise
*/
EN_DIO_ERROR DIO_toggle(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber);
/*
Description : This function reads PIN level and store it in the variable
ARGS        : take PIN Number and PORT Number and pointer to the variable
return      : return DIO_OK if the PIN value stored correctly , DIO_NOT_OK otherwise
*/
EN_DIO_ERROR DIO_read(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber, uint8_t * value);
```

- **Usart**

```
/*
Description : This function inits Usart to operate on specfic mode look at usart.configs
ARGS        : channel id
return      : return STATUS_OK if the module initialized correctly , CONFIG_ERROR , CHANNEL_NOT_FOUND otherwise
*/
en_usart_error_code_t USART_init(uint8_t uint8_arg_channel_id);
/*
Description : This function set byte in the queue to be sent
ARGS        : byte to be sendd
return      : return STATUS_OK if the byte sent to queue correctly , QUEUE_OVERFLOW  otherwise
*/
en_usart_error_code_t USART_send_byte(uint8_t uint8_arg_byte);
```

```
/*
Description : This function set n of bytes in the queue to be sent
ARGS        : pointer to array of bytes
return      : return STATUS_OK if the bytes sent to queue correctly , QUEUE_OVERFLOW  otherwise
*/
en_usart_error_code_t USART_send_n_bytes(uint8_t *uint8_arg_arr_bytes,uint8_t uint8_arg_arr_size);
/*
Description : This function set call back function to specific pointer
ARGS        : pointer to function and state(send/receive)
return      : return STATUS_OK if the bytes sent to queue correctly , CALL_BACK_ERROR  otherwise
*/
en_usart_error_code_t USART_setCallBack(en_usart_operating_state_t en_usart_operating_state , void(*ptr_func)(void));
```

- **Led**

```
/*
Description : This function inits led as output
ARGS        : pointer to struct (pin/port)
return      : return LED_OK if the Led initialized correctly , LED_NOT_OKAY otherwise
*/
enu_led_error_t LED_init(str_led_config_t *str_ptr_led_config);
/*
Description : This function sent High to pin
ARGS        : pointer to struct (pin/port)
return      : return LED_OK if the Led turns high correctly , LED_NOT_OKAY otherwise
*/
enu_led_error_t LED_on(str_led_config_t *str_ptr_led_config);
```

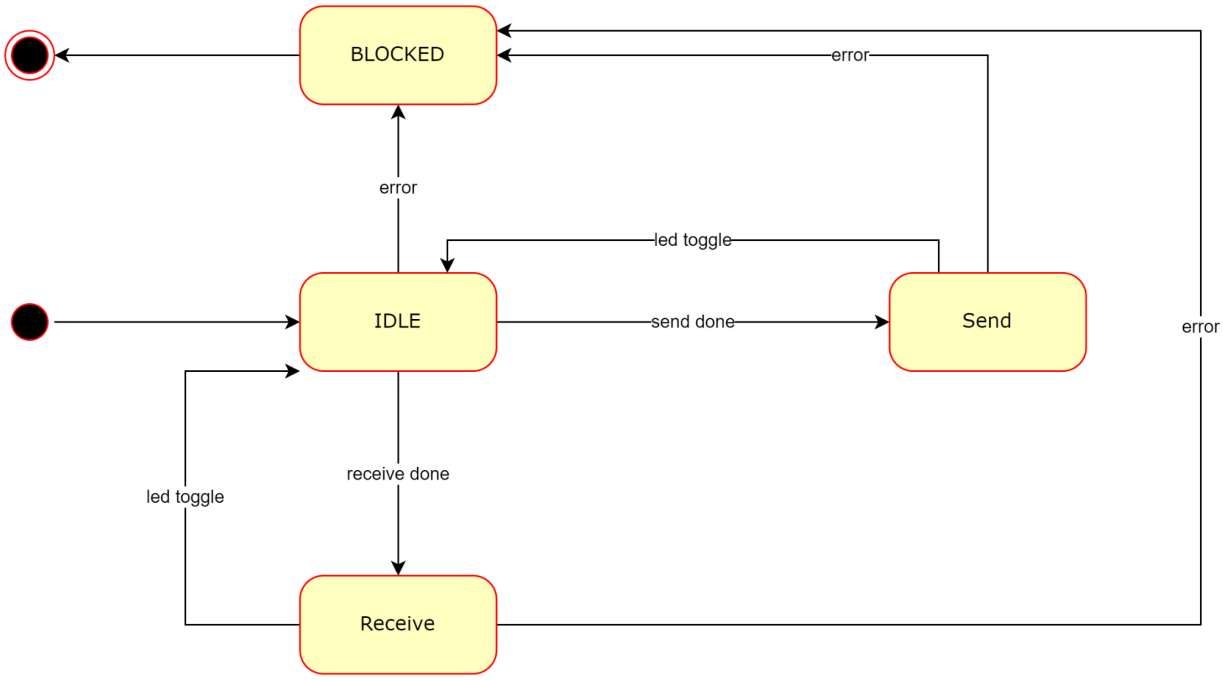
```
/*
Description : This function sent Low to pin
ARGS        : pointer to struct (pin/port)
return      : return LED_OK if the Led turns Low correctly , LED_NOT_OKAY otherwise
