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FIBOCOM Guidelines for the use of GPS Characteristics in Android

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Applicability type

No.	Product model	Description
1	NL668 Series	NA
2	NL660 Series	NA
3	MA510 Series	NA

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1 Foreword

This paper describes how to use the GPS function of NL668 and other series module (including MiniPCI-E) of Fibocom Company on Android platform (include the import of configuration files and HAL files). This paper is mainly for Android drivers and application developers.

This article applies to: Android 6.0, Android 7.1, Android 8.1, Android 9.0.

2 Content validity

2.1 Abbreviation

GPS: Global Positioning System

GNSS: Global Navigation Satellite System

NMEA: National Marine Electronics Association

2.2 Characteristic

Android devices can communicate with modules through USB or physical serial channels.

When communicating through USB serial port, the device loads relevant drivers, and then generates the corresponding control and data channel ttyUSBX (according to different serial passwords, the value of X is different, generally 0-3). Android HAL layer establishes GPS data transceiver through control and data channel ttyUSBX. HAL layer can also directly establish GPS data transceiver through physical serial port. As shown in Figure 2-1:

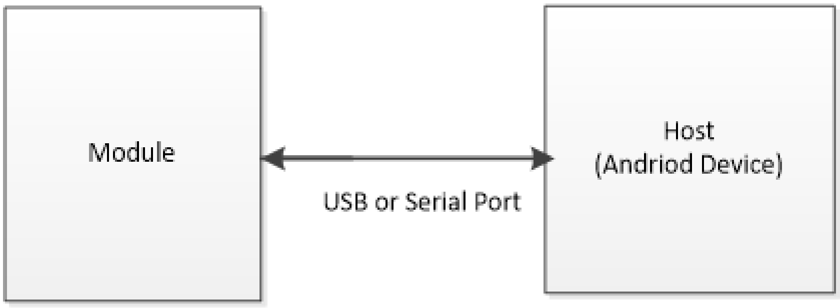

Figure 2-1 Data Transmission Channel

2.3 Software Architecture

The software architecture developed by Android is shown in Figure 2-2. The gps.default.so file provided by Android is located in the HAL layer. HAL layer software controls GPS and receives data by accessing USB serial port or physical serial port. At the same time, the HAL layer software provides access interface to the upper JNI layer, and the upper application finally obtains the data provided by the bottom GPS through the framework of Android system.

Note:

The gps.default.so files of different projects and Android environments are different, which have the uniqueness of customers and need to be provided separately.

