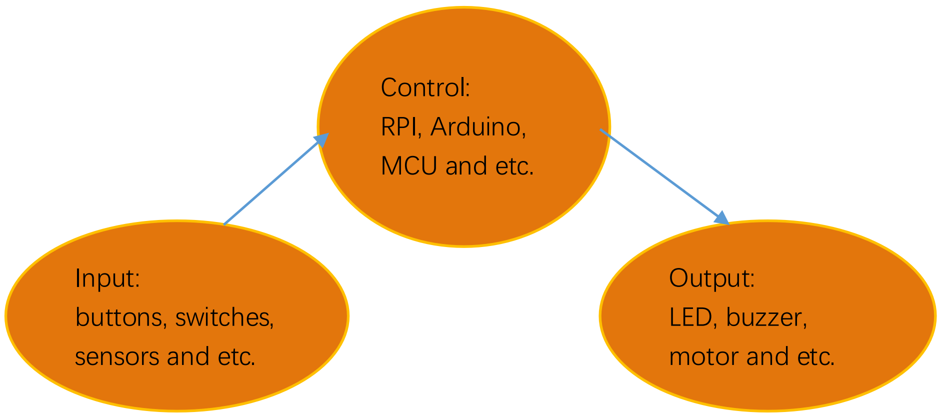
Chapter 2 Button & LED

Usually, there are three essential parts in a complete automatic control device: INPUT, OUTPUT, and CONTROL. In last section, the LED module is the output part and RPI is the control part. In practical applications, we not only just let the LED lights flash, but make the device sense the surrounding environment, receive instructions and then make the appropriate action such as lights the LED, make a buzzer beep and so on.

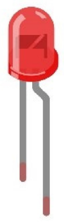
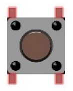


Next, we will build a simple control system to control LED through a button.

Project 2.1 Button & LED

In the project, we will control the LED state through a button. When the button is pressed, LED will be turn on, and when it is released, LED will be turn off.

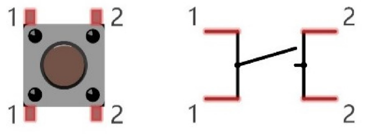
Component List

Raspberry Pi 3B x1 GPIO Extension Board & Wire x1 BreadBoard x1 Jumper 	LED x1 	Resistor 220Ω x1 	Resistor 10kΩ x2 	Push button x1 

Component knowledge

Push button

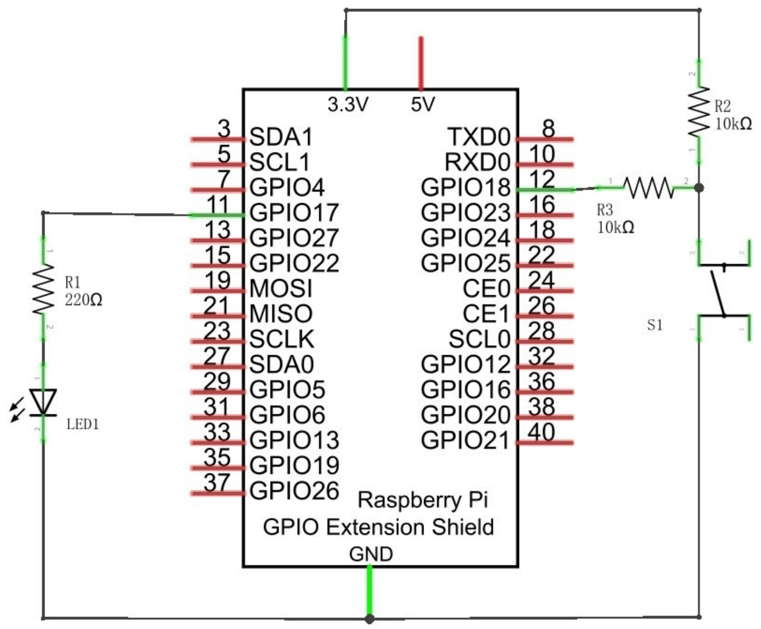
Push button has 4 pins. Two pins on the left is connected, and the right is similar as the left, which is shown in the below:



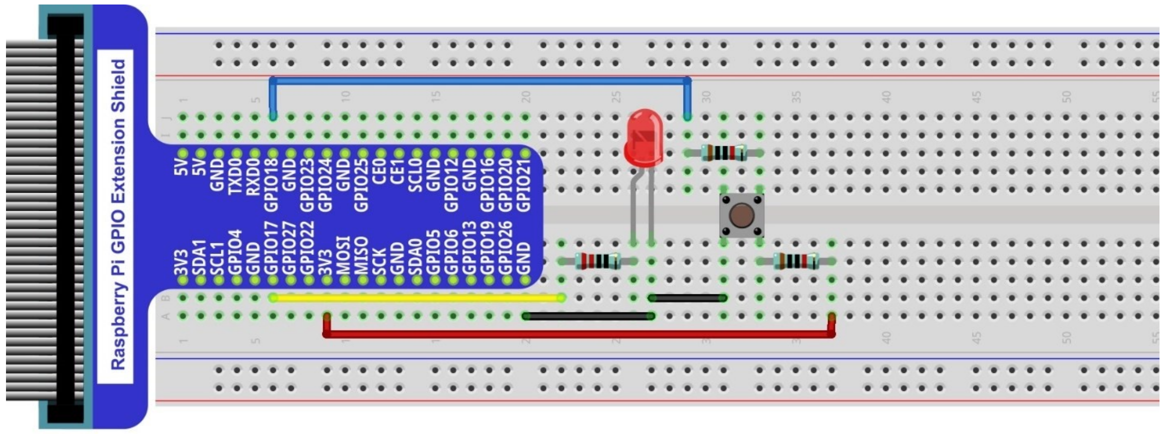
When the push button is pressed, the circuit is turned on.

Circuit

Schematic diagram



Hardware connection. If you need any support, pleasefeel free to contact us via: **support@freenove.com**



Code

This project is designed for learning how to use button to control LED. We first need to read the state of button, and then determine whether turn on LED according to the state of the button.

C Code 2.1.1 ButtonLED

First, observe the project result, then analyze the code.

1. Use cd command to enter 02.1.1_ButtonLED directory of C code.

```
cd ~/Freenove_Ultimate_Starter_Kit_for_Raspberry_Pi/Code/C_Code/02.1.1_ButtonLED
```

2. Use the following command to compile the code “ButtonLED.c” and generate executable file “ButtonLED”

```
gcc ButtonLED.c -o ButtonLED -lwiringPi
```

3. Then run the generated file “ButtonLED”.

```
sudo ./ButtonLED
```

Later, the terminal window continues to print out the characters “led off…”. Press the button, then LED is turned on and then terminal window prints out the "led on…". Release the button, then LED is turned off and then terminal window prints out the "led off…". You can press "Ctrl+C" to terminate the program.

The following is the program code:

```
#include <wiringPi.h>
#include <stdio.h>

#define ledPin    0     //define the ledPin
#define buttonPin 1     //define the buttonPin

int main(void)
{
    if(wiringPiSetup() == -1){ //when initialization for wiring fails, print message to
screen
        printf("setup wiringPi failed !");
        return 1;
    }

    pinMode(ledPin, OUTPUT);
    pinMode(buttonPin, INPUT);

    pullUpDnControl(buttonPin, PUD_UP);  //pull up to high level
    while(1){

        if(digitalRead(buttonPin) == LOW){ //button has pressed down
            digitalWrite(ledPin, HIGH);   //led on
            printf("led on...\n");
        }
        else {              //button has released
            digitalWrite(ledPin, LOW);   //led off
            printf("...led off\n");
        }
    }
    return 0;
}
```

In the circuit connection, LED and Button are connected with GPIO17 and GPIO18 respectively, which correspond to 0 and 1 respectively in wiringPI. So define ledPin and buttonPin as 0 and 1 respectively.

```
#define ledPin    0     //define the ledPin
#define buttonPin 1     //define the buttonPin
```