*/
enu_led_error_t LED_off(str_led_config_t *str_ptr_led_config);
/*
Description : This function toggle pin state
ARGS        : pointer to struct (pin/port)
return      : return LED_OK if the Led toggled correctly , LED_NOT_OKAY otherwise
*/
enu_led_error_t LED_toggle(str_led_config_t *str_ptr_led_config);
```

- **Bcm**

  Look at specification section [Specifications]

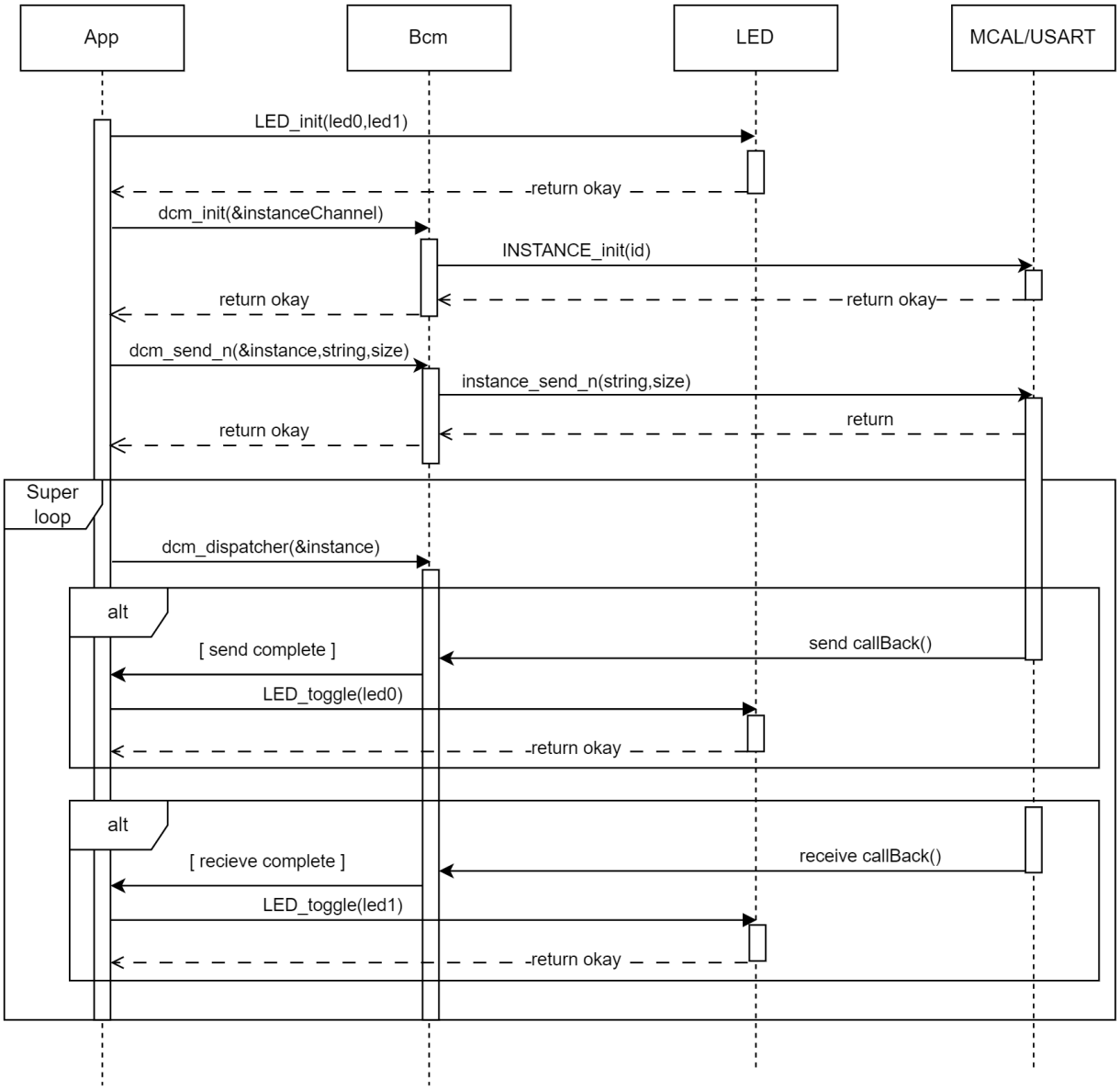
4. UML

- **State Machine**

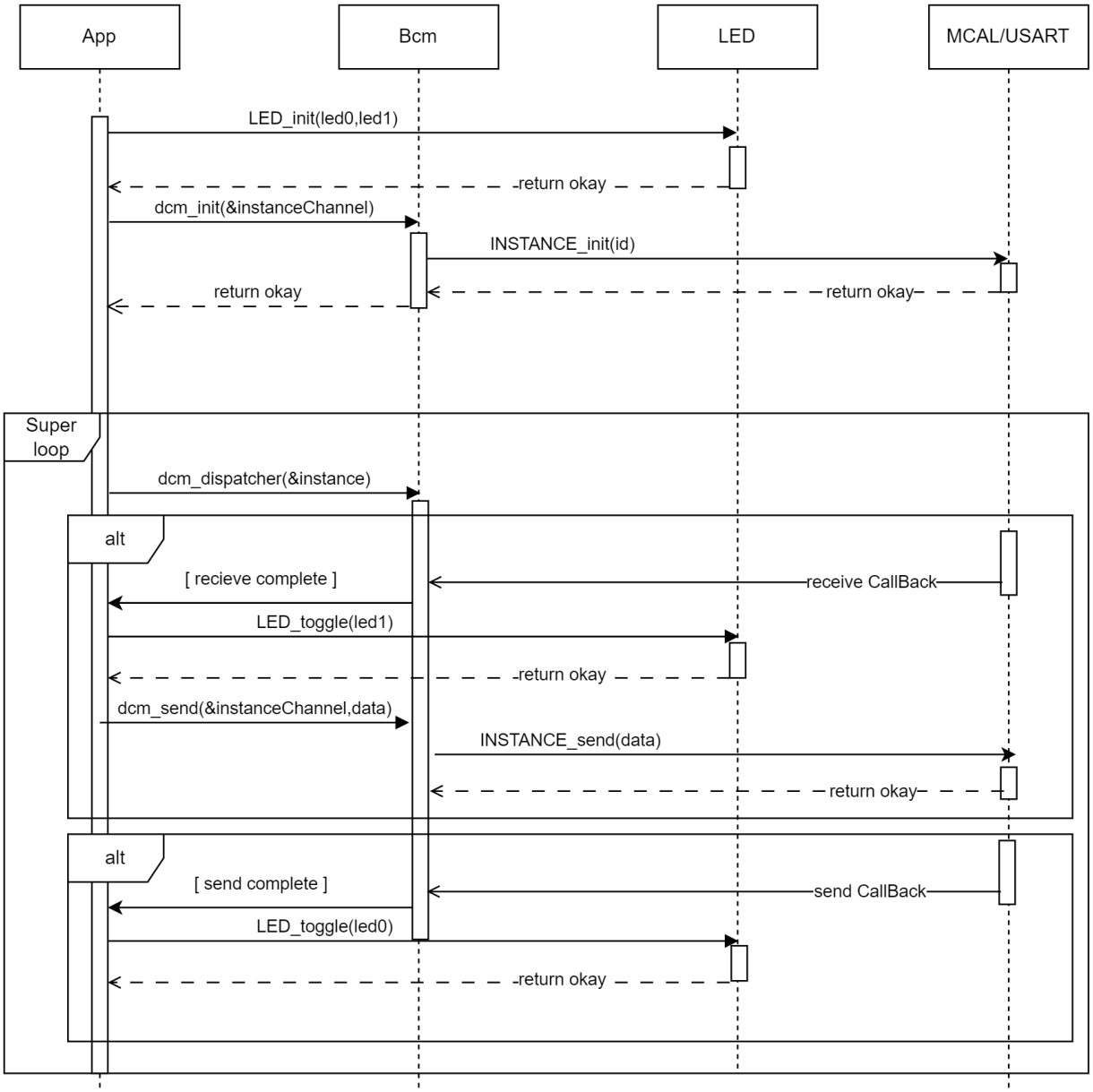


5. Sequence Diagram

- MCU_1

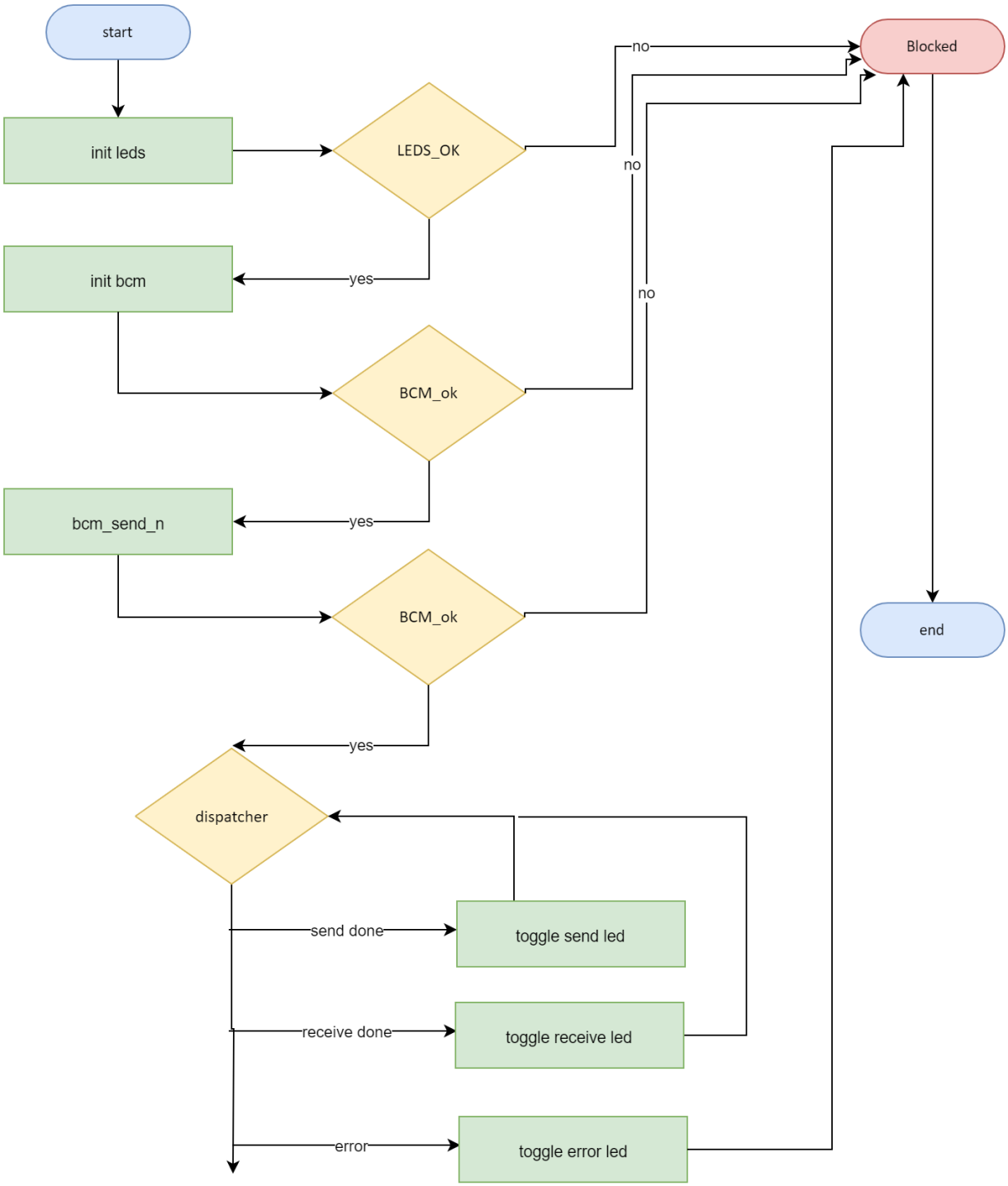


- MCU_2


App
Bcm
LED
MCAL/USART
LED_init(led0,led1)
return okay
dcm_init(&instanceChannel)
INSTANCE_init(id)
return okay
return okay
Super loop
dcm_dispatcher(&instance)
alt
[recieve complete]
receive CallBack
LED_toggle(led1)
return okay
dcm_send(&instanceChannel,data)
INSTANCE_send(data)
return okay
alt
[send complete]
send CallBack
LED_toggle(led0)
return okay

Low Level Design

Flowchart app



Pre-Compiling configuration

- **USART**

```
#define F_CPU                                   8000000UL
#define BAUDRATE                                9600
