NanoPi NEO2

From FriendlyARM WiKi

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Contents

Introduction

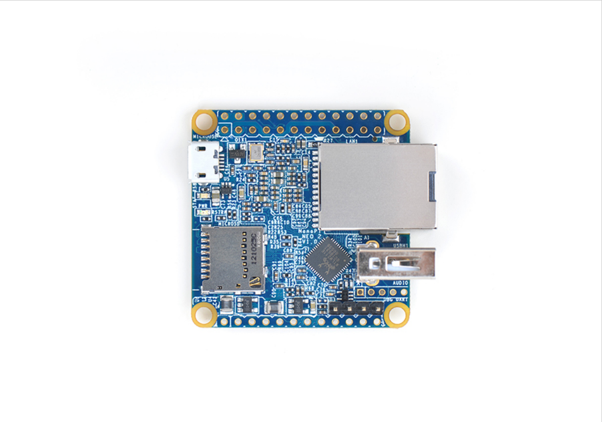
- The NanoPI NEO2 is a newly released super tiny ARM board by FriendlyElec. It uses Allwinner’s 64-bit H5 quad-core SoC (ARM Cortex-A53). It has internal hexa-core Mail450 GPU, 512M DDR3 RAM. A UbuntuCore and Armbian image files are ready for it.

- The NanoPi NEO2 inherits NEO's form factor and has compatible interfaces and ports with NEO. In addition in such a small dimension it has Gbps Ethernet and one USB host port. These features make it especially suitable for applications that require high data throughput , speedy data transmission and high performance. Hobbyists and makers will just love it.

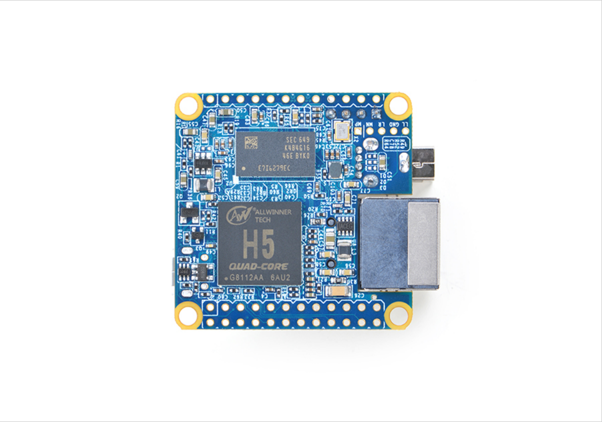
Overview

Hardware Spec

- CPU: Allwinner H5, Quad-core 64-bit high-performance Cortex A53
- DDR3 RAM: 512MB
- Connectivity: 10/100/1000M Ethernet, RTL8211E-VB-CG chip
- USB Host: USB Type A x 1 and USB pin header x 2
- MicroSD Slot: MicroSD x 1 for system boot and storage
- LED: Power LED x 1, System LED(Blue) x 1
- GPIO1: 2.54mm pitch 24 pin-header, compatible with Raspberry Pi's GPIO pin1 - pin 24. It includes UART, SPI, I2C, IO etc
- GPIO2: 2.54mm pitch 12 pin-header. It includes USB, IR receiver, I2S, IO etc
- Serial Debug Port: 2.54mm pitch 4pin-header
- Audio In/Out: 2.0mm pitch 4 pin-header
- MicroUSB: Power input(5V/2A) and OTG
- PCB Dimension: 40 x 40mm
- Weight: 13g(WITHOUT Pin-headers)
- OS/Software: u-boot,Ubuntu Core



