Design document

project title: LED sequence V1.0

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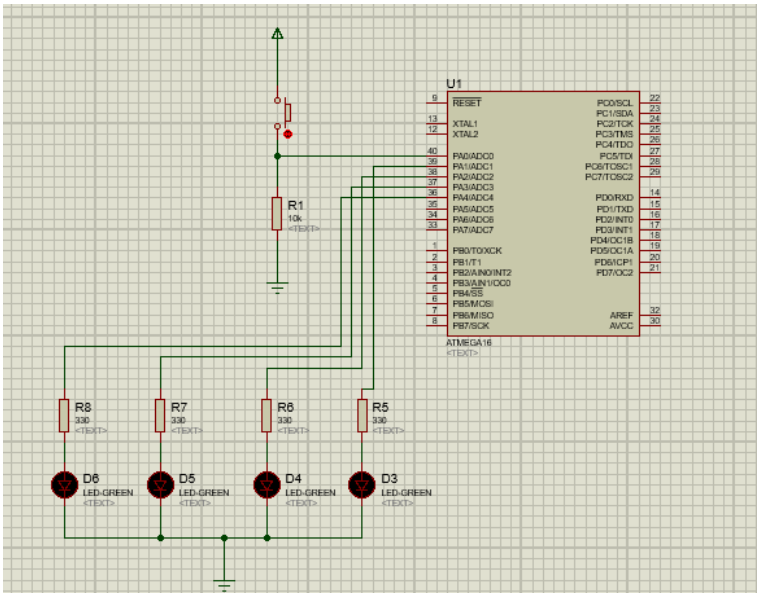
Project Description

