

StarFive
赛昉科技

Using VisionFive 2 IIC to Read SHTC3 Data

with Python

Application Note

Version: 1.1

Date: 2023/06/08

Doc ID: VisionFive2-ANEN-004

Legal Statements

Important legal notice before reading this documentation.

PROPRIETARY NOTICE

Copyright©Shanghai StarFive Technology Co., Ltd., 2023. All rights reserved.

Information in this document is provided "as is," with all faults. Contents may be periodically updated or revised due to the product development. Shanghai StarFive Technology Co., Ltd.(hereinafter "StarFive") reserves the right to make changes without further notice to any products herein.

StarFive expressly disclaims all warranties, representations, and conditions of any kind, whether express or implied, including, but not limited to, the implied warranties or conditions of merchantability, fitness for a particular purpose and non-infringement.

StarFive does not assume any liability rising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation indirect, incidental, special, exemplary, or consequential damages.

All material appearing in this document is protected by copyright and is the property of StarFive. You may use this document or any part of the document for internal or educational purposes only, provided you do not modify, edit or take out of context the information in this document in any manner. Information contained in this document may be used, at your sole risk, for any purposes. StarFive authorizes you to copy this document, provided that you retain all copyright and other proprietary notices contained in the original materials on any copies of the materials and that you comply strictly with these terms. This copyright permission does not constitute an endorsement of the products or services.

Contact Us

Address: Room 502, Building 2, No. 61 Shengxia Rd., China (Shanghai) Pilot Free Trade Zone, Shanghai, 201203, China Room 502, Building 2, No. 61 Shengxia Rd., China (Shanghai) Pilot Free Trade Zone, Shanghai, 201203, China

Website: <http://www.starfivetech.com>

Email: sales@starfivetech.com(sales) , support@starfivetech.com(support)

Preface

About this guide and technical support information.

About this document

This application note provides steps to use VisionFive 2's IIC to read SHTC3 data through an example program with Python.

Revision History

Table 0-1 Revision History

Version	Released	Revision
1.1	2023/06/08	<ul style="list-style-type: none">Added a note in 40-Pin GPIO Header Definition (on page 7).Updated the method for installing VisionFive.gpio package in Preparing Software (on page 9).Added Resources (on page 16) and Buy Now (on page 17) chapters.
1.0	2022/11/30	The first official release.

Notes and notices

The following notes and notices might appear in this guide:

-  **Tip:**
Suggests how to apply the information in a topic or step.
-  **Note:**
Explains a special case or expands on an important point.
-  **Important:**
Points out critical information concerning a topic or step.
-  **CAUTION:**
Indicates that an action or step can cause loss of data, security problems, or performance issues.
-  **Warning:**
Indicates that an action or step can result in physical harm or cause damage to hardware.

Contents

List of Tables.....	.5
List of Figures.....	6
Legal Statements.....	ii
Preface.....	iii
1. Introduction.....	7
1.1. 40-Pin GPIO Header Definition.....	7
2. Preparation.....	8
2.1. Environment Requirements.....	8
2.2. Preparing Hardware.....	8
2.2.1. Hardware Setup.....	8
2.3. Preparing Software.....	9
3. Running Demo Code.....	12
4. Demo Source Code.....	13
5. Resources.....	16
6. Buy Now.....	17

List of Tables

Table 0-1 Revision History.....	iii
Table 2-1 Hardware Preparation.....	8
Table 2-2 Connect Sense Hat (B) to the 40-Pin Header.....	8



List of Figures

Figure 1-1 40-Pin GPIO Header Definition.....	7
Figure 2-1 Connect Sense Hat (B) to the 40-Pin GPIO Header.....	9