Front

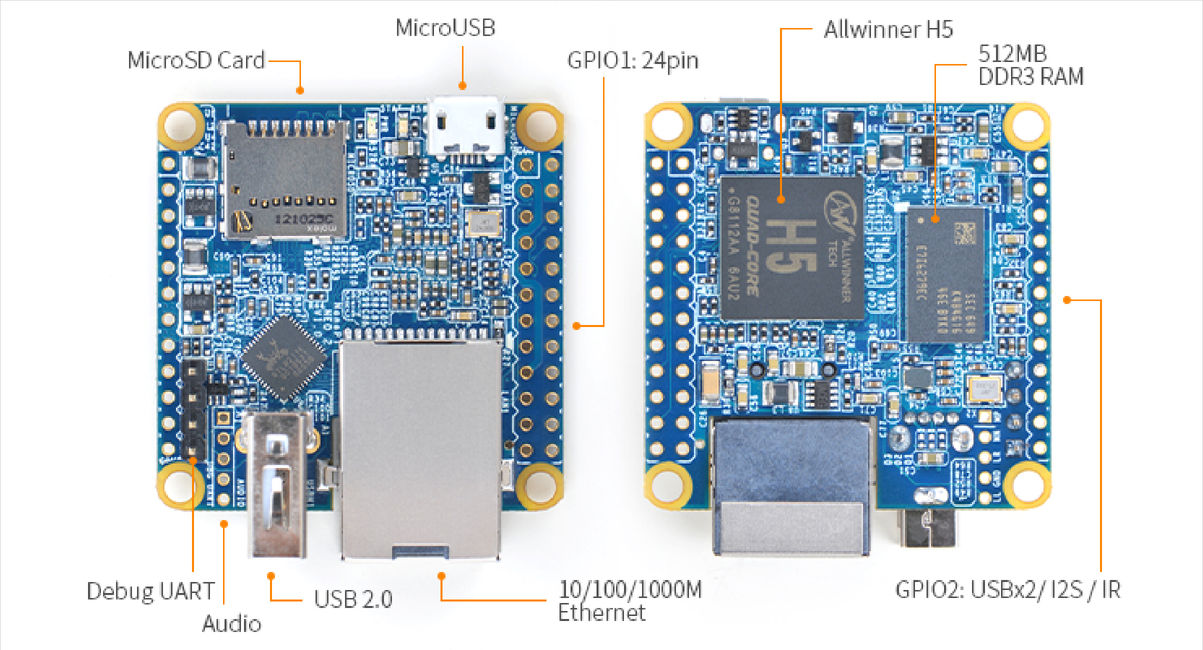


Back

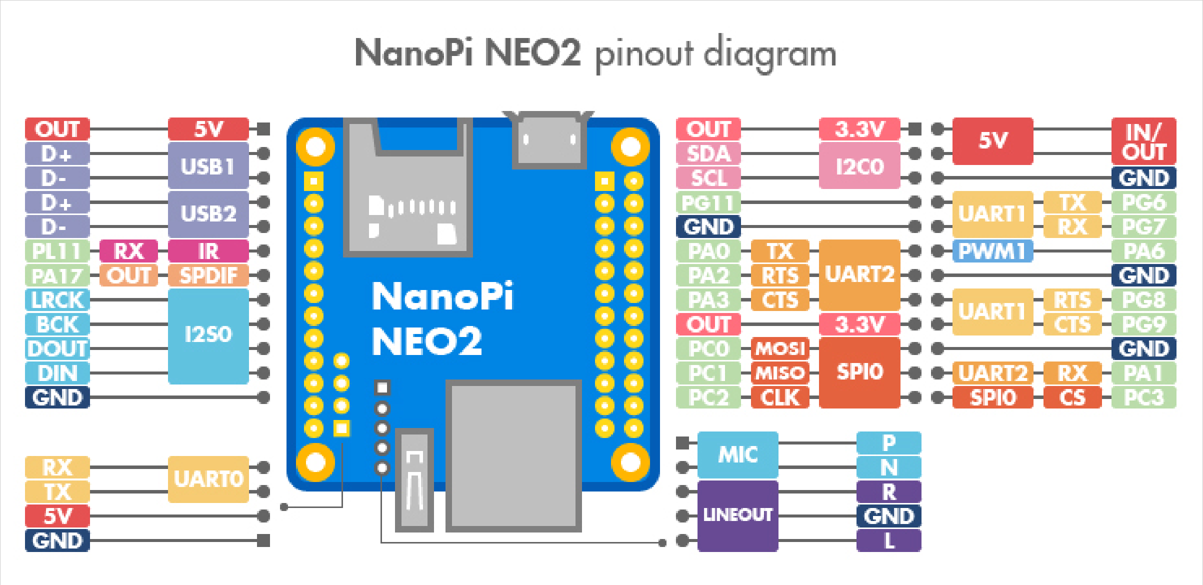
Diagram, Layout and Dimension

Layout

- **GPIO Pin Description**



NanoPi NEO2 Layout



pinout

Pin#	Name	Linux gpio	Pin#	Name	Linux gpio
1	SYS_3.3V		2	VDD_5V	
3	I2C0_SDA		4	VDD_5V	
5	I2C0_SCL		6	GND	
7	GPIOG11	203	8	UART1_TX/GPIOG6	198
9	GND		10	UART1_RX/GPIOG7	199
11	UART2_TX/GPIOA0	0	12	PWM1/GPIOA6	6
13	UART2_RTS/GPIOA2	2	14	GND	
15	UART2_CTS/GPIOA3	3	16	UART1_RTS/GPIOG8	200
17	SYS_3.3V		18	UART1_CTS/GPIOG9	201
19	SPI0_MOSI/GPIOC0	64	20	GND	
21	SPI0_MISO/GPIOC1	65	22	UART2_RX/GPIOA1	1
23	SPI0_CLK/GPIOC2	66	24	SPI0_CS/GPIOC3	67

- **USB/Audio/IR Pin Descripton**