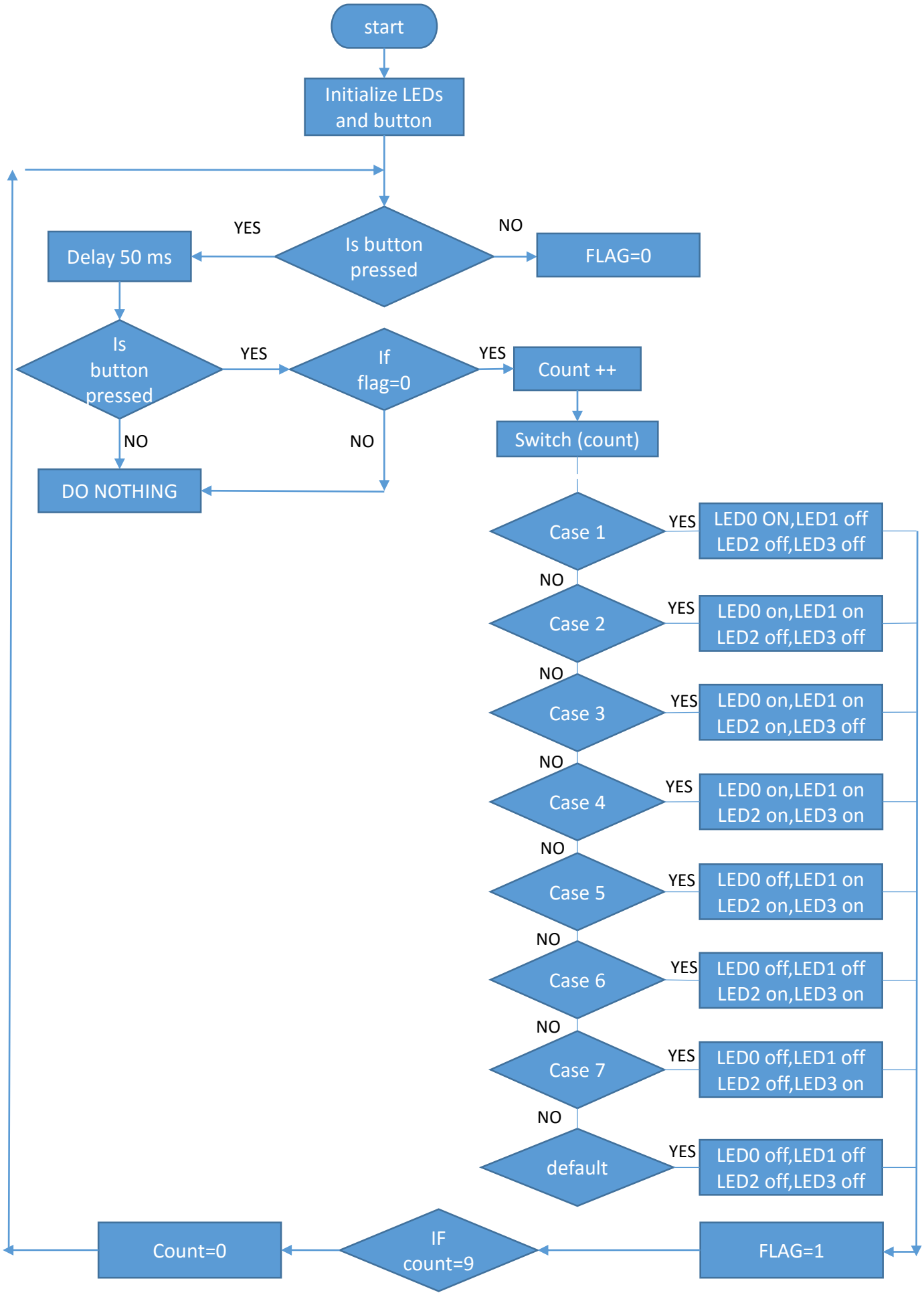
LED sequence project consists of

- ***Hardware components***
  - *Four LEDs (LED0, LED1, LED2, LED3)*
  - One button (BUTTON0)
- ***Software Requirements***
  - Initially, all LEDs are OFF
  - Once BUTTON0 is pressed, LED0 will be ON
  - Each press further will make another LED is ON
  - At the fifth press, LED0 will changed to be OFF
  - Each press further will make only one LED is OFF
  - This will be repeated forever
  - The sequence is described below
    - Initially (OFF, OFF, OFF, OFF)
    - Press 1 (ON, OFF, OFF, OFF)
    - Press 2 (ON, ON, OFF, OFF)
    - Press 3 (ON, ON, ON, OFF)
    - Press 4 (ON, ON, ON, ON)
    - Press 5 (OFF, ON, ON, ON)
    - Press 6 (OFF, OFF, ON, ON)
    - Press 7 (OFF, OFF, OFF, ON)
    - Press 8 (OFF, OFF, OFF, OFF)
    - Press 9 (ON, OFF, OFF, OFF)