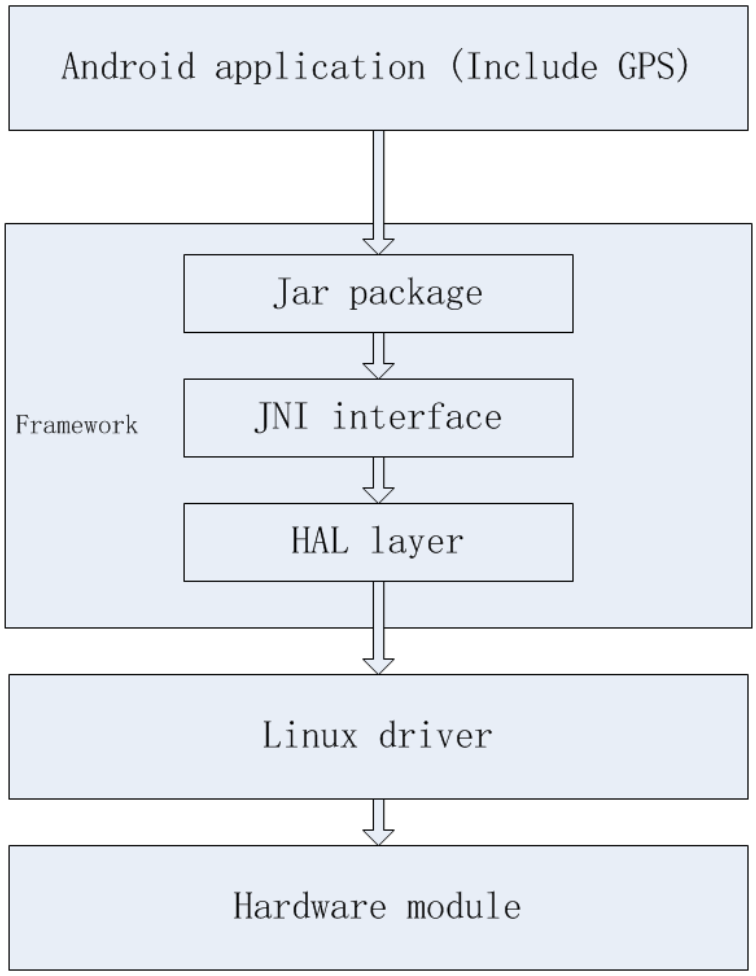

Figure 2-2 Software Framework

3 Method of use

In the debugging phase, the related files need to be imported using ADB debugging terminal. After successful import, the development board can be restarted to continue to use. Before importing files, please ensure that the ADB environment is normal, otherwise the import will fail.

The company will provide 32-bit and 64-bit HAL files under Android environment, named gps. default. so, which can be imported into the specified directory first, and then selected to use according to needs. By default, the system will automatically select the appropriate directory to load the corresponding files according to the current configuration.

3.1 Configuration file import

1. Configuration file name

   gps_cfg.inf

2. Configuration file format

   An example configuration file using ttyUSB1 serial port is as follows:

   [MODULE]

   MODULE_TYPE=NL668

   NMEA_PORT_PATH=/dev/ttyUSB1

   BAUD_RATE=115200

3. File import path:

   Configuration files need to be imported into the system/etc/ directory.

```
C:\Users\Administrator>adb root

C:\Users\Administrator>adb remount
remount succeeded

C:\Users\Administrator>adb push E:\tmp\GPS\gps-jin\gps\gps_cfg.inf system/etc/
[100%] system/etc/gps_cfg.inf

C:\Users\Administrator>_
```

Figure 3-1 Import Configuration File

Note:

Different projects have different gps_cfg.inf file, which is unique to customers and need to be provided separately.

3.2 HAL file import

1. HAL file name

gps.default.so

2. HAL file import path

   1) 64-bit HAL files need to be imported into vendor/lib64/hw/. directory

```
C:\Users\Administrator>
C:\Users\Administrator>adb push E:\tmp\GPS\so\64\gps.default.so vendor/lib64/hw/.
[100%] vendor/lib64/hw/./gps.default.so
```

Figure 3-2 Imports 64-bit HAL files

   2) 32-bit HAL files need to be imported into vendor/lib/hw/. directory

```
C:\Users\Administrator>
C:\Users\Administrator>adb push E:\tmp\GPS\so\32\gps.default.so vendor/lib/hw/.
[100%] vendor/lib/hw/./gps.default.so
```

Figure 3-3 Imports 32-bit HAL files

Note:

1. 32-bit and 64-bit HAL file names are the same. When importing, pay attention to the distinction.
2. Configuration and HAL file names cannot be modified at will, otherwise loading fails.
3. The above is the use of debugging scenarios.

3.3 Demo verification

The company provides an App software (gps.apk) to verify whether the GPS reception is normal. After importing relevant documents, users can use the software to verify whether the GPS reception is normal.