#define BAUD_PRESCALLER                 ((F_CPU/(16UL*BAUDRATE))-1)
#define BAUD_PRESCALLER_DOUBLE_SPEED    ((F_CPU/(8UL*BAUDRATE))-1)
#define USART_NORMAL_SPEED                      0
#define USART_DOUBLE_SPEED                      1
#define USART_ENABLE_INTERRUPT                  0
#define USART_DISABLE_INTERRUPT                 1
#define USART_CHANNELS                          2
#define TASKS_MAX_SIZE                          200
#define USART_SPEED_SELECT              USART_NORMAL_SPEED
#define USART_INTERRUPT_OPTION          USART_ENABLE_INTERRUPT
```

Linking Configuration

- **USART**

```
const str_usart_configs_t str_gl_usart_arr_configs[USART_CHANNELS] =
{
        {
                .uint8_channel_id           = 0,
                .en_usart_set_mode          = USART_ASYNC_MODE,
                .en_usart_operating_state   = USART_FULL_DUBLEX_STATE,
                .en_usart_parity_select     = USART_DIS_PARITY,
                .en_usart_stop_bit_select   = USART_ONE_STOP_BIT,
                .en_usart_data_size_select  = USART_DATA_SIZE_8,
        },
        {
                .uint8_channel_id           = 1,
                .en_usart_set_mode          = USART_ASYNC_MODE,