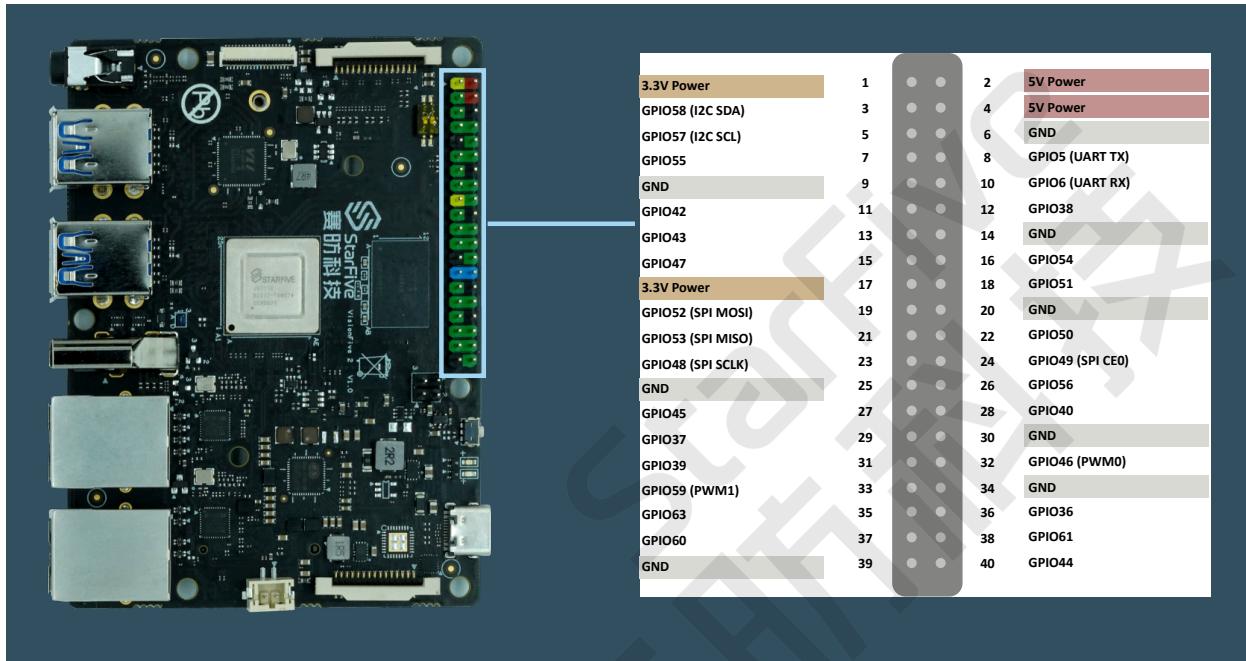
1. Introduction

This application note provides steps to use VisionFive 2's IIC to read SHTC3 data through an example program with Python.

1.1. 40-Pin GPIO Header Definition

The following figure shows the location of the 40-pin header on VisionFive 2.

Figure 1-1 40-Pin GPIO Header Definition



Note:

The multiplexed pin has been initialized and cannot be used as a general GPIO.

2. Preparation

Before executing the demo program, make sure you prepare the following:

2.1. Environment Requirements

The environment requirements are as follows:

- Linux Kernel: Linux 5.15
- OS: Debian 12
- SBC: VisionFive 2
- SoC: JH7110

2.2. Preparing Hardware

Prepare the following hardware items before running the demo code:

Table 2-1 Hardware Preparation

Type	M/O*	Item	Notes
General	M	VisionFive 2 Board	-
General	M	<ul style="list-style-type: none">• 32 GB (or more) micro-SD card• Micro-SD card reader• Computer (Windows/Mac OS/Linux)• USB to serial converter (3.3 V I/O)• Ethernet cable• Power adapter (5 V / 3 A)• USB Type-C Cable	These items are used for flashing Fedora OS into a micro-SD card.
I2C Demo	M	<ul style="list-style-type: none">• Sense Hat (B)• Dupont Line	-



Note:

*: M: Mandatory, O: Optional

2.2.1. Hardware Setup

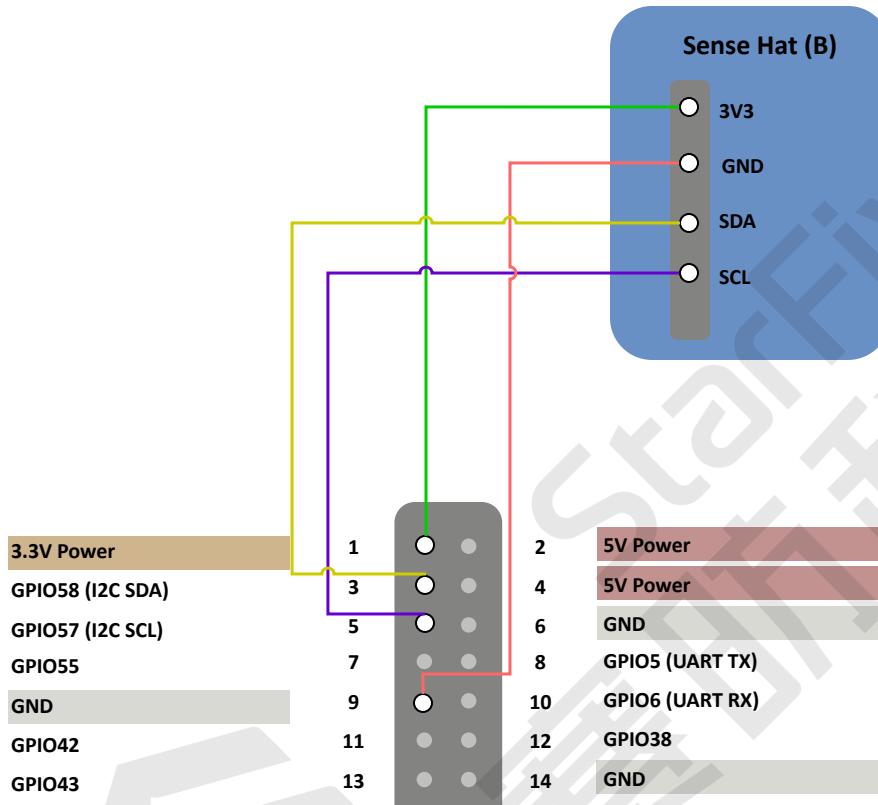
The following table and figure describe how to connect Sense HAT to the 40-pin header:

Table 2-2 Connect Sense Hat (B) to the 40-Pin Header

Sense HAT (B)	40-Pin GPIO Header	
	Pin Number	Pin Name
3V3	1	3.3V Power
GND	9	GND

Table 2-2 Connect Sense Hat (B) to the 40-Pin Header (continued)

Sense HAT (B)	40-Pin GPIO Header	
	Pin Number	Pin Name
SDA	3	GPIO58 (I2C SDA)
SCL	5	GPIO57 (I2C SCL)

Figure 2-1 Connect Sense Hat (B) to the 40-Pin GPIO Header

2.3. Preparing Software

Make sure the following procedures are performed:



Note:

The python project, VisionFive.GPIO, is applicable for VisionFive, VisionFive 2 and JH7110 EVB.

1. Flash Debian OS into a Micro-SD card as described in the *Flashing Fedora OS to a Micro-SD Card* section in the [VisionFive 2 Single Board Computer Quick Start Guide](#).
2. Log into the Debian and make sure VisionFive 2 is connected to the Internet. For detailed instructions, refer to the [Using SSH over Ethernet](#) or [Using a USB to Serial Converter](#) section in the [VisionFive 2 Single Board Computer Quick Start Guide](#).
3. Extend the partition on Debian as described in *Extend Partition* in the [VisionFive 2 Single Board Computer Quick Start Guide](#).
4. Execute the following command to install PIP on Debian:

```
apt-get install python3-pip
```

5. Execute the `pip` command on VisionFive 2 Debian to install the `VisionFive.GPIO` package:



Note:

Due to the fact that `pypi.org` official website does not yet support uploading `whl` installation packages for the RISC-V platform, so it cannot directly execute `pip install VisionFive.GPIO` command to install online.

Please follow the steps below to install the `VisionFive.GPIO` package.

- Execute the following command to install dependent package:

```
apt install libxml2-dev libxslt-dev
python3 -m pip install requests wget bs4
```

- Execute the following command to run the installation script `Install_VisionFive_gpio.py`:

```
python3 Install_VisionFive_gpio.py
```