1. The display when searching for stars is shown in Figure 3-4.

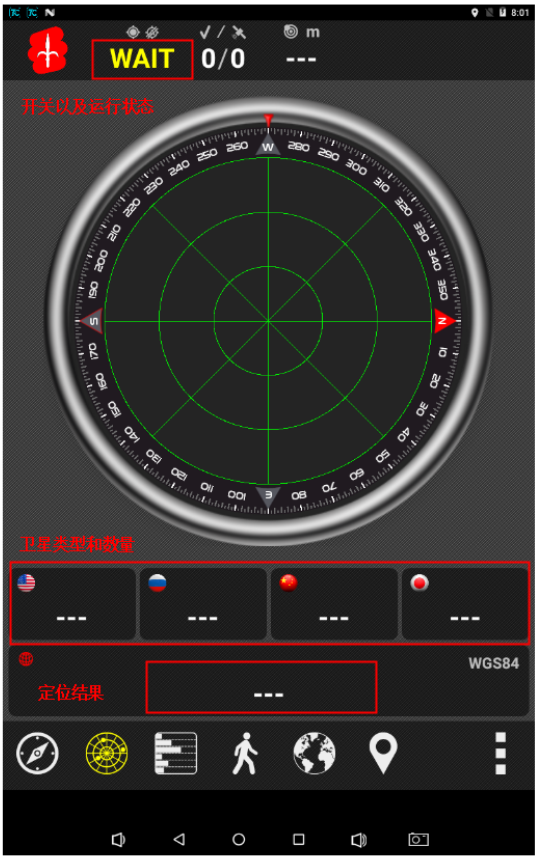

Figure 3-4 Searching

2. The display when the satellite is found is shown in Fig. 3-5.

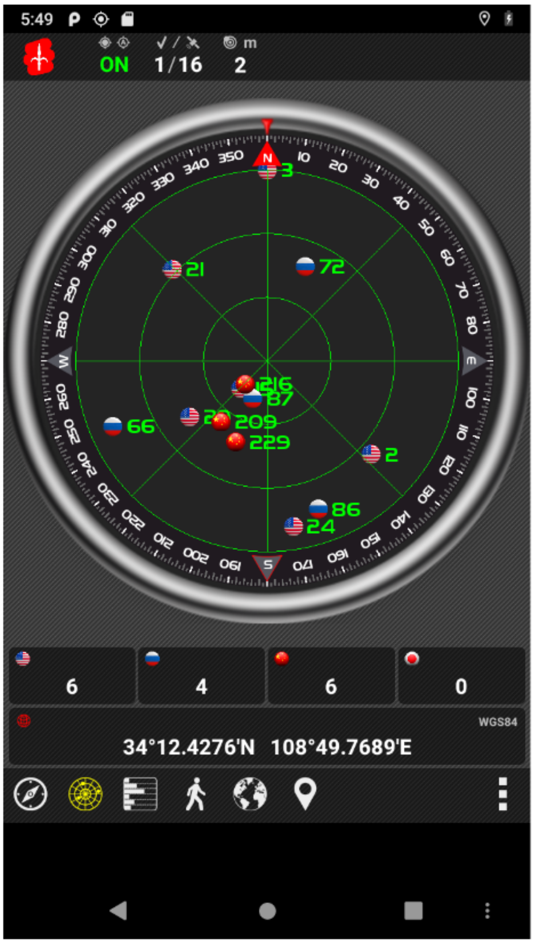

Figure 3-5 Finds the satellite and locates it


gps.apk

3.4 Debugging Method

Users can develop and debug by grabbing logs in ADB environment. GPS prints relevant log information in the process of establishing channels and receiving data. By looking at the error items in the log information, the cause of the error can be determined. If the user can't solve the problem, please save the relevant log and contact the company's technicians.

Some examples of logs in normal startup are as follows:

01-01 08:01:24.171 775 788 D gps_fbc : nemaStart: line = 1576, at+gtgpspower=1

01-01 08:01:24.176 775 788 D gps_fbc : nemaStart: line = 1579, at+gtset=nmeaen,1

01-01 08:01:24.182 775 788 D gps_fbc : nemaStart: line = 1583, nemaStart

01-01 08:01:24.184 775 2046 D gps_fbc : ql_gps_nmea_reader_thread: line = 1393, ql_gps_nmea_reader_thread create!

4 GPS data

4.1 Data examples

An example of a typical package of GPS data is as follows:

$GPRMC,042353.00,A,3412.491435,N,10849.777258,E,0.0,,170619,3.0,W,A*19

$GPGSA,A,3,01,20,19,13,,,,,,,,,40.4,24.4,32.2*0A

$GPGGA,092204.999,4250.5589,S,14718.5084,E,1,04,24.4,19.7,M,,,,0000*1F

$GPGSV,3,1,10,20,78,331,45,01,59,235,47,22,41,069,,13,32,252,45*70

4.2 Data format

4.2.1GPRMC

Description: Recommended location information data format

Field 0: $GPRMC, statement ID, indicating that the statement is Recommended Minimum Specific GPS/TRANSIT Data (RMC) Recommended Minimum Location Information

