LAB MANUAL 5

Getting Started with DFRobot Hat & Raspberry PI (Installation with Led blink)

This IO Expansion HAT from DFRobot is the perfect companion for your Raspberry Pi 4B/3B+! It leads out all of the IO ports on Raspberry Pi including digital port, analog port, PWM, IIC, UART, SPI, and IIS. Besides that, the HAT is totally compatible with DFRobot Gravity Series which frees users from complicated connection work, and enables them to just concentrate on their projects building.

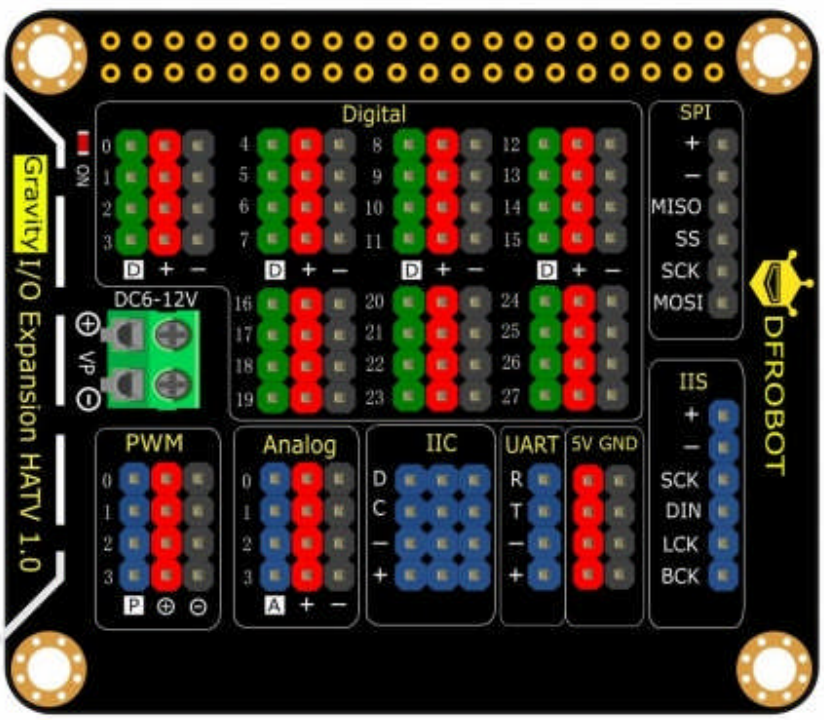
Raspberry Pi GPIO pins work with a maximum logic level of 3.3V. Besides the 3.3V power sensor and module, the product also supports:

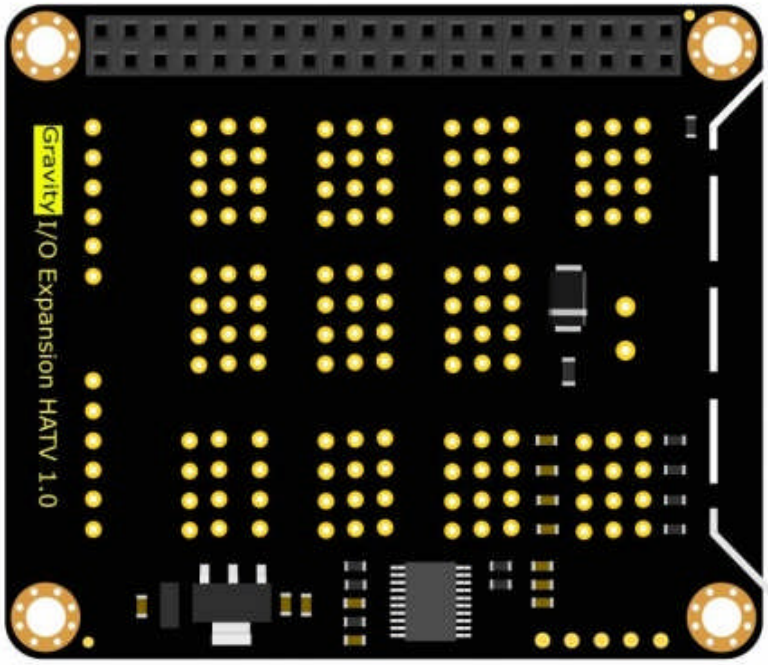
- Sensor and module with 5V power supply and 3.3V level
- PWM external power supply (6~12V)
- Controlling multiple servos

