

# ARM<sup>®</sup> ARM926EJ-S 32-bit Microprocessor

## NuMaker NuWicam Programming Guide

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## 1 INTRODUCTION

**NuMaker NuWicam**[1] is an open-source Wi-Fi camera module. It is based on Nuvoton's N32905R3DN video MPU. N32905R3DN provides a powerful JPEG codec for encoding. NuWicam firmware provides audio and video streams over RTSP server. The format of video stream is Motion-JPEG with VGA resolution. The format of audio stream is G.711-alaw. It also provides a virtual COM software for high-speed UART connective. For example, mobile APP can read LM35 temperature sensor data from Nudurino board (or Nu-mbed board) or light on LEDs on Nudurino board over Modbus RTU protocol. User also can modify configurations over HTTP. We wish the NuWicam can help you get A/V stream and do some data sampling between mobile devices and some low-end MCUs easily.

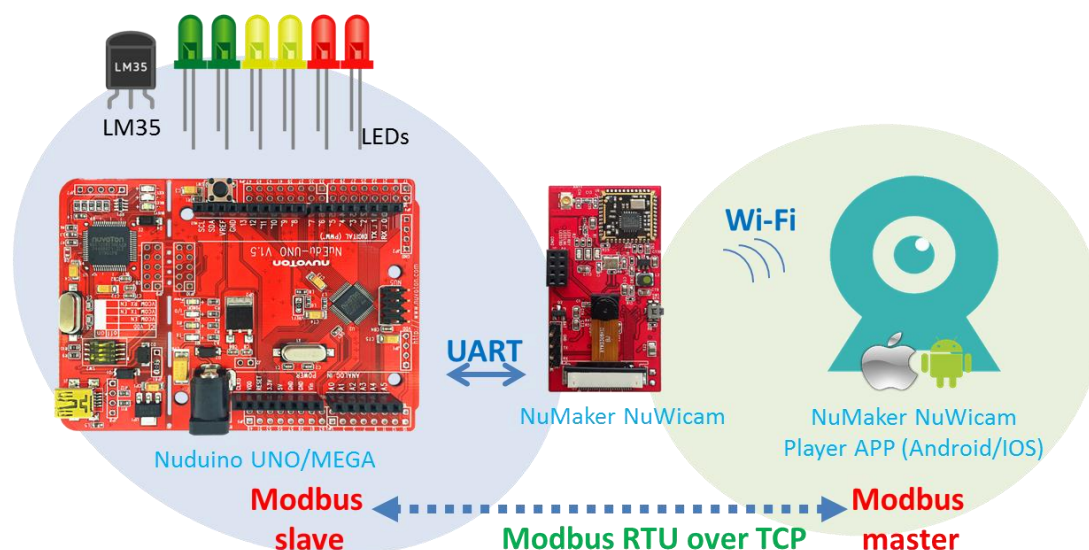


Figure 1-1 NuWicam application scenario

[1] NuWicam is short for NuMaker NuWicam.

## 2 HTTP SERVER

### 2.1 Feature

1. Porting light-weight HTTP server – boa.
2. CGI with extension name **.cgi**
3. Embedded C language CGI in boa HTTP server
4. Response in JSON format except for stream request

Content-type: application/json\r\n\r\n

{"value": "xxx"}

### 2.2 Limitation

1. Request string is case sensitive

### 2.3 Configuraiton

Configuration parameters list in JSON format or update

#### 2.3.1 List all Wi-Fi parameters

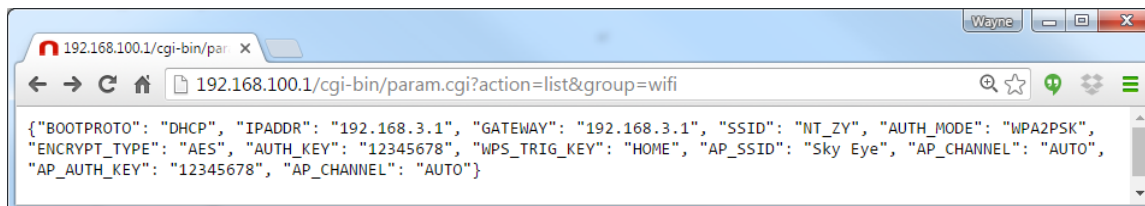
#### Request String

<http://<IP-Address>/cgi-bin/param.cgi?action=list&group=wifi>

#### Return Value

| Name         | Value                      | Description                  |
|--------------|----------------------------|------------------------------|
| BOOTPROTO    | STATIC or DHCP             | Boot protocol                |
| IPADDR       | xxx.xxx.xxx.xxx            | IP address for static        |
| GATEWAY      | xxx.xxx.xxx.xxx            | Gateway static               |
| SSID         | String                     | SSID                         |
| AUTH_MODE    | OPEN/SHARED/WPAPSK/WPA2PSK | Authentication mode          |
| ENCRYPT_TYPE | NONE/WEP/TKIP/AES          | Encryption type              |
| AUTH_KEY     | String                     | Authentication key           |
| WPS_TRIG_KEY | HOME                       | WPS key                      |
| AP_SSID      | String                     | SSID                         |
| AP_AUTH_KEY  | String                     | Soft AP's authentication key |
| AP_CHANNEL   | 1 ~ 13, AUTO               | Soft AP's channel            |