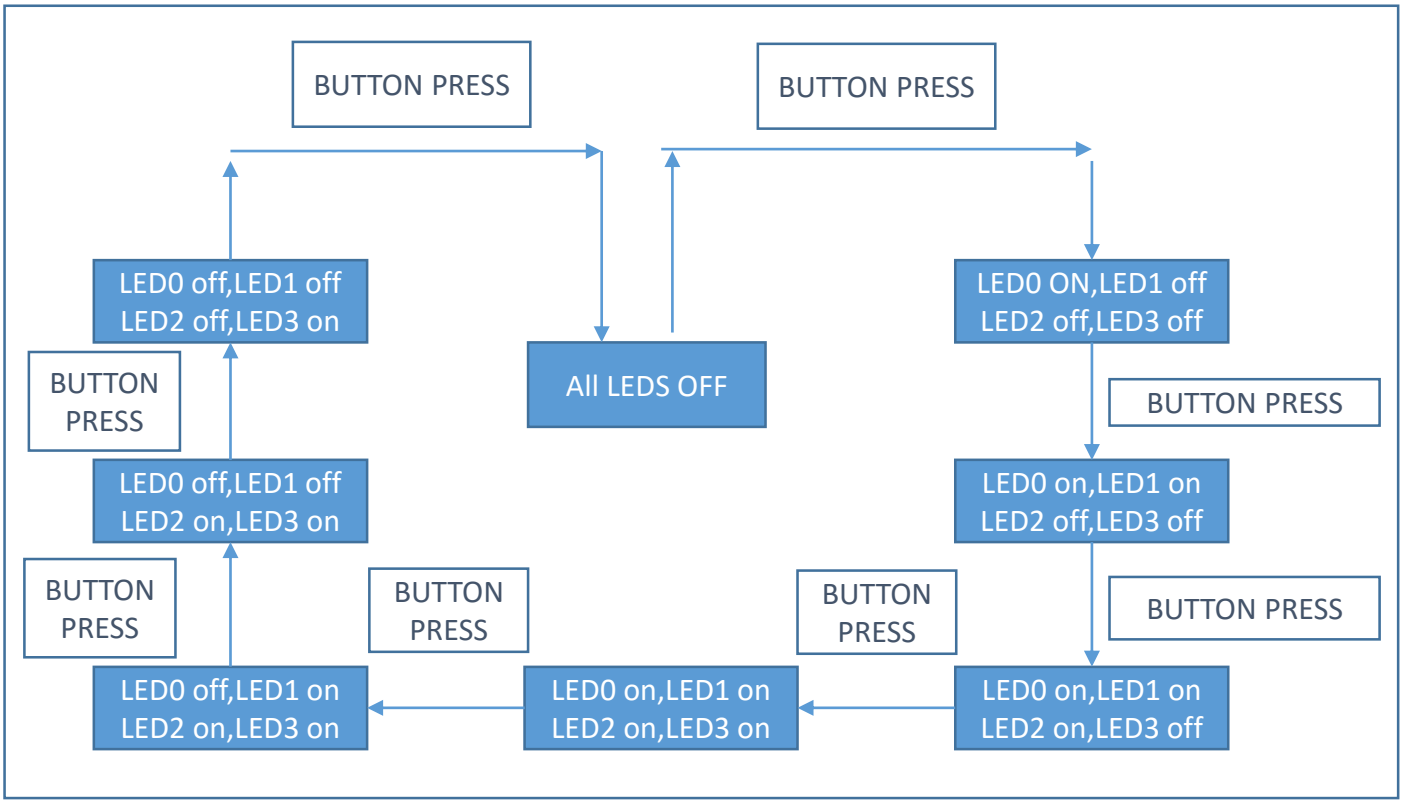


Circuit wiring

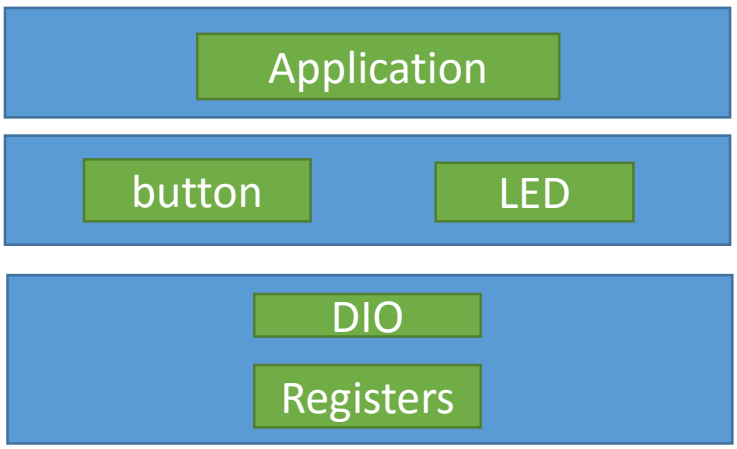
Project flowchart diagram



Project state machine diagram



Layered architecture



Project Modules APIs

- GPIO module APIs

/*============ TYPE DEFINITION ============*/

```
typedef enum{
PIN_INPUT,PIN_OUTPUT
}EN_PIN_DIRECTION;

typedef enum
{
PORT_INPUT,PORT_OUTPUT=0xFF
}EN_PORT_DIRECTION;

typedef enum{
Low,High
}EN_PIN_VALUE;

typedef enum{
LOW,HIGH=0xFF
}EN_PORT_VALUE;

typedef enum{
FAILED,SUCCESS
}EN_STATE;

typedef struct{
uint8 pinx;
uint8 ddrx;
uint8 portx;
}ST_register_name;
typedef ST_register_name* REG_NAME;
```

/*============ FUNCTION PROTOTYPE============*/

EN_STATE **pinMode(uint8 pin_no,EN_PIN_DIRECTION pin_direction);**

Description:

- PinMode:used to set pin direction input/output
- function parameters
- pin_no:pin number to set
- pin_direction:direction of the pin
- Return success pin number is in the range, FAILED if pin number out of the range

EN_STATE **digitalWrite(uint8 pin_no,EN_PIN_VALUE pin_val);**

Description:

- digitalWrite:used to write high/low to specific pin
- function parameters
- pin_no:pin number to write
- pin_val:output value high / low
- Return success pin number is in the range, FAILED if pin number out of the range

Project Modules APIs

- GPIO module APIs

EN_STATE **digitalRead(uint8 pin_no,uint8 *pin_val);**

Description:

- digitalRead:used to read specific pin value
- function parameters
- pin_no:pin number to read
- pin_val:address to variable of the return reading
- Return success pin number is in the range, FAILED if pin number out of the range

EN_STATE portMode(REG_NAME port,EN_PORT_DIRECTION port_direction);

Description:

- portMode: used to specific port direction
- function parameters
- port: port name (PORTA-PORTB-PORTC-PORTD)
- port_direction: direction of the port
- Return success port name is in the range, FAILED if port name out of the range

EN_STATE digitalWrite_Port(REG_NAME port,EN_PORT_VALUE port_val);

Description

- digitalWrite_PORT:used to write high/low to specific port
- function parameters
- port: port name (PORTA-PORTB-PORTC-PORTD)
- port_val: output value HIGH / LOW
- Return success port name is in the range, FAILED if port name out of the range

EN_STATE digitalRead_Port(REG_NAME port,uint8 *port_val);

Description

- digitalRead_PORT:used to read specific port value
- function parameters
- port: port name (PORTA-PORTB-PORTC-PORTD)
- port_val: address to variable of the return reading
- Return success port name is in the range, FAILED if port name out of the range

EN_STATE **Enable_PULLUP (uint8 pin_no);**

Description

- active internal pull up resistor for specific pin
- pin_no:pin number to set
- Return success pin number is in the range, FAILED if pin number out of the range

Project Modules APIs

❑ LED module APIs

/*============= MACRO DEFINITION =============*/

#define LED_logic 1 //1:positive logic , 2:negative logic

Description : Macro used to configure LED logic connection

/*============= FUNCTION PROTOTYPE =============*/

EN_STATE **LED_init(uint8 led);**

Description:

- LED_init: used to initialize LED direction and initial value for the pin
- function parameters
- Led: pin number to be set
- Return success pin number is in the range, FAILED if pin number out of the range

EN_STATE **LED_digitalwrite(uint8 led,EN_PIN_VALUE value);**

Description

- LED_digitalwrite**:** used to write high/low to specific led
- function parameters
- Led: pin number to be set
- Value: led high/low
- Return success pin number is in the range, FAILED if pin number out of the range

❑ BUTTON module APIs

/*============= TYPE DEFINITION =============*/

typedef enum{

disable,enable

}EN_internal_pullup;

/*============= FUNCTION PROTOTYPE =============*/

EN_STATE Button_init(uint8 pin,EN_internal_pullup state);

Description

- Button_init: used to initialize BUTTON direction and set internal pullup resistor
- function parameters
- pin: pin number to be set
- State: to disable/enable internal pullup resistor
- Return success pin number is in the range, FAILED if pin number out of the range

