StarFive 赛昉科技

Using VisionFive 2 UART to Read GPS Data

with Python

Application Note

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Important legal notice before reading our documentation.

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Preface

About this guide and technical support information.

About this document

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

Revision History

Table 0-1 Revision History

Version	Released	Revision
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.

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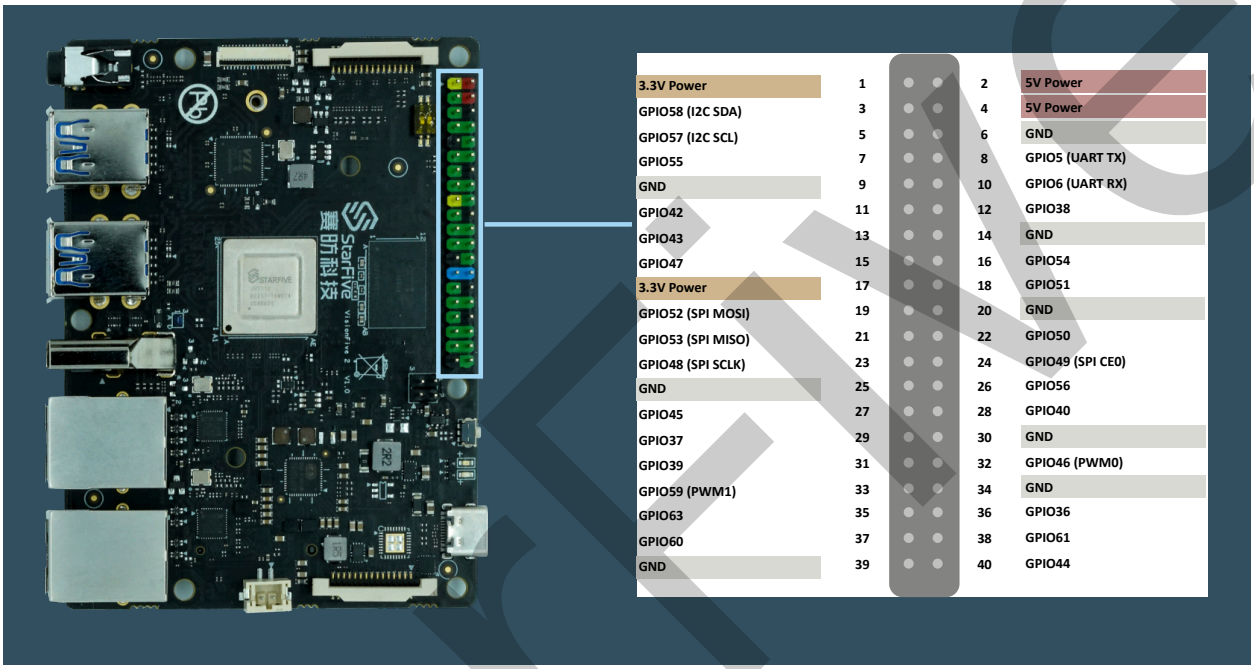
1. Introduction

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

1.1. 40-Pin Header Definition

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

Figure 1-1 40-Pin Definition



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 single board computer	-
General	M	• 32 GB (or more) micro-SD card • micro-SD card reader • Computer (Windows/macOS/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 Debian OS into a micro-SD card.
UART Demo	M	• NEO-6M GPS • 4 Dupont lines (female to female) • An external antenna (Optional)	The antenna is used to improve GPS signal reception.