In the while cycle of main function, use digitalRead(buttonPin) to determine the state of Button. When the button is pressed, the function returns low level, the result of “if” is true, and then turn on LED. Or, turn off LED.

```
if(digitalRead(buttonPin) == LOW){ //button has pressed down
            digitalWrite(ledPin, HIGH);   //led on
            printf("led on...\n");
        }
        else {              //button has released
            digitalWrite(ledPin, LOW);   //led off
            printf("...led off\n");
        }
```

About digitalRead():

`int digitalRead (int pin);`
This function returns the value read at the given pin. It will be “**HIGH**” or “**LOW**”(1 or 0) depending on the logic level at the pin.

Python Code 2.1.1 ButtonLED

First, observe the project result, then analyze the code.

1. Use cd command to enter 01.1.1_btnLED directory of Python code.

```
cd ~/Freenove_Ultimate_Starter_Kit_for_Raspberry_Pi/Code/Python_Code/02.1.1_ButtonLED
```

2. Use Python command to execute btnLED.py.

```
python ButtonLED.py
```

Later, the terminal window continue to print out the characters “led off···”, press the button, then LED is turned on and then terminal window print out the "led on···". Release the button, then LED is turned off and then terminal window print out the "led off···". You can press "Ctrl+C" to terminate the program.

The following is the program code:

```python
import RPi.GPIO as GPIO

ledPin = 11    # define the ledPin
buttonPin = 12    # define the buttonPin

def setup():
    print ('Program is starting...')
    GPIO.setmode(GPIO.BOARD)       # Numbers GPIOs by physical location
    GPIO.setup(ledPin, GPIO.OUT)   # Set ledPin's mode is output
    GPIO.setup(buttonPin, GPIO.IN, pull_up_down=GPIO.PUD_UP)    # Set buttonPin's mode is
input, and pull up to high level(3.3V)

def loop():
    while True:
        if GPIO.input(buttonPin)==GPIO.LOW:
            GPIO.output(ledPin,GPIO.HIGH)
            print ('led on ...')
        else :
            GPIO.output(ledPin,GPIO.LOW)
            print ('led off ...')

def destroy():
    GPIO.output(ledPin, GPIO.LOW)     # led off
    GPIO.cleanup()                     # Release resource

if __name__ == '__main__':     # Program start from here
    setup()
    try:
        loop()
    except KeyboardInterrupt:  # When 'Ctrl+C' is pressed, the subprogram destroy() will
be  executed.
        destroy()
```

In subfunction setup (), GPIO.setmode (GPIO.BOARD) is used to set the serial number of the GPIO, which is based on physical location of the pin. So, GPIO17 and GPIO18 correspond to pin11 and pin12 respectively in the circuit. Then set ledPin to output mode, buttonPin to input mode with a pull resistor.

```
ledPin = 11    # define the ledPin
buttonPin = 12    # define the buttonPin
def setup():
    print ('Program is starting...')
    GPIO.setmode(GPIO.BOARD)       # Numbers GPIOs by physical location
    GPIO.setup(ledPin, GPIO.OUT)   # Set ledPin's mode is output
    GPIO.setup(buttonPin, GPIO.IN, pull_up_down=GPIO.PUD_UP)    # Set buttonPin's mode is 
input, and pull up to high level(3.3V)
```

In the loop function while dead circulation, continue to judge whether the key is pressed. When the button is pressed, the GPIO.input(buttonPin) will return low level, then the result of "if" is true, ledPin outputs high level, LED is turned on. Or, LED will be turned off.

```
def loop():
    while True:
        if GPIO.input(buttonPin)==GPIO.LOW:
            GPIO.output(ledPin,GPIO.HIGH)
            print ('led on ...')
        else :
            GPIO.output(ledPin,GPIO.LOW)
            print ('led off ...')
```

Execute the function destroy (), close the program and release the resource.
About function GPIO.input ():

GPIO.input()

This function returns the value read at the given pin. It will be "**HIGH**" or "**LOW**"(1 or 0) depending on the logic level at the pin.