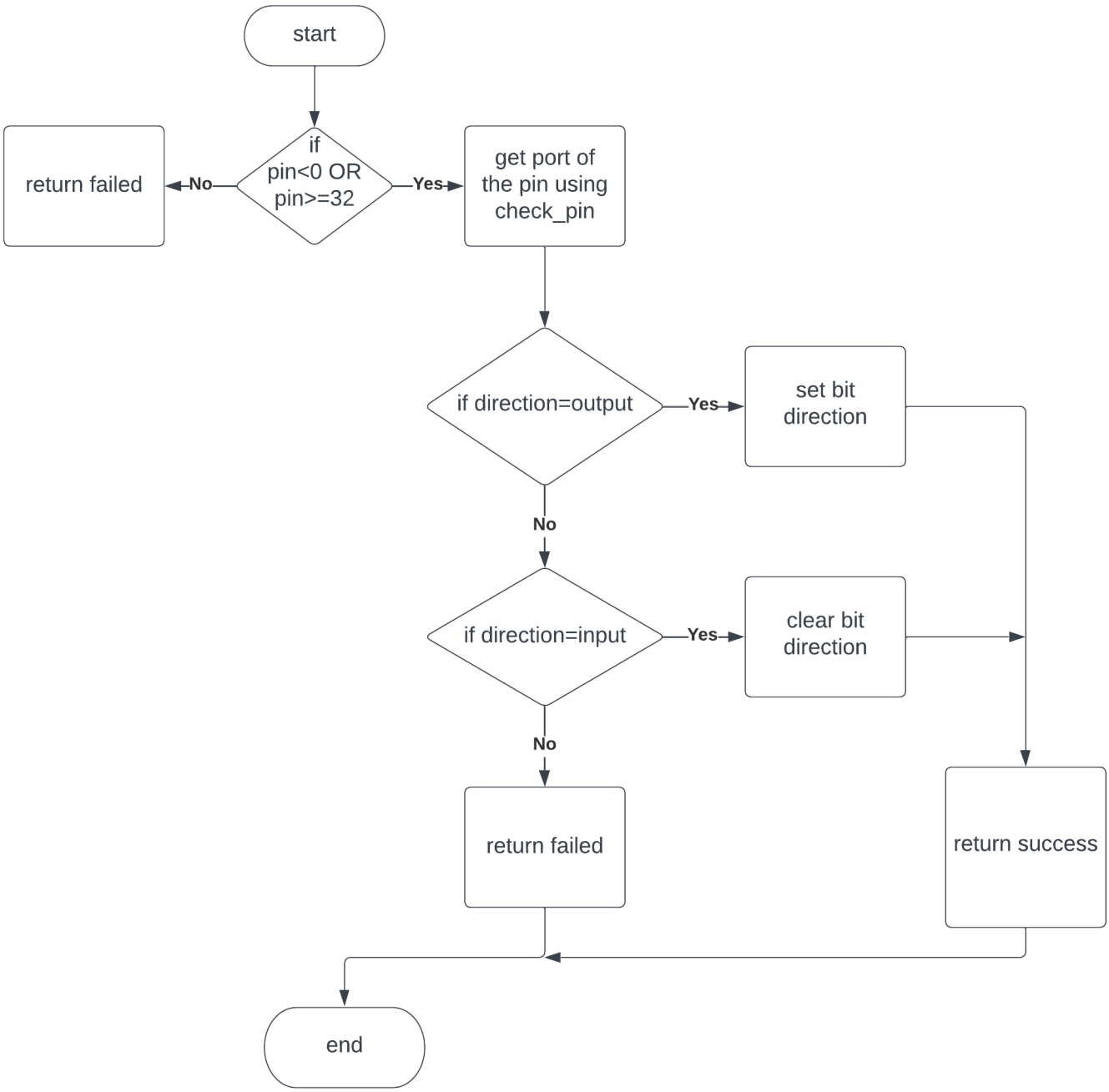
uint8 Button_Read(uint8 pin);

Description

- Button_Read: used to read button state high/low
- function parameters
- pin: pin number to read
- Return button state high / low