Specification

- Driver Main controller: STM32
- Operating Voltage: 5V
- PWM External Power Supply: 6-12V
- PWM Pin Voltage: 5V
- Sensor Interface Power Supply: 3.3V
- Communication Interface: 28 digital Ports, 4 groups of analog port, 3 groups of IIC port, 1 group of UART, 4 groups of 5V power interfaces, 1 group of SPI, 1 group of IIS port
- Device Address: 0x10
- Outline Dimension: 65×56mm/2.56×2.20”

Board Overview





Silkscreen	Label	Description
+	+	3.3V Positive
-	-	Negative
⊕	⊕	Binding post connect to external power positive
⊖	⊖	Binding post connect to external power negative
Digital	0-27	Raspberry Pi GPIO0-GPIO27
PWM	0-3	PWM signal output pin 0-3
Analog	0-3	Analog signal input pin 0-3
IIC	C	IIC port clock line
	D	IIC port data line
UART	T	UART Transmit port
	R	UART Receive port
5V	5V	5V positive
GND	GND	Negative
IIS	SCK	IIS serial clock line
	DIN	IIS serial data input
	LCK	IIS L/R channel selection line
	BCK	IIS system clock line
SPI	MISO	SPI data output line
	SS	SPI enable pin
	SCLK	SPI serial clock line
	MOSI	SPI data input line

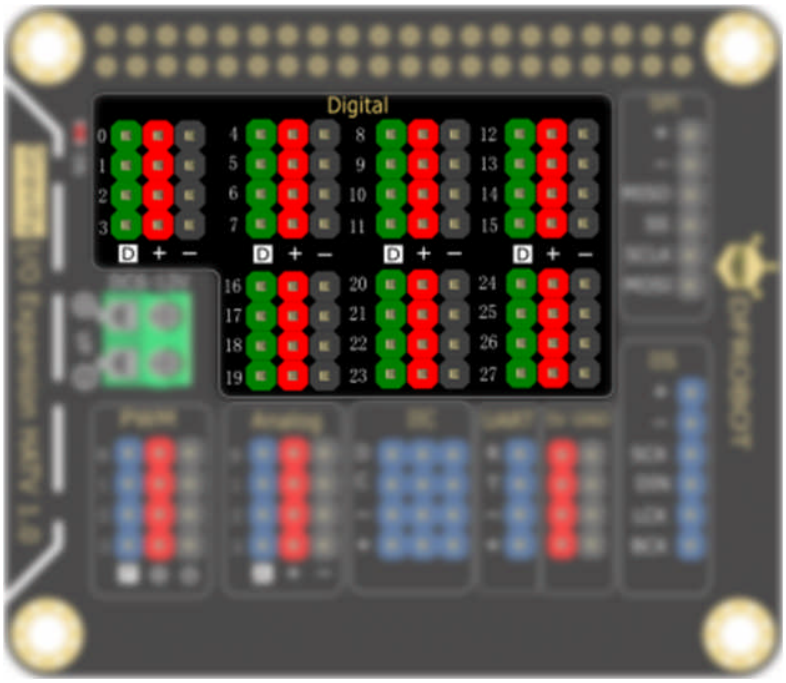
Note:

- The GPIO number in this board adopts BCM codes.
- When the VP port is not power by external power, the voltage of PWM ⊕ is 5V.