Note:
*: M: Mandatory, O: Optional

2.2.1. Hardware Setup

The following table and figure describe how to connect NEO-6M GPS to the 40-pin header:

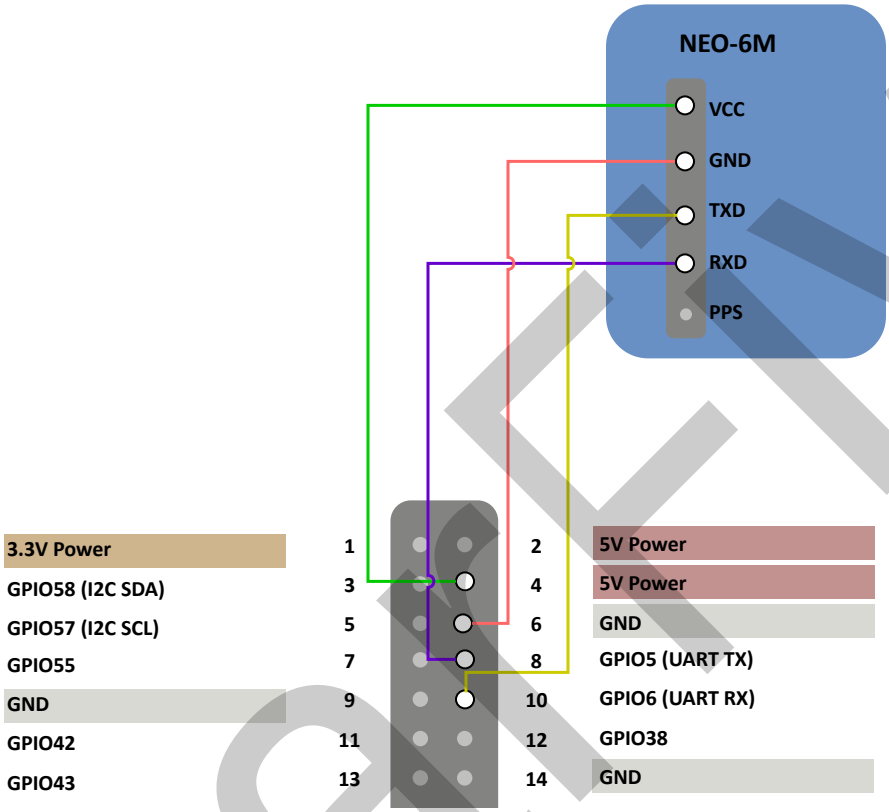
Table 2-2 Connect NEO-6M GPS to the 40-Pin GPIO Header

NEO-6M	40-Pin GPIO Header	
	Pin Number	Pin Name
VCC	4	5V Power
GND	6	GND

Table 2-2 Connect NEO-6M GPS to the 40-Pin GPIO Header (continued)

NEO-6M	40-Pin GPIO Header	
	Pin Number	Pin Name
TXD	10	GPIO6 (UART RX)
RXD	8	GPIO5 (UART TX)

Figure 2-1 Connect NEO-6M GPS 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 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:

```
sudo pip install VisionFive.gpio
```

Alternatively, you can execute the following command:

```
sudo pip3 install VisionFive.gpio
```

6. (Optional) If you copy the source code to the local directory under VisionFive 2 Debian, execute the following commands under the source code directory:

Tip:
The source code can be downloaded by clicking the following link: VisionFive.gpio.

```
sudo apt-get install python3-dev
sudo python setup.py install
```

Alternatively, you can execute the following command:

```
sudo python3 setup.py install
```

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, `uart_gps_demo.py`, exists:

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

    ```
    pip show VisionFive.gpio
    ```

    Example 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. Execute the following command on your terminal before executing the demo code:

    ```
    sudo systemctl stop serial-getty@ttyS0.service
    ```

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

    ```
    sudo python uart_gps_demo.py
    ```

    Alternatively, you can execute the following command:

    ```
    sudo python3 uart_gps_demo.py
    ```

    Result:

    If the GPS signal is weak, the terminal output is as the following:

    ```
    *****The GGA info is as follows: *****
     msg_id: $GPGGA
     NorS:
     EorW:
     pos_indi: 0
     total_Satellite: 00

    !!!!!!Positioning is invalid!!!!!!
    ```

    If the GPS signal is strong, the terminal output is as the following after a few seconds:

    ```
    *****The GGA info is as follows: *****
     msg_id: $GPGGA
     utc time: 2:54:47.0
     utc time: 025447.00 (format: hhmmss.sss)
     latitude: 30 degree 33.29251 minute
     latitude: 3033.29251 (format: dddmm.mmmmm)
     NorS: N
     longitude: 104 degree 3.45523 minute
     longitude: 10403.45523 (format: dddmm.mmmmm)
     EorW: E
     pos_indi: 1
     total_Satellite: 08

    *****The positioning type is 3D *****
    ```

```
The Satellite ID of channel {} : {}
                            ch1 : 14
                            ch2 : 01
                            ch3 : 03
                            ch4 : 06
                            ch5 : 30
                            ch6 : 21
                            ch7 : 19
                            ch8 : 17
```

4. Demo Source Code

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

`uart_gps_demo.py`:

```
'''
Please make sure the NEO-6M is connected to the correct pins.
The following table describes how to connect NEO-6M to the 40-pin header
----------------------------------------
Passive Buzzer___Pin Number_____Pin Name
    VCC             4           5 V Power
    GND             6             GND
    TXD             10          UART RX
    RXD             8           UART TX
----------------------------------------
'''

import sys
import serial
import time

#Reference information of the GPGSA format.
'''
Example 1 (GPS only):

$GPGSA,M,3,17,02,30,04,05,10,09,06,31,12,,,1.2,0.8,0.9*35

Example 2 (Combined GPS and GLONASS):

$GNGSA,M,3,17,02,30,04,05,10,09,06,31,12,,,1.2,0.8,0.9*2B

$GNGSA,M,3,87,70,,,,,,,,,,1.2,0.8,0.9*2A

-------------------------------------------------------
SN      Field
                Description
                                Symbol
                                                Example
-------------------------------------------------------
1       $GPGSA
                Log header. For information about the log headers, see ASCII, Abbreviated ASCII or Binary.
                                N/A
                                                $GPGSA
2       mode MA
                Mode: 1 = Fix not available; 2 = 2D; 3 = 3D
                                x
                                                3
3       mode 123
                Latitude (DDmm.mm)
                                llll.ll
                                                5106.9847
4-15   prn
                PRN numbers of satellites used in solution (null for unused fields), total of 12 fields
                GPS = 1 to 32
                SBAS = 33 to 64 (add 87 for PRN number)
                GLO = 65 to 96
                                xx,xx,.....
                                                18,03,13,25,16,24,12,20,,,,

The detail info, please see
 https://docs.novatel.com/OEM7/Content/Logs/GPGSA.htm?tocpath=Commands%20%2526%20Logs%7CLogs%7CGNSS%20Logs%7C_
____63

'''

GPGSA_dict = {
"msg_id":  0,
"mode1":  1,
"mode2":  2,
```

```
"ch1":          3,
"ch2":          4,
"ch3":          5,
"ch4":          6,
"ch5":          7,
"ch6":          8,
"ch7":          9,
"ch8":          10,
"ch9":          11,
"ch10":         12,
"ch11":         13,
"ch12":         14,
}

#Reference information of the GPGGA format.
'''
Example 1 (GPS only):

$GPGSA,M,3,17,02,30,04,05,10,09,06,31,12,,,1.2,0.8,0.9*35

Example 2 (Combined GPS and GLONASS):

$GNGSA,M,3,17,02,30,04,05,10,09,06,31,12,,,1.2,0.8,0.9*2B

$GNGSA,M,3,87,70,,,,,,,,,,1.2,0.8,0.9*2A

------------------------------------------------------------
SN   Field
               Description
                              Symbol
                                          Example
------------------------------------------------------------
1   $GPGGA
               Log header. For information about the log headers, see ASCII, Abbreviated ASCII or Binary.
                              N/A
                                          $GPGGA
2   utc
               UTC time status of position (hours/minutes/seconds/ decimal seconds)
                              hhmmss.ss
                                          202134.00
3   lat
               Latitude (DDmm.mm)
                              llll.ll
                                          5106.9847