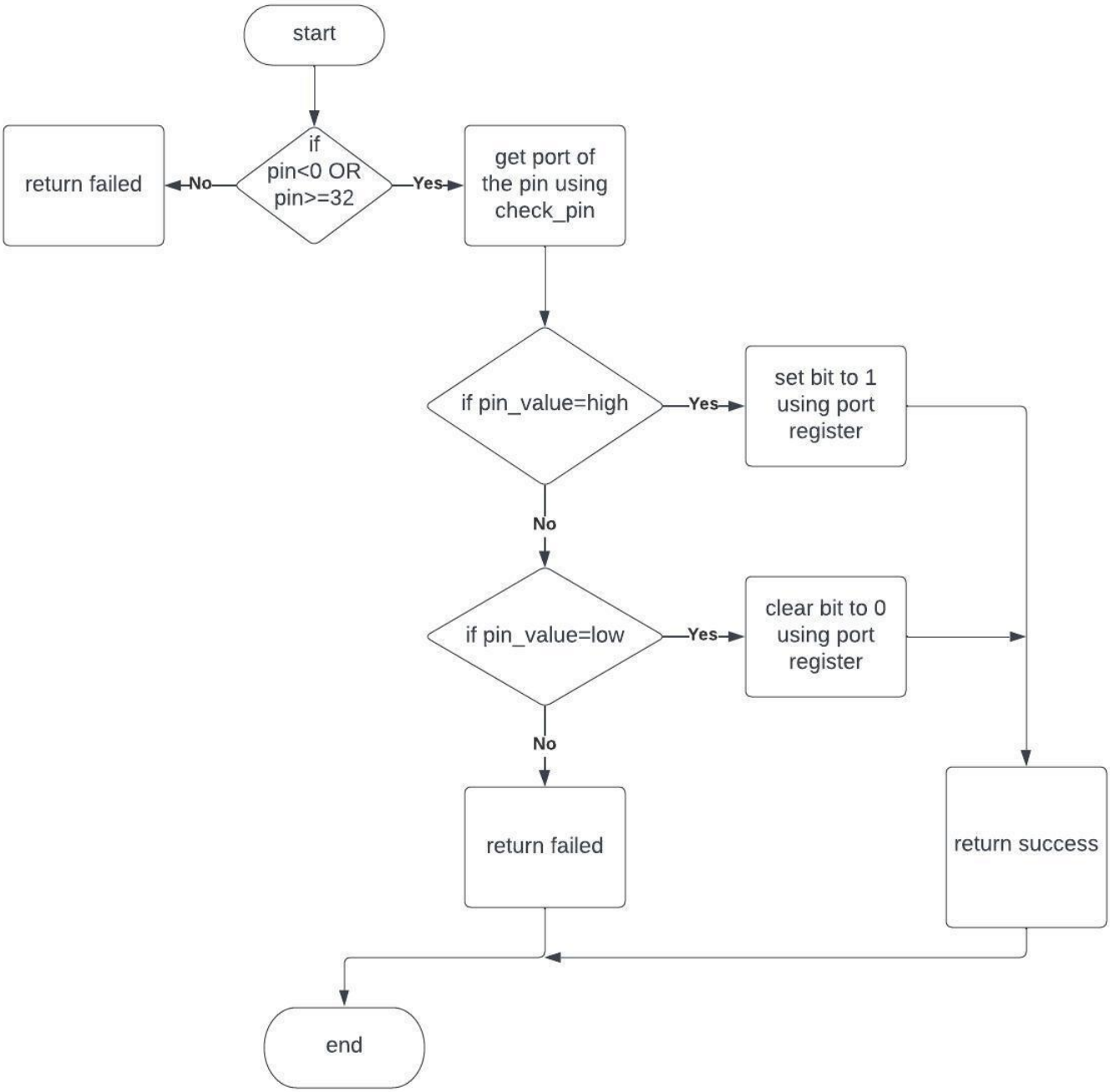
APIs flowcharts

EN_STATE **pinMode(uint8 pin_no,EN_PIN_DIRECTION pin_direction);**



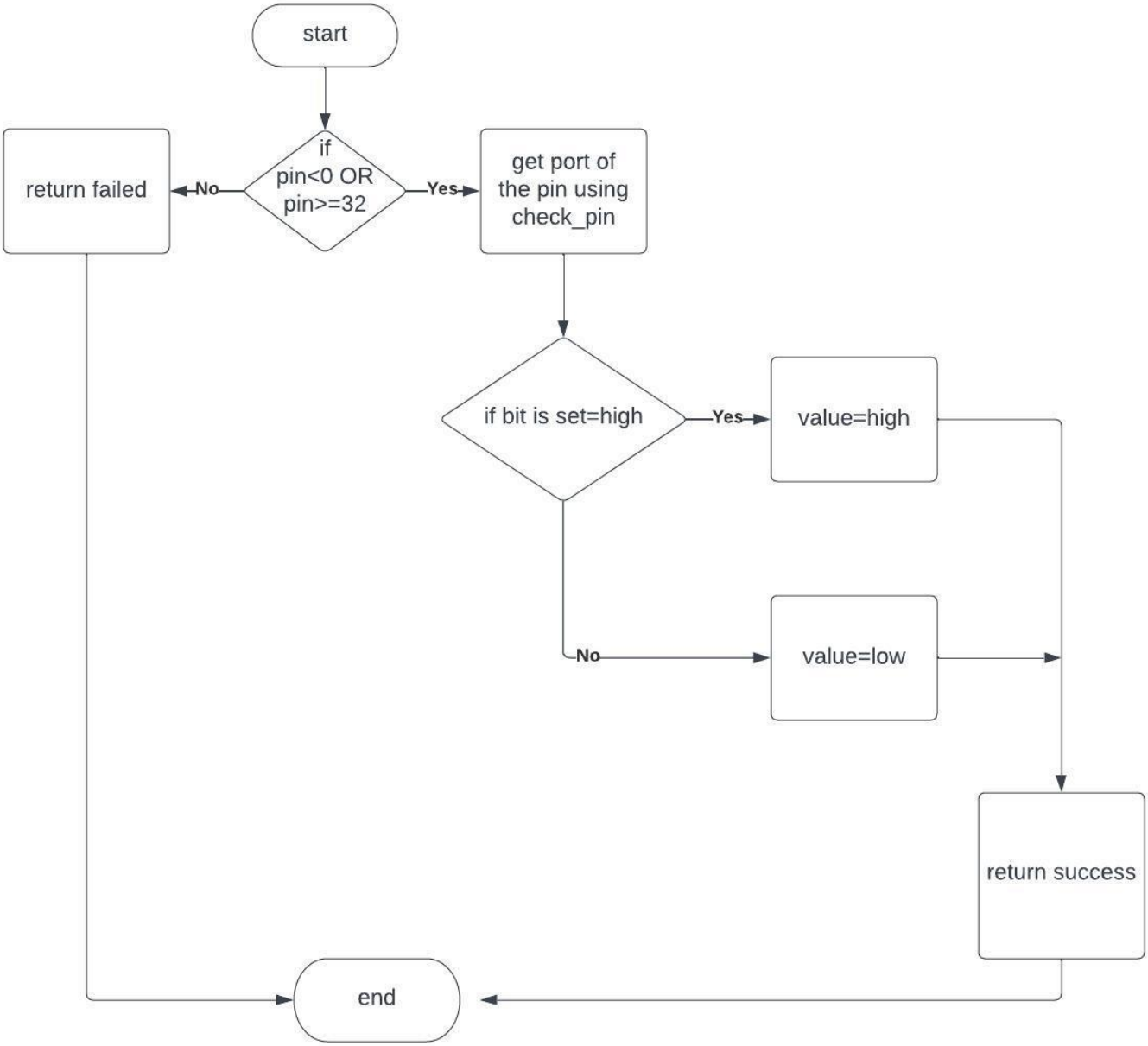
APIs flowcharts