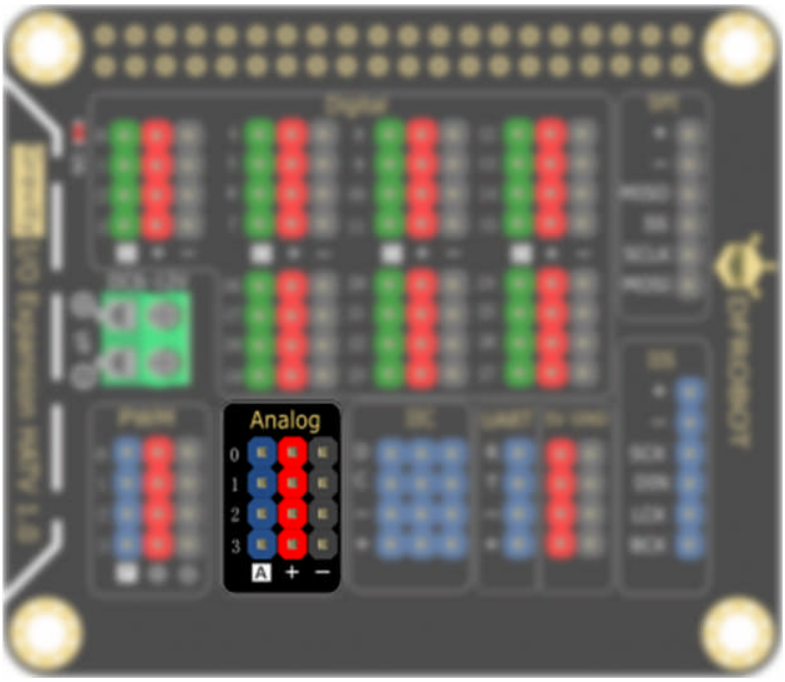
- When the VP port is powered by external power, the voltage of PWM ⊕ is equal to that of the VP external power (6-12V).

Port and Learning Guide

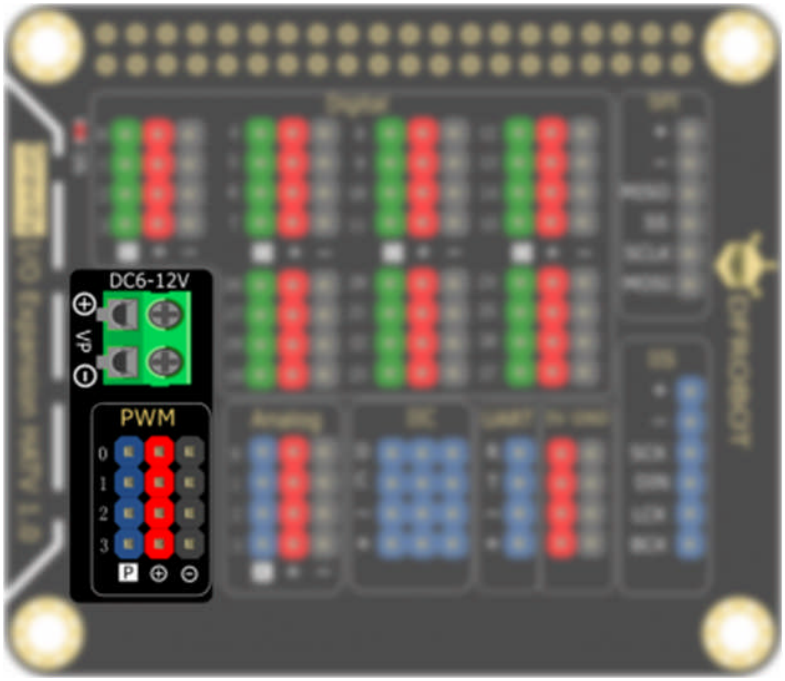
- Digital Port: IO expansion board offers 28 groups (D0-D27) of digital ports that are led out via Raspberry Pi ports GPIO0~GPIO27 (BCM codes).