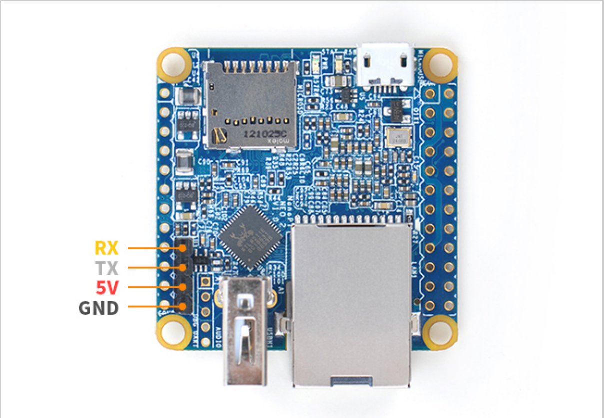
NanoPi-NEO2		
Pin#	Name	Description
1	VDD_5V	5V Power Out
2	USB-DP1	USB1 DP Signal
3	USB-DM1	USB1 DM Signal
4	USB-DP2	USB2 DP Signal
5	USB-DM2	USB2 DM Signal
6	GPIOL11/IR-RX	GPIOL11 or IR Receive
7	SPDIF-OUT/GPIOA17	GPIOA17 or SPDIF-OUT
8	PCM0_SYNC/I2S0_LRC	I2S/PCM Sample Rate Clock/Sync
9	PCM0_CLK/I2S0_BCK	I2S/PCM Sample Rate Clock
10	PCM0_DOUT/I2S0_SDOUT	I2S/PCM Serial Data Output
11	PCM0_DIN/I2S0_SDIN	I2S/PCM Serial Data Input
12	GND	0V

- **Audio**

Pin#	Name	Description
1	MICIN1P	Microphone Positive Input
2	MICIN1N	Microphone Negative Input
3	LINEOUTR	LINE-OUT Right Channel Output
4	GND	0V
5	LINEOUTL	LINE-OUT Left Channel Output