                .en_usart_operating_state   = USART_SEND_STATE,
                .en_usart_parity_select     = USART_EVEN_PARITY,
                .en_usart_stop_bit_select   = USART_TWO_STOP_BITS,
                .en_usart_data_size_select  = USART_DATA_SIZE_8,
        }
};
```

- Bcm

```
const str_bcm_instance_t str_bcm_instance[BCM_INSTANCES] =
{
        {
                .en_bcm_comm_type = BCM_USART,
                .en_bcm_channel   = CHANNEL_0,
                .str_bcm_functions_pointer.ptr_func_init    = USART_init,
                .str_bcm_functions_pointer.ptr_func_send    = USART_send_byte,
                .str_bcm_functions_pointer.ptr_func_send_n  = USART_send_n_bytes,
                .str_bcm_functions_pointer.ptr_func_setCall = USART_setCallBack

        },
        {
                .en_bcm_comm_type = BCM_SPI,
                .en_bcm_channel   = CHANNEL_1,
                //.str_bcm_functions_pointer.ptr_func_init   = SPI_init;
                //.str_bcm_functions_pointer.ptr_func_send   = SPI_send_byte;
                //.str_bcm_functions_pointer.ptr_func_send_n = SPI_send_n_bytes;
        }
};
```

To be Done Work

- Adding missing flowcharts