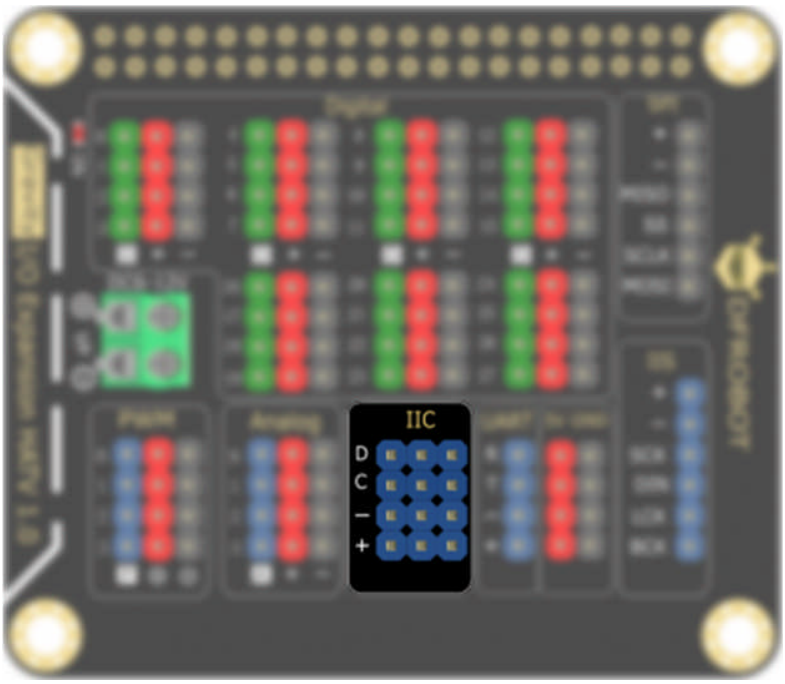
- Analog Port: IO expansion board has four groups of analog ports A0-A3. The board integrates on-board MCU STM32, and 12-bits ADC. The input voltage of analog sensor is 12-bit ADC. After the analog data is converted into digital data, it will be sent to Raspberry Pi via IIC communication.



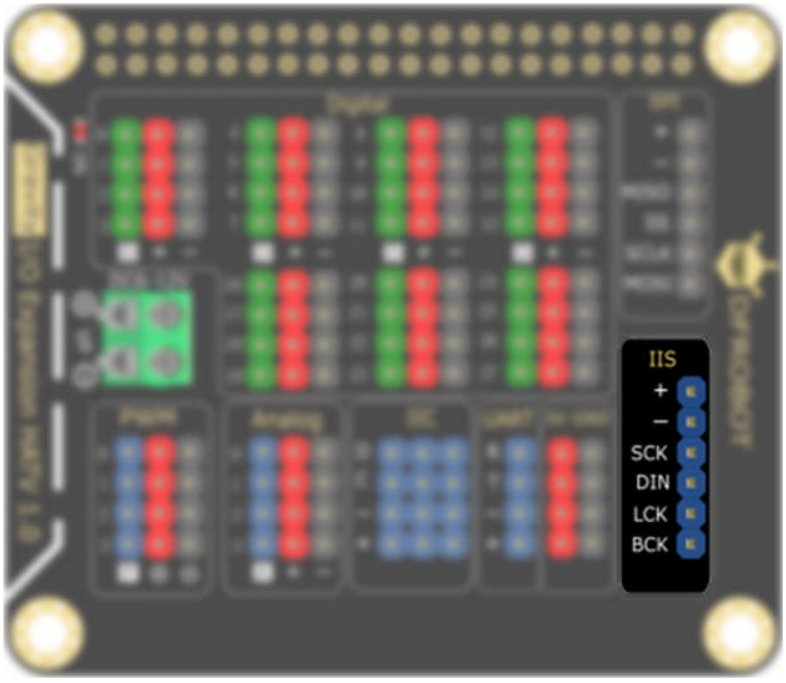
- PWM Port: IO expansion board provides four groups of PWM ports. Connect the STM32 to PWM. Raspberry Pi will send data to STM32 via IIC to control. VP port can supply 6-12V external power to PWM port. When not powered, the voltage of PWM ⊕ is 3.3V.