4   lat dir
               Latitude direction (N = North, S = South)
                              a
                                          N
5   lon
               Latitude direction (N = North, S = South)
                              yyyyy.yy
                                          11402.2986
6   lon dir
               Longitude direction (E = East, W = West)
                              a
                                          W
7   quality
               refer to Table: GPS Quality Indicators
                              x
                                          1
8   # sats
               Number of satellites in use. May be different to the number in view
                              xx
                                          10
The detail info, please see
 https://docs.novatel.com/OEM7/Content/Logs/GPGGA.htm?tocpath=Commands%20%2526%20Logs%7CLogs%7CGNSS%20Logs%7C_
____59

'''
GPGGA_dict = {
"msg_id":   0,
"utc":          1,
```

```
"latitude":             2,
"NorS":                 3,
"longitude":            4,
"EorW":                 5,
"pos_indi":             6,
"total_Satellite":      7,
}

uart_port = "/dev/ttyS0"

def IsValidGpsinfo(gps):
    data = gps.readline()
    #Convert the data to string.
    msg_str = str(data, encoding="utf-8")
    #Split string with ",".
    #GPGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99*30
    msg_list = msg_str.split(",")

    #Parse the GPGSA message.
    if (msg_list[GPGSA_dict['msg_id']] == "$GPGSA"):
            print()
            #Check if the positioning is valid.
            if msg_list[GPGSA_dict['mode2']] == "1":
                print("!!!!!!Positioning is invalid!!!!!!")
            else:
                print("*****The positioning type is {}D *****".format(msg_list[GPGSA_dict['mode2']]))
                print("The Satellite ID of channel {} : {}")
                #Parse the channel information of the GPGSA message.
                for id in range(0, 12):
                    key_name = list(GPGSA_dict.keys())[id + 3]
                    value_id =  GPGSA_dict[key_name]
                    if  not (msg_list[value_id] == ''):
                        print("                          {} : {}".format(key_name, msg_list[value_id]))

    #Parse the GPGGA message.
    if msg_list[GPGGA_dict['msg_id']] == "$GPGGA":
        print()
        print("*****The GGA info is as follows: *****")
        for key, value in GPGGA_dict.items():
            #Parse the utc information.
            if key == "utc":
                utc_str =  msg_list[GPGGA_dict[key]]
                if not utc_str == '':
                    h = int(utc_str[0:2])
                    m = int(utc_str[2:4])
                    s = float(utc_str[4:])
                    print(" utc time: {}:{}:{}".format(h,m,s))
                    print(" {} time: {} (format: hhmmss.sss)".format(key, msg_list[GPGGA_dict[key]]))
            #Parse the latitude information.
            elif key == "latitude":
                lat_str = msg_list[GPGGA_dict[key]]
                if not lat_str == '':
                    Len = len(lat_str.split(".")[0])
                    d = int(lat_str[0:Len-2])
                    m = float(lat_str[Len-2:])
                    print(" latitude: {} degree {} minute".format(d, m))
                    print(" {}: {} (format: dddmm.mmmmm)".format(key, msg_list[GPGGA_dict[key]]))
            #Parse the longitude information.
            elif key == "longitude":
                lon_str = msg_list[GPGGA_dict[key]]
                if not lon_str == '':
                    Len = len(lon_str.split(".")[0])
                    d = int(lon_str[0:Len-2])
                    m = float(lon_str[Len-2:])
                    print(" longitude: {} degree {} minute".format(d, m))
                    print(" {}: {} (format: dddmm.mmmmm)".format(key, msg_list[GPGGA_dict[key]]))
            else:
                print(" {}: {}".format(key, msg_list[GPGGA_dict[key]]))

def main():
    gps = serial.Serial(uart_port, baudrate=9600, timeout=0.5)
    while True:
```

```
        IsValidGpsinfo(gps)
        time.sleep(1)

    gps.close()

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