- EN_STATE **digitalWrite(uint8 pin_no,EN_PIN_VALUE pin_val);**



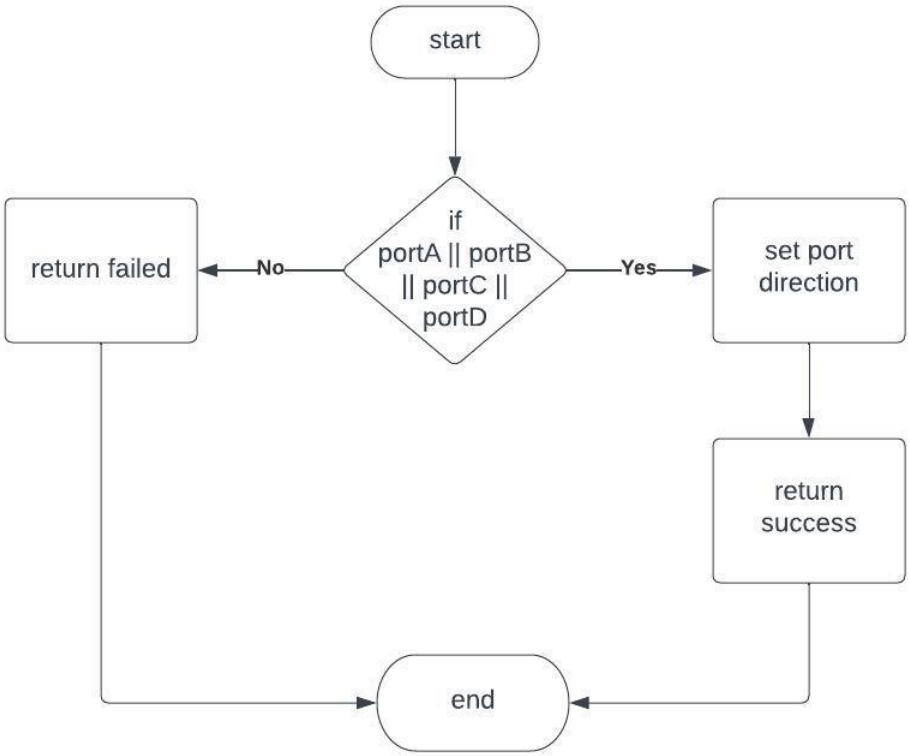
APIs flowcharts

- EN_STATE **digitalRead(uint8 pin_no,uint8 *pin_val);**

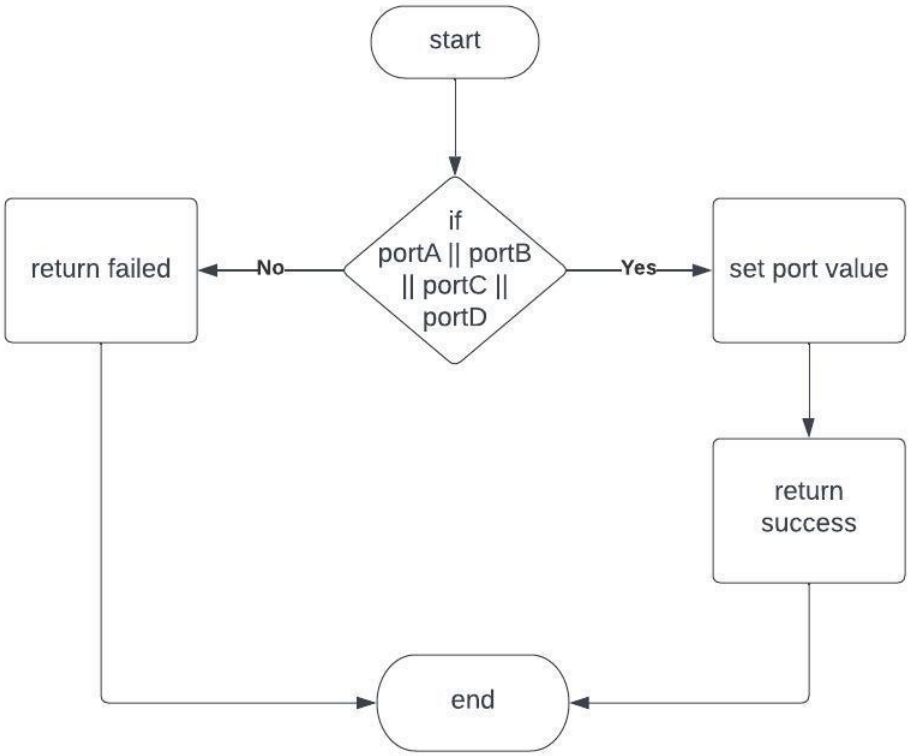