### Example Response Data



### 2.3.2 Update all Wi-Fi parameters

#### Request String

http://<IP-Address>/cgi-bin/param.cgi?action=update&group=wifi&{Name}={Value}

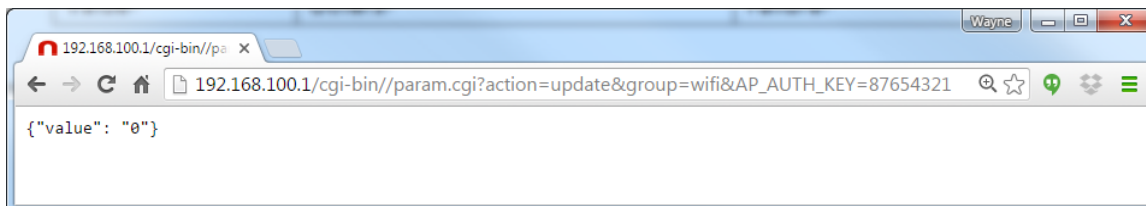
#### Available Parameter List

| Name         | Value                       | Description                  |
|--------------|-----------------------------|------------------------------|
| BOOTPROTO    | STATIC or DHCP              | Boot protocol                |
| IPADDR       | xxx.xxx.xxx.xxx             | IP address for static        |
| GATEWAY      | xxx.xxx.xxx.xxx             | Gateway static               |
| SSID         | String                      | SSID                         |
| AUTH_MODE    | OPEN/SHARED/WPA2PSK/WPA2PSK | Authentication mode          |
| ENCRYPT_TYPE | NONE/WEP/TKIP/AES           | Encryption type              |
| AUTH_KEY     | String                      | Authentication key           |
| WPS_TRIG_KEY | HOME                        | WPS key                      |
| AP_SSID      | String                      | SSID                         |
| AP_AUTH_KEY  | String                      | Soft AP's authentication key |
| AP_CHANNEL   | 1 ~ 13                      | Soft AP's channel            |

#### Return Value

| Name  | Value  | Description |
|-------|--------|-------------|
| value | 0      | Success     |
| value | Others | Failure     |

### Example Request String



### 2.3.3 List all stream parameters

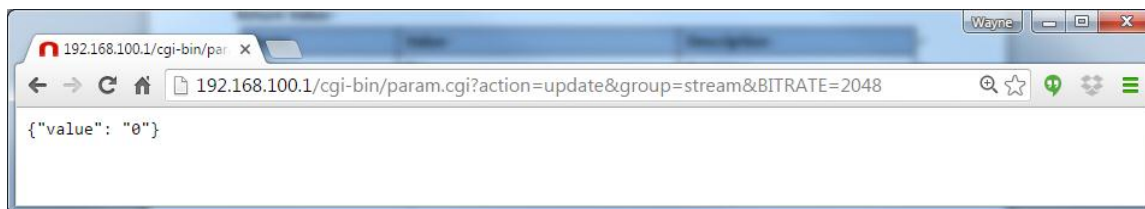
#### Available Parameter List

| Name          | Value     | Description |
|---------------|-----------|-------------|
| VINWIDTH      | 8~4096    |             |
| VINHEIGHT     | 8~4096    |             |
| JPEGENCWIDTH  | 8~4096    |             |
| JPEGENCHEIGHT | 8~4096    |             |
| BITRATE       | 1024~8192 | Unit: Kbps  |

#### Return Value

| Name  | Value  | Description |
|-------|--------|-------------|
| value | 0      | Success     |
| value | Others | Failure     |