Field 1: UTC time, hhmmss. SSS format

Field 2: Status, A = Location, V = Unlocated

Field 3: latitude ddmm. mmmm, degree grading format (if the leading digit is insufficient, fill 0)

Field 4: Latitude N (North Latitude) or S (South Latitude)

Field5: Longitude dddmm. mmmm, grading format (if the leading digit is insufficient, make up 0)

Field 6: Longitude E (Eastern Meridian) or W (Western Meridian)

Field 7: Speed, knots

Field 8: Azimuth, Degree

Field 9: UTC date, DDMMYY format

Field 10: Magnetic declination, (000 - 180) degrees (if the leading digit is insufficient, make up 0)

Field 11: Direction of magnetic declination, E = East W = West

Field 12: Mode, A = automatic, D = differential, E = estimation, N = invalid data (3.0 protocol content)

Field 13: Validation value ($and *)

4.2.2 GPGSA

Description: Current satellite information

Field 0: $GPGSA, statement ID, indicating that the statement is GPS DOP and Active Satellites (GSA) current satellite information

Field 1: Location mode (select 2D/3D), A = automatic selection, M = manual selection

Field 2: Location type, 1 = Unpositioned, 2 = 2D positioning, 3 = 3D positioning

Field3: PRN Code (Pseudo-random Noise Code), Satellite PRN Code Number (00) being used in Channel 1 (0 if the preamble is insufficient)

Field4: PRN Code (Pseudo-random Noise Code), Satellite PRN Code Number (00) being used in Channel 2 (0 if the preamble is insufficient)

Fields 5: PRN code (pseudo-random noise code), satellite PRN code number (00) in use in channel 3 (0 if the preamble is insufficient)

Field 6: PRN code (pseudo-random noise code), satellite PRN code number (00) in use in channel 4 (0 if the preamble is insufficient)

Field 7: PRN code (pseudo-random noise code), satellite PRN code number (00) being used in channel 5 (0 if the prea

Fields 8: PRN code (pseudo-random noise code), satellite PRN code number (00) being used in channel 6 (0 if the preamble is insufficient)

Fields 9: PRN code (pseudo-random noise code), satellite PRN code number (00) in use in channel 7 (0 if the preamble is insufficient)

Fields 10: PRN code (pseudo-random noise code), satellite PRN code number (00) in use in channel 8 (0 if the preamble is insufficient)

Fields 11: PRN code (pseudo-random noise code), satellite PRN code number (00) being used in channel 9 (0 if the preamble is insufficient)

Fields 12: PRN code (pseudo-random noise code), satellite PRN code number (00) in use in channel 10 (0 if the preamble is insufficient)

Field 13: PRN code (pseudo-random noise code), satellite PRN code number (00) in use in channel 11 (0 if the preamble is insufficient)

Fields 14: PRN code (pseudo-random noise code), satellite PRN code number (00) being used in channel 12 (0 if the preamble is insufficient)

Field 15: PDOP Integrated Position Accuracy Factor (0.5 - 99.9)

Field 16: HDOP horizontal precision factor (0.5 - 99.9)

Field 17: VDOP Vertical Precision Factor (0.5 - 99.9)

Field 18: Validation value ($and *)

4.2.3 GPGGA

Description: Location information

Field 0: $GPGGA, statement ID, indicating that the statement is Global Positioning System Fix Data (GGA) GPS positioning information

Field 1: UTC time, hhmmss. sss, time-seconds format

Field 2: latitude ddmm. mmmm, degree grading format (if the leading digit is insufficient, make up 0)

Field 3: Latitude N (North Latitude) or S (South Latitude)

Field4: Longitude dddmm. mmmm, grading format (if the leading digit is insufficient, make up 0)

Field 5: Longitude E (Eastern Meridian) or W (Western Meridian)

Fields 6: GPS status, 0 = unavailable (FIX NOT valid), 1 = single point positioning (GPS FIX), 2 = differential positioning (DGPS), 3 = invalid PPS, 4 = Real-Time Differential Positioning (RTK FIX), 5 = RTK FLOAT, 6 = being estimated

Field 7: Number of satellites in use (00 - 12) (if the leading digit is insufficient, make up 0)

Field 8: HDOP horizontal precision factor (0.5 - 99.9)