- **Debug Port（UART0）**

Pin#	Name
1	GND
2	VDD_5V
3	UART_TXD0
4	UART_RXD0

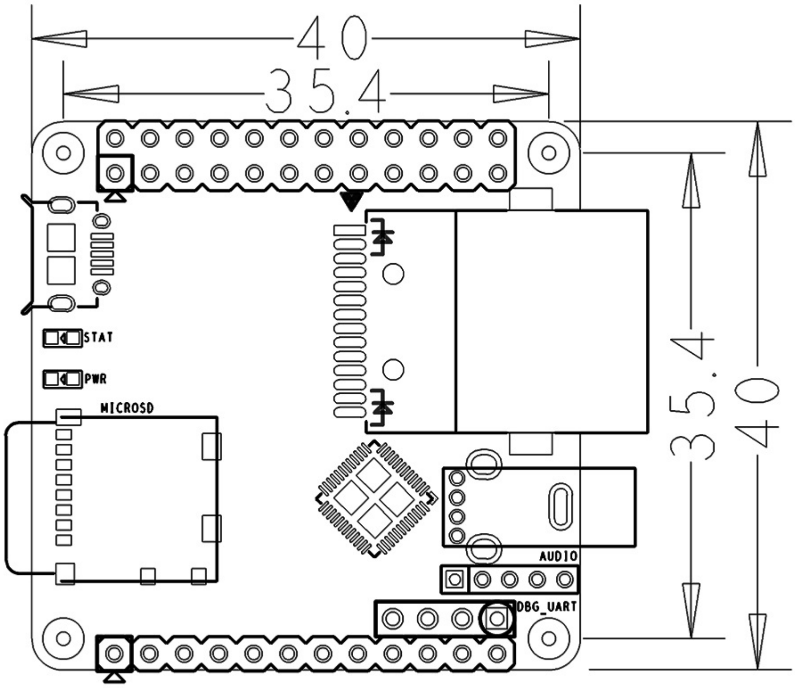


DBG_UART

Note

1. SYS_3.3V: 3.3V power output
2. VDD_5V: 5V power input/output. The input range is 4.7V ~ 5.6V. It can take power input from the MicroUSB.
3. All pins are 3.3V and output current is 5mA
4. For more details refer to the document: NanoPi_NEO2-1701-Schematic.pdf (http://wiki.friendlyarm.com/wiki/images/a/a1/Schematic_NanoPi_NEO2-v1.0_1701.pdf)

Dimensional Diagram



For more details refer to pcb file in dxf format (http://wiki.friendlyarm.com/wiki/index.php/File:NanoPi_NEO_2_Dimesions(dxf).rar)

Get Started

Essentials You Need

Before starting to use your NanoPi NEO2 get the following items ready

- NanoPi NEO2
- microSD Card/TFCard: Class 10 or Above, minimum 8GB SDHC
- microUSB power. A 5V/2A power is a must
- A Host computer running Ubuntu 14.04 64 bit system

TF Cards We Tested

To make your NanoPi NEO2 boot and run fast we highly recommend you use a Class10 8GB SDHC TF card or a better one. The following cards are what we used in all our test cases presented here:

- SanDisk TF 8G Class10 Micro/SD TF card:

SanDisk 闪迪

- SanDisk TF128G MicroSDXC TF 128G Class10 48MB/S:

- 川宇 8G C10 High Speed class10 micro SD card:

Make an Installation TF Card

Get Image File

Get the following files from download link (https://www.mediafire.com/folder/ah4i6w029912b/NanoPi-NEO2) to download image files (under the officail-ROMs directory) and the flashing utility(under the tools directory):

Image Files:	
nanopi-neo2-ubuntu-core-qte-sd4g.img.zip	Ubuntu-Core with Qt-Embedded Image File
Flash Utility:	
win32diskimager.rar	Windows utility. Under Linux users can use "dd"

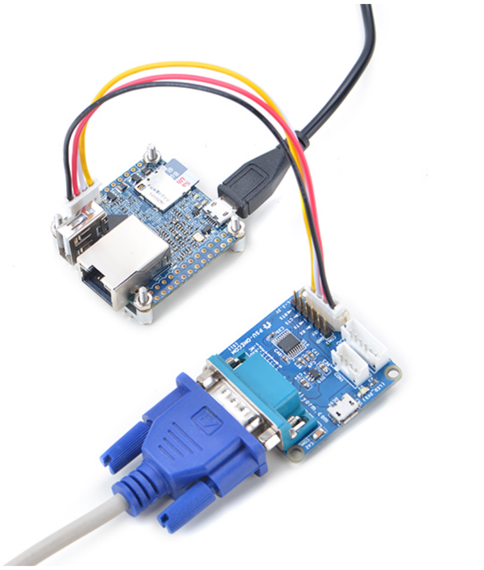
Make Ubuntu-Core with Qt-Embedded Image Card