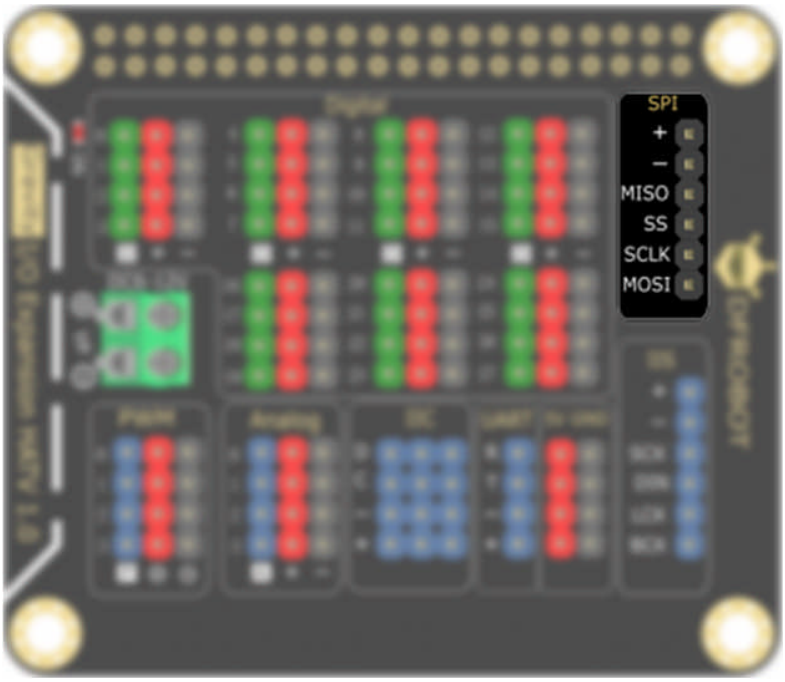
- IIC Port: IO expansion board has 3 groups of IIC ports that are led out via Raspberry Pi GPIO2（SDA.1）and GPIO3（SCL.1）（BCM code).



- IIS Port: there is 1 group of IIS port that is led out via Raspberry Pi GPIO ports: GIO21 (SCK), GPIO20(DIN), GPIO19(LCK), GPIO18(BCK).



- SPI Port: IO expansion board leads out a group of SPI ports via its GPIO port (BCM code): GPIO10(MOSI)and GPIO9(MISO), GIO11(SCLK), GPIO8(SS).