The installation script codes are as follows:

```
import requests
import wget
import sys
import os
from bs4 import BeautifulSoup

def parse_data(link_addr, class_type, key_str):
    req = requests.get(url=link_addr)
    req.encoding = "utf-8"
    html=req.text
    soup = BeautifulSoup(req.text,features="html.parser")
    package_version = soup.find(class_type,class_=key_str)
    dd = package_version.text.strip()
    data = dd.split()
    return data

def parse_link(link_addr, class_type, key_str):
    req = requests.get(url=link_addr)
    req.encoding = "utf-8"
    html=req.text
    soup = BeautifulSoup(req.text,features="html.parser")
    search_data = soup.find(class_type,class_=key_str)
    search_data_2 = search_data.find("a")
    dl_link_get = search_data_2.get("href")
    return dl_link_get

def get_dl_addr_page():
    link_address = "https://pypi.org/project/VisionFive.GPIO/#history"
    key_str = "release__version"
    class_key = "p"
    data_get = parse_data(link_address, class_key, key_str)
    latest_version = data_get[0]

    dl_addr_page
    = "https://pypi.org/project/VisionFive.GPIO/{}/#files".format(latest_version)

    return dl_addr_page

def get_dl_addr_of_latest_version(link_addr):
    key_str = "card_file__card"
    class_key = "div"
    addr_get = parse_link(link_addr, class_key, key_str)

    return addr_get

def main():
    dl_addr_p = get_dl_addr_page()
    whl_dl_addr = get_dl_addr_of_latest_version(dl_addr_p)

    whl_name = whl_dl_addr.split("/")[-1]
    whl_name_suffix = os.path.splitext(whl_name)[-1]
    whl_name_prefix = os.path.splitext(whl_name)[0]
```



```
whl_name_prefix_no_platform = whl_name_prefix[0: len(whl_name_prefix) - 3]
new_platform = "linux_riscv64"

rename_whl_name = "{}{}{}".format(whl_name_prefix_no_platform, new_platform,
whl_name_suffix)

wget.download(whl_dl_addr, out=rename_whl_name)

os.system("pip install " + rename_whl_name)
os.system("rm -rf " + rename_whl_name)

if __name__ == '__main__':
    sys.exit(main())
```



3. Running Demo Code

To run the demo code, perform the following on VisionFive 2 Debian:

1. Locate to the directory where the test code, `I2C_Sense_Hat.py`, exists:

- a. Execute the following command to get the directory where `VisionFive.GPIO` exists:

```
pip show VisionFive.GPIO
```

Result:

```
Location: /usr/local/lib64/python3.9/site-packages
```



Note:

The actual output depends on how the application is installed.

- b. Execute the following to enter the directory, for example, `/usr/local/lib64/python3.9/site-packages` as indicated in the previous step output:

```
cd /usr/local/lib64/python3.9/site-packages
```

- c. Execute the following command to enter the sample-code directory:

```
cd ./VisionFive/sample-code/
```

2. Under the sample-code directory, execute the following command to run the demo code:

```
sudo python I2C_Sense_Hat.py
```

Alternatively, you can execute the following command:

```
sudo python3 I2C_Sense_Hat.py
```

Result:

The temperature and the humidity data are displayed on the terminal:

```
[riscv@fedora-starfive sample-code]$ sudo python3 I2C_Sense_Hat.py
i2c_dev: /dev/i2c-1
Temperature = 27.85°C , Humidity = 56.59 %

Temperature = 27.83°C , Humidity = 56.60 %

Temperature = 27.85°C , Humidity = 56.61 %

Temperature = 27.86°C , Humidity = 56.60 %

Temperature = 27.80°C , Humidity = 56.60 %

Temperature = 27.87°C , Humidity = 56.60 %
```

4. Demo Source Code

The Python source code of this demo is provided for reference purpose only.

I2C_Sense_Hat.py:

```
#!/usr/bin/python
...
Please make sure the sense HAT(B) is connected to the correct pins.
The following table describes how to connect the Sense HAT(B) to the 40-pin header.
-----
Sense HAT (B) Pin Number Pin Name
3V3          1      3.3 V Power
GND          9      GND
SDA          3      I2C SDA
SCL          5      I2C SCL
-----
...
import sys
import struct
import fcntl
import os
import math
import time
import VisionFive.i2c as I2C
import VisionFive.boardtype as board_t

SHTC3_I2C_ADDRESS = 0x70
I2C_SLAVE = 0x0703
#I2C_DEVICE = "/dev/i2c-1"
#I2C_DEVICE = "/dev/i2c-0"

##Commands
cmd_dict = {
    "SHTC3_WakeUp": 0x3517,
    "SHTC3_Sleep": 0xB098,
    "SHTC3_NM_CE_ReadTH": 0x7CA2,
    "SHTC3_NM_CE_ReadRH": 0x5C24,
    "SHTC3_NM_CD_ReadTH": 0x7866,
    "SHTC3_NM_CD_ReadRH": 0x58E0,
    "SHTC3_LM_CE_ReadTH": 0x6458,
    "SHTC3_LM_CE_ReadRH": 0x44DE,
    "SHTC3_LM_CD_ReadTH": 0x609C,
    "SHTC3_LM_CD_ReadRH": 0x401A,
    "SHTC3_Software_RES": 0x401A,
    "SHTC3_ID": 0xEFC8,
    "CRC_POLYNOMIAL": 0x131,
}

def SHTC3_CheckCrc(data, len, checksum):
    crc = 0xff
    for byteCtr in range(0, len):
        crc ^= data[byteCtr]
        for bit in range(8, 0, -1):
            if(crc & 0x80):
                crc = (crc << 1) ^ cmd_dict["CRC_POLYNOMIAL"]
            else:
                crc = crc << 1
    if (crc != checksum):
        return 1
    else:
        return 0

def SHTC3_WriteCommand(cmd):
    buf0 = (cmd >> 8)& 0xff
    buf1 = cmd & 0xff
    buf = [buf0, buf1]
    I2C.write(buf)
```