Extract the nanopi-neo2-ubuntu-core-qte-sd4g.img.zip and win32diskimager.rar files. Insert a TF card(at least 8G) into a Windows PC and run the win32diskimager utility as administrator. On the utility's main window select your TF card's drive, the wanted image file and click on "write" to start flashing the TF card. After this writing process is done insert this card into your NanoPi NEO2's TF card slot and power on (with a 5V/2A power source). If the blue LED is blinking this indicates your NanoPi NEO2 has successfully booted.

Work with Ubuntu-Core with Qt-Embedded

Run Ubuntu-Core with Qt-Embedded

- If you want to do kernel development you need to use a serial communication board, ie a PSU-ONECOM board, which will allow you to operate the board via a serial terminal. Here is a setup where we connect a NanoPi NEO2 to a PC via the PSU-ONECOM and you can power on your NEO2 from either the PSU-ONECOM or the board's MicroUSB:



- Ubuntu-Core's User Accounts:

Non-root User:

```
User Name: pi
Password: pi
```

Root:

```
User Name: root
Password: fa
```

The system is automatically logged in as "pi". You can do "sudo npi-config" to disable auto login.

- Update packages:

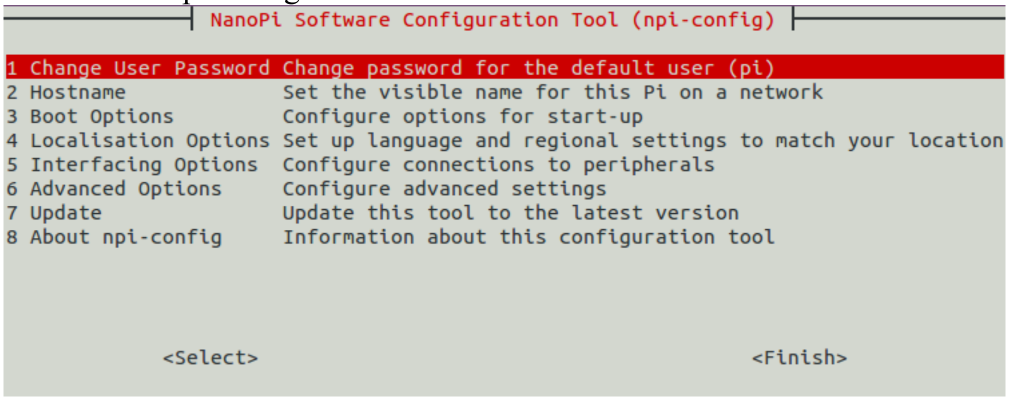
```
sudo apt-get update
```

Configure System with npi-config

The npi-config is a commandline utility which can be used to initialize system configurations such as user password, system language, time zone, Hostname, SSH switch , Auto login and etc. Type the following command to run this utility.

```
sudo npi-config
```

Here is how npi-config's GUI looks like:



```
NanoPi Software Configuration Tool (npi-config)

1 Change User Password Change password for the default user (pi)
2 Hostname             Set the visible name for this Pi on a network
3 Boot Options         Configure options for start-up
4 Localisation Options Set up language and regional settings to match your location
5 Interfacing Options  Configure connections to peripherals
6 Advanced Options     Configure advanced settings
7 Update               Update this tool to the latest version
8 About npi-config     Information about this configuration tool

            <Select>                                        <Finish>
```

Ethernet Connection

If a NanoPi NEO2 is connected to a network via Ethernet before it is powered on it will automatically obtain an IP after it is powered up. If it is not connected via Ethernet or its DHCP is not activated obtaining an IP will fail and system will hang on for about 15 to 60 seconds.In this case you can try obtaining an IP by using the following command:

```
dhclient eth0
```