Hardware

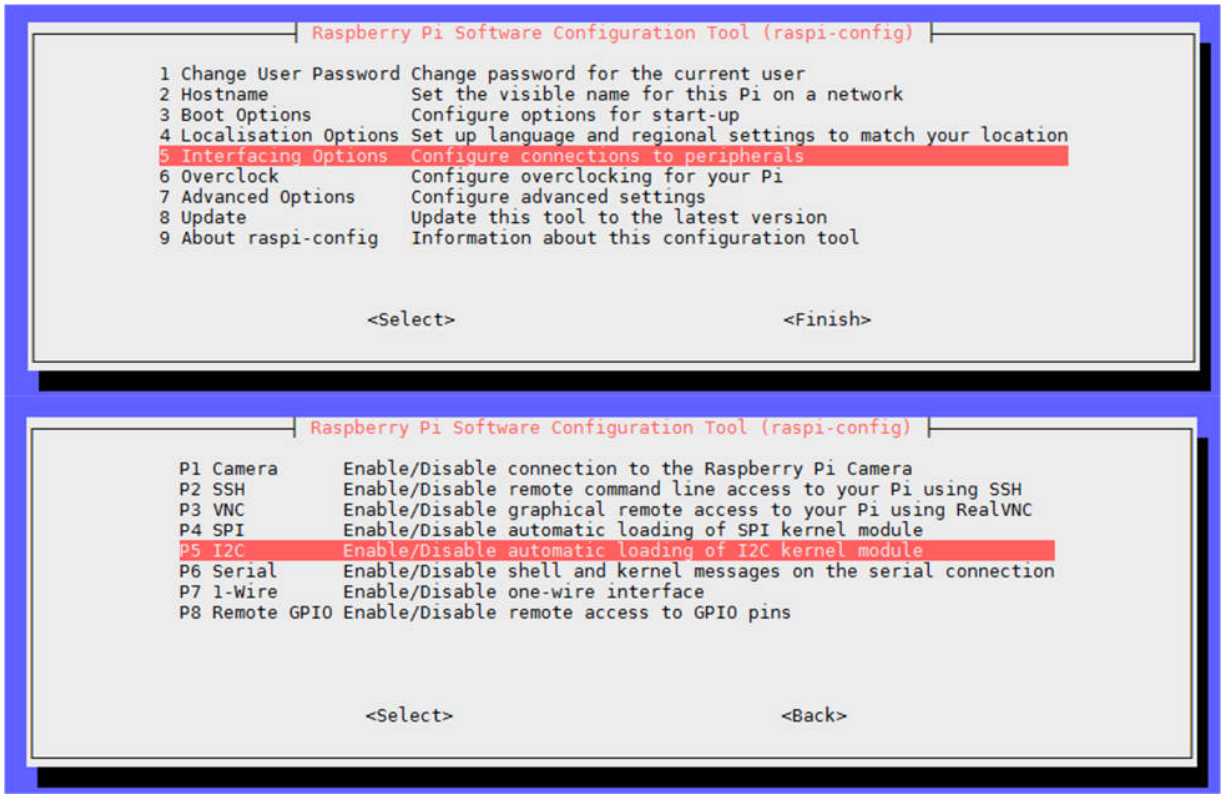
- Raspberry Pi Board x1
- IO Expansion HAT for Raspberry Pi x1
- HDMI Cable x1
- Display x1
- Keyboard and Mouse x1