APIs flowcharts

EN_STATE portMode(REG_NAME port,EN_PORT_DIRECTION port_direction);

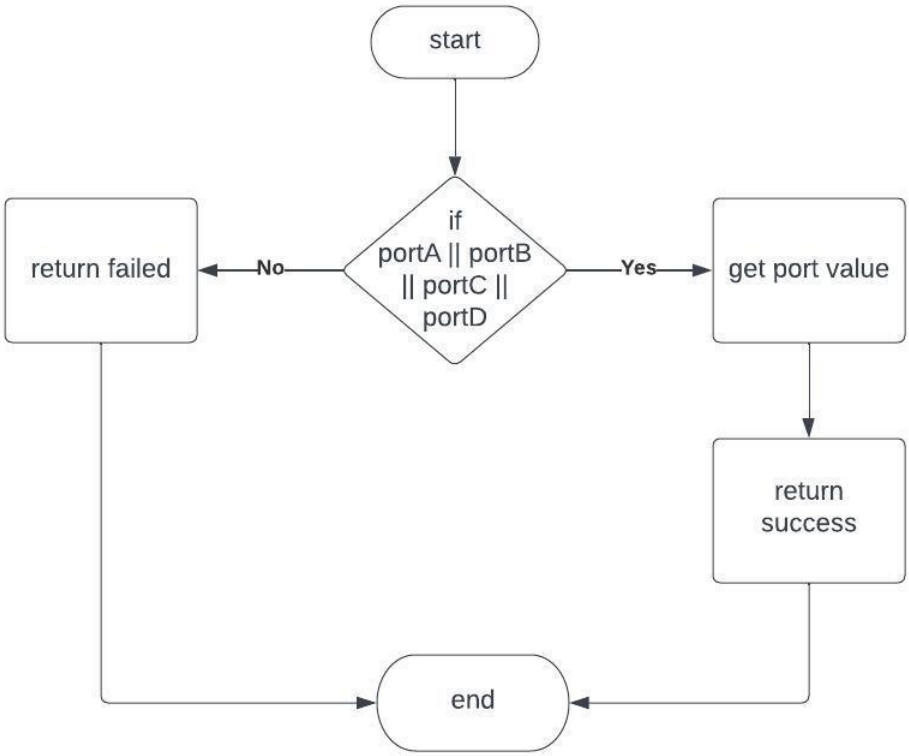


EN_STATE digitalWrite_Port(REG_NAME port,EN_PORT_VALUE port_val);