Login via SSH

The NanoPi NEO2 doesn't have a video output interface. You can log into the board via SSH. In our test the IP address detected by our router was 192.168.1.230 and we ran the following command to log into the NanoPi NEO2:

```
ssh root@192.168.1.230
```

The password is fa

Extend TF Card's rootfs Section

When you boot Debian/UbuntuCore for the first time with your image card your OS will automatically resize the file system and this process takes a relatively long time.After your OS is fully loaded you can check the file system's size by using the following command:

```
df -h
```

Connect USB WiFi to NEO2

Our system has support for popular USB WiFi drivers. Many USB WiFi modules are plug and play with our system. Here is a list of models we tested;

Number	Model
1	RTL8188CUS 802.11n WLAN Adapter
2	RT2070 Wireless Adapter
3	RT2870/RT3070 Wireless Adapter
4	RTL8192CU Wireless Adapter
5	NetGear, Inc. WG111v3 54 Mbps Wireless [realtek RTL8187B]

If you NanoPi NEO2 is connected to a USB WiFi and is powered up you can log into NEO2 and run the following command to check if the USB WiFi is recognized. If "wlan0" is listed it indicates your USB WiFi has been recognized:

```
sudo ifconfig -a
```

Open this file "/etc/wpa_supplicant/wpa_supplicant.conf":

```
sudo vi /etc/wpa_supplicant/wpa_supplicant.conf
```

Open the /etc/wpa_supplicant/wpa_supplicant.conf file and append the following lines:

```
network={
        ssid="YourWiFiESSID"
        psk="YourWiFiPassword"
}
```

The "YourWiFiESSID" and "YourWiFiPassword" need to be replaced with your actual ESSID and password. Save, exit and run the following commands to connect to your WiFi router:

```
$ sudo ifdown wlan0
$ sudo ifup wlan0
```

If your WiFi password has special characters or you don't want your password saved as plain text you can use "wpa_passphrase" to generate a psk for your WiFi password. Here is how you can do it:

```
$ sudo wpa_passphrase YourWiFiESSID
```

Following the prompt type in your password and you will get a new password in the /etc/wpa_supplicant/wpa_supplicant.conf file. Now you can replace the existing password in the wlan0 file with the new one.

Connect NanoPi NEO2 to USB Camera(FA-CAM202)

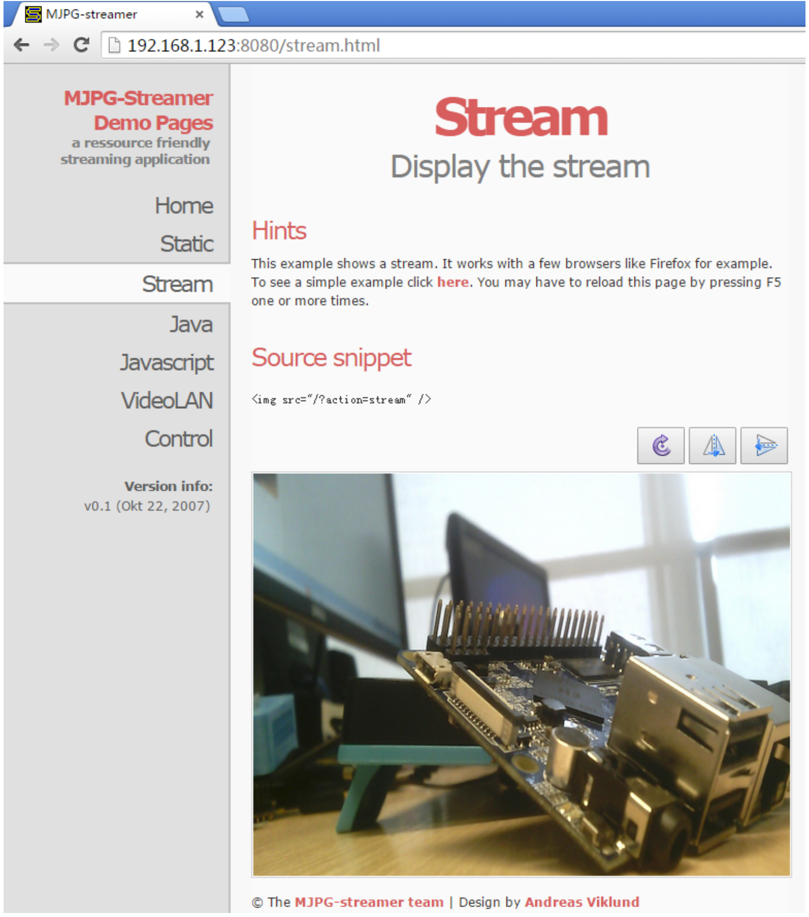
USB camera
The FA-CAM202 is a 2M-pixel USB camera module. Boot your NEO2, connect NEO2 to the internet, log in the system as root, compile and run the mjpg-streamer utility:

```
cd /root/mjpg-streamer
apt-get install libjpeg62-dev
make
./start.sh
```