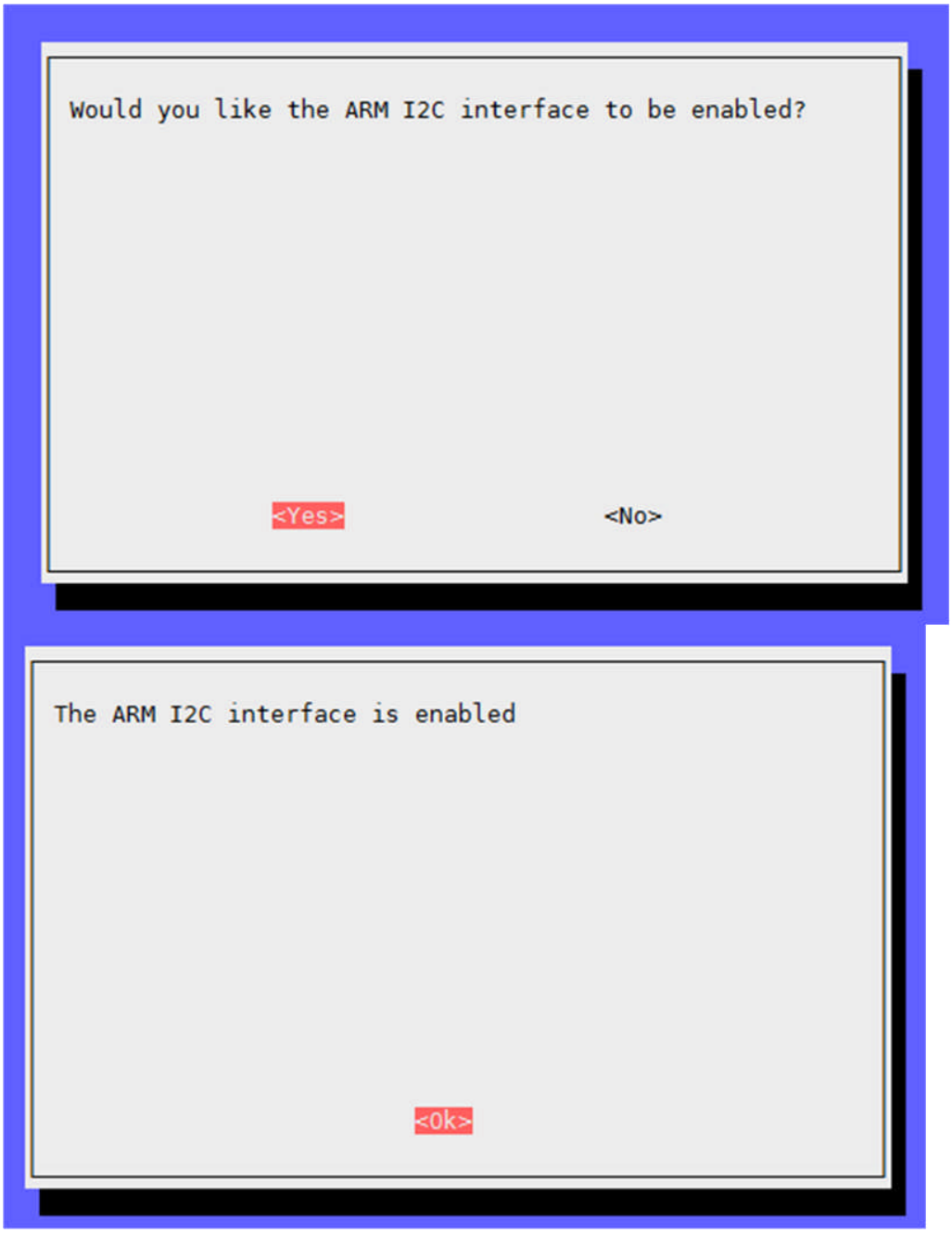
IIC Usage Operation and Program Execution Introduction

- Enable Raspberry Pi I2C interface. (Way to enable SPI is the same with IIC). Skip this step if it is already enabled.

Open Terminal and input the following commands, press "Enter":
sudo raspi-config

Use the "Enter" key to select: [Interfacing Options] or ([Advanced Options])->[I2C]->[Yes]->[OK]->[Finish]:





- Install Phython demo library and git, and make sure the network connection of Raspberry Pi is fine. Skip this step if these have been installed.

Input the following commands into the terminal:

sudo apt-get update
sudo apt-get install build-essential python-dev python-smbus git

Download the driver library and run.