| 4 - Demo Source Code

```
def SHTC3_WAKEUP():
    SHTC3_WriteCommand(cmd_dict["SHTC3_WakeUp"])
    time.sleep(0.03)

def SHTC3_SLEEP():
    SHTC3_WriteCommand(cmd_dict["SHTC3_Sleep"])

def SHTC_SOFT_RESET():
    SHTC3_WriteCommand(cmd_dict["SHTC3_Software_RESET"])
    time.sleep(0.03)

def getdata():
    time.sleep(0.02)
    buf_list = I2C.read(3)
    checksum = buf_list[2]
    DATA = 0
    if (not SHTC3_CheckCrc(buf_list, 2, checksum)):
        DATA = (buf_list[0] << 8 | buf_list[1])
    return DATA

def SHTC3_Read_DATA():
    SHTC3_WriteCommand(cmd_dict["SHTC3_NM_CD_ReadTH"])
    TH_DATA = getdata()
    SHTC3_WriteCommand(cmd_dict["SHTC3_NM_CD_ReadRH"])
    RH_DATA = getdata()
    TH_DATA = 175 * TH_DATA / 65536.0 - 45.0 #Calculate the temperature value.
    RH_DATA = 100 * RH_DATA / 65536.0 #Calculate the humidity value.
    DATA = [TH_DATA,RH_DATA]
    return DATA

def getTem():
    SHTC3_WriteCommand(cmd_dict["SHTC3_NM_CD_ReadTH"])
    TH_DATA = getdata()
    TH_DATA = 175 * TH_DATA / 65536.0 - 45.0 #Calculate the temperature value.
    return TH_DATA

def getHum():
    SHTC3_WriteCommand(cmd_dict["SHTC3_NM_CD_ReadRH"])
    RH_DATA = getdata()
    RH_DATA = 100 * RH_DATA / 65536.0 #Calculate the humidity value.
    return RH_DATA

def main():
    #Determining cpu Type: 1 means visionfive1; 2 means visionfive 2
    vf_t = board.t.boardtype()
    if vf_t == 1:
        I2C_DEVICE = "/dev/i2c-1"
    elif vf_t == 2:
        I2C_DEVICE = "/dev/i2c-0"
    else:
        print('This module can only be run on a VisionFive board!!')
        return 0

    #Open the Sense HAT by I2C.
    ret = I2C.open(I2C_DEVICE, SHTC3_I2C_ADDRESS)
    if (ret < 0):
        return 0

    SHTC_SOFT_RESET()
    i = 0
    while i < 7:
        Temp = getTem()
        Hum = getHum()
        SHTC3_SLEEP()
        SHTC3_WAKEUP()
        print("Temperature = {:.2f}°C , Humidity = {:.2f} %\n".format(Temp, Hum))
        i = i + 1

    I2C.close()
    return 0
```

```
if __name__ == "__main__":
    sys.exit(main())
```



StarFive

5. Resources

Click on this tab to find all SBC relevant resources.

StarFive provides the following resources to guide you through an extraordinary experience on using the VisionFive 2 SBC.

- [RVspace Wiki](#)
- [Application Center](#)
- [Documentation Center](#)
- [Technical Forum](#)
- [VisionFive 2 GitHub Repository](#)
- [VisionFive 2 Debian OS Download](#)
- [Code download](#)
- [View All PDF Documents](#)

6. Buy Now

Click on this tab to find all the online shops and compatible accessories.

Buy SBC

Use the following page to find your nearest sales channel or the global channels for purchasing a VisionFive 2 Single Board Computer (SBC).

- [Buy VisionFive 2](#)

Buy Parts

Use the following page to find the parts that are tested as compatible to VisionFive 2.

- [Buy Accessory](#)



StarFive
技术