Field 9: Altitude (- 9999.9 - 99999.9)

Field 10: Unit: M (m)

Field 11: Height of the Earth's ellipsoid relative to the geoid WGS84

Field 12: WGS84 Level Division Unit: M (m)

Field 13: Differential time (the number of seconds from the receipt of the differential signal, if not differential positioning, will be empty)

Field 14: Differential station ID number 0000 - 1023 (if the leading digit is insufficient, make up 0, otherwise differential positioning will be empty)

Field15: Check value ($and * numberally different or later value)

4.2.4 GPGSV

Description: Visible satellite information

Field 0: $GPGSV, statement ID, indicating that the statement is GPS Satellites in View (GSV) visible satellite information

Field 1: Total number of GSV statements (1 - 3)

Field2: This GSV statement is the last one of this GSV statement (1 - 3)

Field 3: Total number of currently visible satellites (00 - 12) (if the leading digit is insufficient, make up 0)

Field4: PRN code (pseudo-random noise code) (01-32) (if the preamble is insufficient, make up 0)

Field5: Satellite elevation (00 - 90) degrees (if the leading digit is insufficient, make up 0)

Field6: Satellite azimuth (00 - 359) degree (if the leading digit is insufficient, make up 0)

Field 7: Signal-to-noise ratio (00-99) dbHz

Field8: PRN (Pseudo-Random Noise Code) (01 - 32) (if the preamble is insufficient, make up 0)

Field 9: Satellite elevation (00 - 90) degrees (if the leading digit is insufficient, make up 0)

Field10: Satellite azimuth (00 - 359) degree (if the leading digit is insufficient, make up 0)

Field 11: Signal-to-noise ratio (00-99) dbHz

Fields 12: PRN (Pseudo Random Noise Code) (01 - 32) (if the preamble is insufficient, make up 0)

Field 13: Satellite elevation (00 - 90) degrees (if the leading digit is insufficient, make up 0)

Field14: Satellite azimuth (00 - 359) degree (if the leading digit is insufficient, make up 0)

Field 15: Signal-to-noise ratio (00-99) dbHz

Fields 12: PRN (Pseudo Random Noise Code) (01 - 32) (if the preamble is insufficient, make up 0)

Field 13: Satellite elevation (00 - 90) degrees (if the leading digit is insufficient, make up 0)

Field14: Satellite azimuth (00 - 359) degree (if the leading digit is insufficient, make up 0)

Field 15: Signal-to-noise ratio (00-99) dbHz

Field 16: PRN (Pseudo-Random Noise Code) (01 - 32) (If the preamble is insufficient, make up 0)

Field 17: Satellite elevation (00 - 90) degrees (if the leading digit is insufficient, make up 0)

Field18: Satellite azimuth (00 - 359) degree (if the leading digit is insufficient, make up 0)

Field 19: Signal-to-noise ratio (00-99) dbHz

Field 20: Validation value ($and *)

4.2.5 GPVTG

Description: Ground speed information

Field 0: $GPVTG, statement ID, indicates that the statement is track made good and ground speed (VTG) ground speed information

Field 1: motion angle, 000 - 359, (fill 0 if the leading digits are insufficient)

Field 2: T = true north reference system

Field 3: motion angle, 000 - 359, (fill 0 if the leading digits are insufficient)

Field 4: M = magnetic north reference system

Field 5: horizontal movement speed (0.00) (fill 0 if the leading digits are insufficient)

Field 6: n = section, knots

Field 7: horizontal movement speed (0.00) (fill 0 if the leading digits are insufficient)

Field 8: k = km / h, km / h

Field 9: check value (the value after exclusive or between $and *)

5 Common problems

1. File import failed

Make sure the ADB is installed successfully and the file path is correct.

2. GPS communication anomaly after import

Configuration files can be opened to determine whether the serial number is correct or not, and technical personnel of the company can be contacted when uncertain. You can also try to traverse all USB or physical serial ports to determine the specific serial password.

3. After the software is opened, the satellite can not be searched all the time.

Generally, satellites need to be searched in the open outdoors, but not in the indoors. When debugging, you can also try to operate by the window.

4. No satellite signals can be found outdoors.

Check if the GPS antenna is connected correctly.