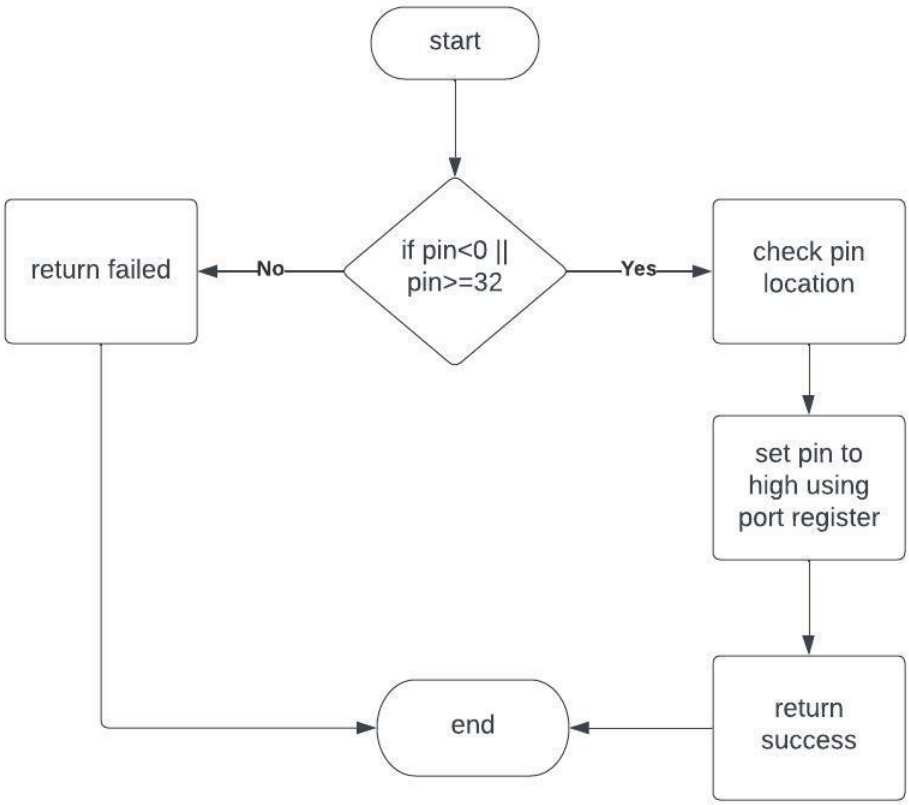


APIs flowcharts

EN_STATE digitalRead_Port(REG_NAME port,uint8 *port_val);

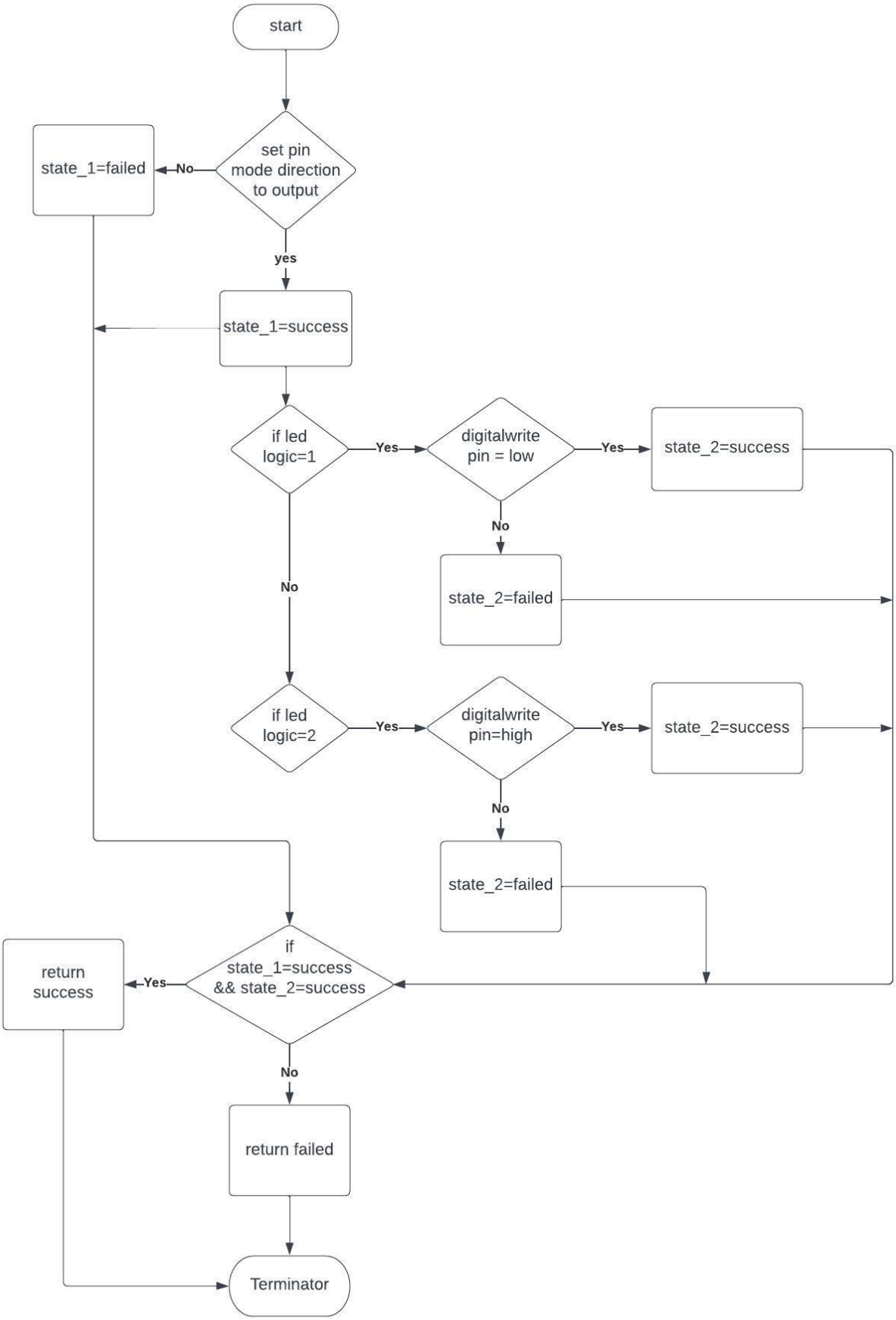


EN_STATE **Enable_PULLUP (uint8 pin_no);**



APIs flowcharts

EN_STATE **LED_init(uint8 led);**



APIs flowcharts

EN_STATE **LED_digitalwrite(uint8 led,EN_PIN_VALUE value);**

APIs flowcharts

EN_STATE Button_init(uint8 pin,EN_internal_pullup state);

uint8 **Button_Read(uint8 pin)**