The mjpg-streamer is an open source media server. After it is started successfully you will see the following messages:

```
i: Using V4L2 device.: /dev/video0
i: Desired Resolution: 1280 x 720
i: Frames Per Second.: 30
i: Format............: YUV
i: JPEG Quality......: 90
o: www-folder-path...: ./www/
o: HTTP TCP port.....: 8080
o: username:password.: disabled
o: commands..........: enabled
```

In our case our NEO2's IP address was 192.168.1.123. We typed "192.168.1.123:8080" on a browser, entered and we got the following screenshot:



Version info:
v0.1 (Okt 22, 2007)

Stream

Display the stream

Hints

This example shows a stream. It works with a few browsers like Firefox for example. To see a simple example click here. You may have to reload this page by pressing F5 one or more times.

Source snippet

```
<img src="/?action=stream" />
```

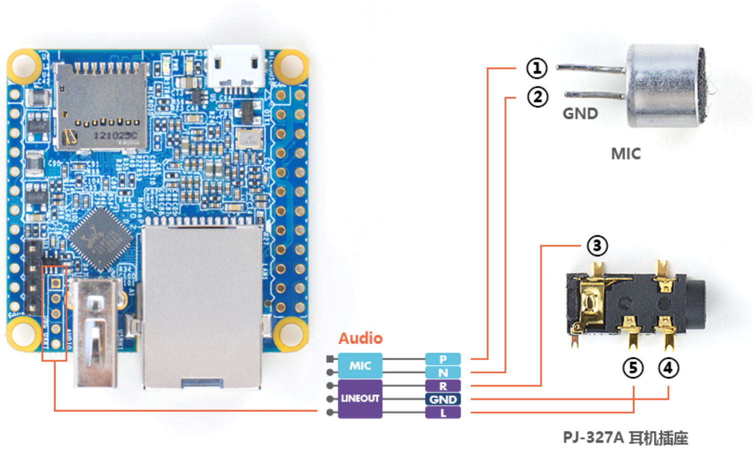
© The MJPG-streamer team | Design by Andreas Viklund

Play & Record Audio

The NanoPi NEO2 has an audio interface (2.0mm pitch 5-pin header) whose pin description is as follows:

Pin#	Name	Description
1	MICIN1P	Microphone Positive Input
2	MICIN1N	Microphone Negative Input
3	LINEOUTR	LINE-OUT Right Channel Output
4	GND	地
5	LINEOUTL	LINE-OUT Left Channel Output

Here is a hardware setup on how to connect an audio device to a NEO2:



Before begin to play or record a audio make sure your NEO2 is connected to an audio device.
Check a recognized audio device:

```
$ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: audiocodec [audiocodec], device 0: SUNXI-CODEC sun50iw2codec-0 []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

Play an audio file:

```
$ aplay /root/Music/test.wav -D plughw:0
```

Record an audio file:

```
$ arecord -f cd -d 5 test.wav
```

Make Your Own Ubuntu-Core with Qt-Embedded

Preparations

Visit this link download link (https://pan.baidu.com/s/1eRDbeG6) and enter the "sources/nanopi-H5-bsp" directory and download all the source code.Use the 7-zip utility to extract it and a lichee directory and an Android directory will be generated.You can check that by running the following command:

```
ls ./
lichee
```

Or you can get it from our github:

```
git clone https://github.com/friendlyarm/h5_lichee.git lichee
```

Note: "lichee" is the project name named by Allwinner for its CPU's source code which contains the source code of U-boot, Linux kernel and various scripts.

Install Cross Compiler

Visit this site download link (https://pan.baidu.com/s/1eRDbeG6), enter the "toolchain" directory, download the cross compiler "gcc-linaro-arm-4.6.3.tar.xz" and "gcc-linaro-aarch64.tar.xz" and copy them to the "lichee/brandy/toochain/" directory.
"gcc-linaro-arm-4.6.3.tar.xz"is for compiling u-boot and "gcc-linaro-aarch64.tar.xz" is for compiling Linux kernel.

Compile lichee Source Code

Compilation of the H5's BSP source code must be done under a PC running a 64-bit Linux.The following cases were tested on Ubuntu-14.04 LTS-64bit:

```
sudo apt-get install gawk git gnupg flex bison gperf build-essential \
zip curl libc6-dev libncurses5-dev:i386 x11proto-core-dev \
libx11-dev:i386 libreadline6-dev:i386 libgl1-mesa-glx:i386 \
libgl1-mesa-dev g++-multilib mingw32 tofrodos \
python-markdown libxml2-utils xsltproc zlib1g-dev:i386
```

Enter the lichee directory and run the following command to compile the whole package:

```
cd lichee/fa_tools
./build.sh -b nanopi-neo2 -p linux -t all
```

After this compilation succeeds a u-boot, Linux kernel and kernel modules will be generated.
Note: the lichee directory contains cross-compilers we have setup. When the build.sh script runs it will automatically call these cross-compilers.

The following commands can be used to update the u-boot on an installation TF card:

```
cd lichee/fa_tools/
./fuse.sh -d /dev/sdx -p linux -t u-boot
```

Note: you need to replace "/dev/sdx" with the device name in your system.
The boot.img and kernel modules are under the "linux-3.10/output" directory. You can copy the new boot.img file to your TF card's boot section.

Compile U-boot

You can run the following commands to compile u-boot individually:

```
cd lichee/fa_tools/
./build.sh -b nanopi-neo2 -p linux -t u-boot
```

Compile Linux Kernel

You can run the following commands to compile Linux kernel individually:

```
cd lichee/fa_tools/
./build.sh -b nanopi-neo2 -p linux -t kernel
```

The boot.img and kernel modules are under the "linux-3.10/output" directory. You can copy the new boot.img file to your TF card's boot section.

Clean Source Code

```
cd lichee/fa_tools/
./build.sh -b nanopi-neo2 -p linux -t clean
```

3D Printing Files

downloadfile (http://www.thingiverse.com/thing:2180624)

frameless

Resources

Datasheet & Schematics

- Schematics
  - NanoPi-NEO2-1701-Schematic.pdf (http://wiki.friendlyarm.com/wiki/images/a/a1/Schematic_NanoPi_NEO2-v1.0_1701.pdf)
- Dimensional Diagram
  - NanoPi-NEO2-1701 pcb in dxf format (http://wiki.friendlyarm.com/wiki/index.php/File:NanoPi_NEO_2_Dimesions(dxf).rar)
- H5 Datesheet Allwinner_H5_Datasheet_V1.0.pdf (http://wiki.friendlyarm.com/wiki/images/d/de/Allwinner_H5_Datasheet_V1.0.pdf)

Update Log

March-14-2017

- Released English Version

April-5-2017

- Added sections 5.2 and 5.8

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