### Example Request String



## 2.4 Subsystem

### 2.4.1 Restart

#### Request String

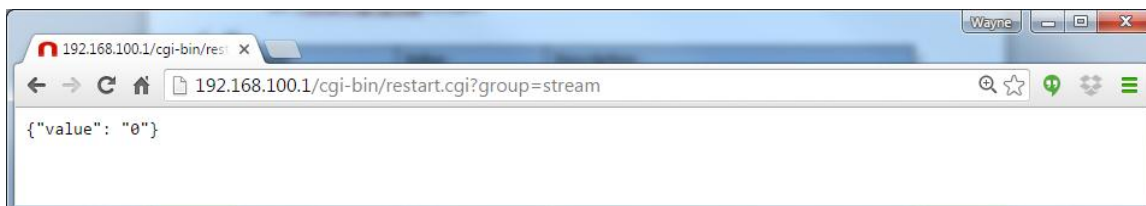
`http://<IP-Address>/cgi-bin/restart.cgi?group={Name}`

| Name   | Description                       |
|--------|-----------------------------------|
| wifi   | Restart Wi-Fi start-up procedure. |
| board  | Reset board.                      |
| stream | Restart RTSP server.              |

#### Return Value

| Name  | Value  | Description |
|-------|--------|-------------|
| value | 0      | Success     |
| value | Others | Failure     |

#### Example Response Data



**NOTICE:** If you specify to restart board or Wi-Fi networking, you won't get response from NuWicam properly.

### 3 A/V STREAM OVER RTSP

#### 3.1 Motion JPEG and G.711-ALAW streaming

MRL: rtsp://<Server-IP address>:port/cam1/mpeg4

The RTSP server is TCP port 554 by default. You can use **mplayer** or **VLC** on window platform and NuWicam Player APP to get streams.

Command: [mplayer -nocache "rtsp://192.168.100.1/cam1/mpeg4"](#)



## 4 VIRTUAL COM FUNCTION

### 4.1 UART From/To TCP connection

We ported **ser2net** open source package to do a virtual COM function. By default, we configure the High speed UART port and a TCP port 502 is the pair. The baud rate setting is '115200N81' by default. If you need to modify these parameters, you can modify "/mnt/nuwicam/etc/ser2net.conf" file.

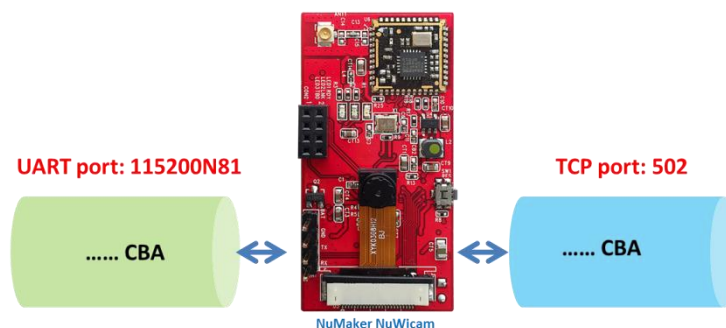


Figure 4-1 UART transparent transmission

## 5 OPEN SOURCE LIST

| Item             | Description                                  | URL & Major modification  |
|------------------|--|---|
| uclibc-gcc-4.8   | GCC toolchain                                | <a href="https://buildroot.org/">https://buildroot.org/</a>   |
| linux-2.6.35.4   | Linux kernel                                 | <a href="http://www.linux.org/">http://www.linux.org/</a>   |
| busybox.1.15.2   | Linux shell                                  | <a href="http://www.busybox.net/about.html">http://www.busybox.net/about.html</a>   |
| dnsmasq-2.60     | DHCP server                                  | <a href="http://www.thekelleys.org.uk/dnsmasq/doc.html">http://www.thekelleys.org.uk/dnsmasq/doc.html</a>                                     |
| hostapd          | Wi-Fi access point and authentication server | <a href="http://hostap.epitest.fi/wpa_supplicant/">http://hostap.epitest.fi/wpa_supplicant/</a>   |
| spook-20050207   | RTSP server                                  | <a href="http://www.litech.org/spook/">http://www.litech.org/spook/</a><br>Major modification: Support H/W JPEG encoding acceleration.        |
| wireless-tool.29 | Network configuration utilities              | <a href="http://www.hpl.hp.com/personal/Jean_Tourrilhes/Linux/Tools.html">http://www.hpl.hp.com/personal/Jean_Tourrilhes/Linux/Tools.html</a> |
| wpa_supplicant   | IEEE 802.11i supplicant                      | <a href="http://hostap.epitest.fi/wpa_supplicant/">http://hostap.epitest.fi/wpa_supplicant/</a>   |
| ser2net-2.10.0   | Serial to Network Proxy                      | <a href="http://ser2net.sourceforge.net/">http://ser2net.sourceforge.net/</a>   |
| boa-0.94.13      | Light-weight Webserver                       | <a href="http://www.boa.org/">http://www.boa.org/</a>   |

## 6 REVISION HISTORY

| Date       | Revision | Description          |
|------------|----------|----------------------|
| 2016.07.31 | 1.00     | 1. Initially issued. |

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