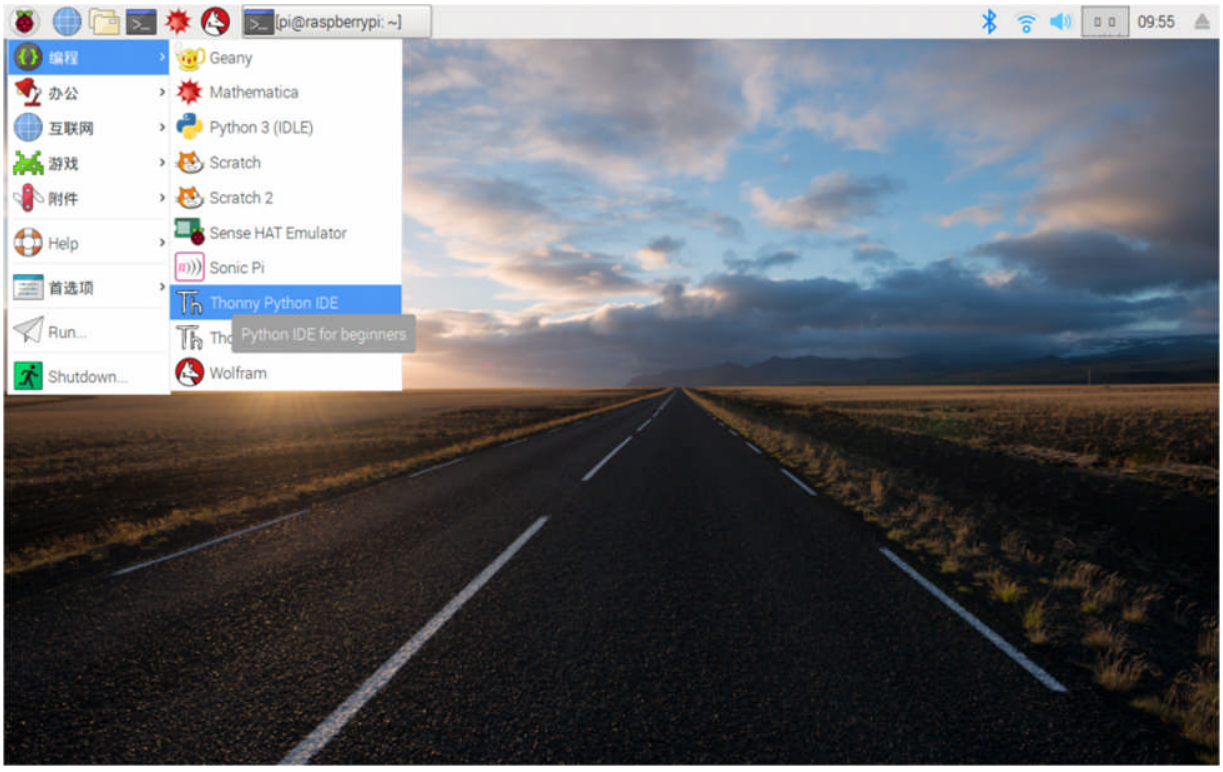
Input the following commands into the terminal:

cd ~
git clone
https://github.com/DFRobot/DFRobot_RaspberryPi_Expansion_Board.git

Two ways to run the program after the library is installed:

1. Input command:
   cd DFRobot_RaspberryPi_Expansion_Board/raspberry
   python demo_adc.py

2. Open Thonny Python IDE under Raspberry Pi system to check the downloaded file.



IIC Usage Example

IO expansion board has 3 groups of IIC ports that are led out via Raspberry Pi GPIO2（SDA.1）and GPIO3（SCL.1）（BCM code).

Input the following command into the terminal:

cd ~
git clone https://github.com/DFRobot/DFRobot_VEML6075.git

Run the DFRobot_VEML6075_demo.

```
# -*- coding: utf-8 -*-

'''
 *  file DFRobot_VEML6075_demo.py
 *  normal test for VEML6075
 *  UVA index, UVB index and UV index will print on terminal
 *
 *  Copyright    [DFRobot](https://www.dfrobot.com), 2018
 *  Copyright    GNU Lesser General Public License
 *  version  V1.0
 *  date  2018-12-18
'''

import time
import sys
sys.path.append("..")

from DFRobot_VEML6075 import DFRobot_VEML6075

if __name__ == '__main__':

  VEML6075 = DFRobot_VEML6075(1, 0x10)  # use i2c bus 1, module address is
0x10

  while VEML6075.begin() != True:
    print("VEML6075 begin faild")
    time.sleep(2)
  print("VEML6075 begin succeed")

  while True:
    Uva = VEML6075.getUva()         # get UVA
    Uvb = VEML6075.getUvb()         # get UVB
    Uvi = VEML6075.getUvi(Uva, Uvb)  # get UVI
    print("")
    print("======== start print ========")
    print("UVA:     %.2f" %(Uva))
```

```
print("UVB:     %.2f" %(Uvb))
print("UVA:     %.2f" %(Uvi))
print("mw/cm^2: %.2f" %(VEML6075.Uvi2mwpcm2(Uvi)))
print("======== end print =========")
time.sleep(1)
```

Read UV data on Raspberry Pi.