ARM® ARM926EJ-S

32-bit Microprocessor

NuMaker NuWicam Programming Guide

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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 NuMaker UNO board (or NuMaker-PFM-NUC472 board) or light on LEDs on NuMaker UNO 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.

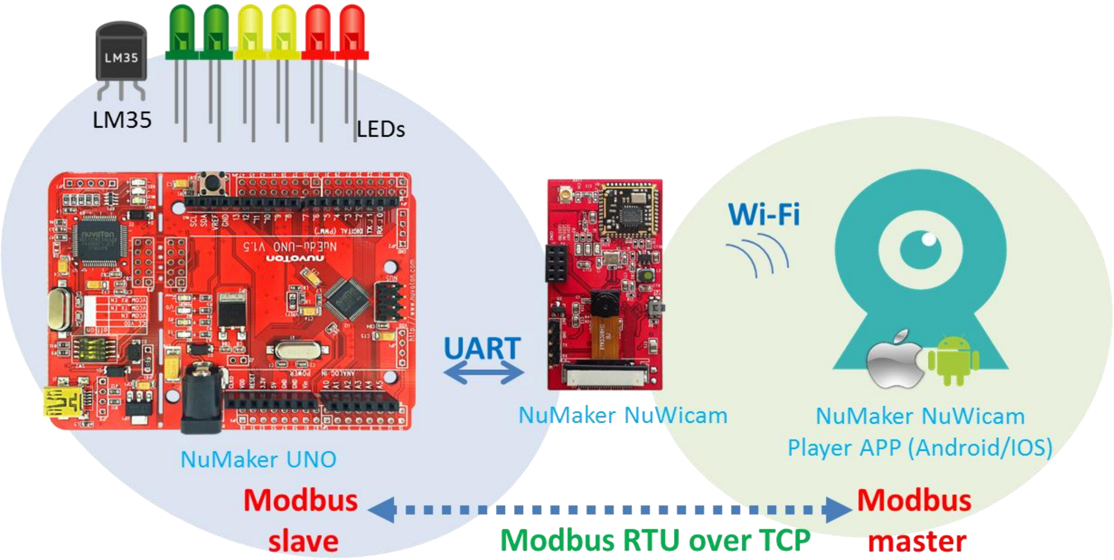


Figure 1-1 NuWicam application scenario

[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

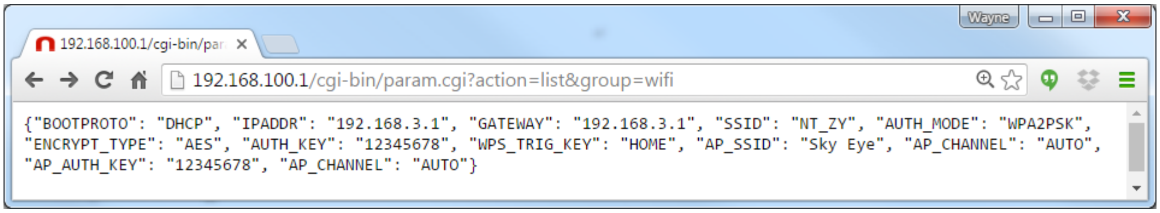
Request String

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



192.168.100.1/cgi-bin/par
Wayne
192.168.100.1/cgi-bin/param.cgi?action=list&group=wifi

```
{"BOOTPROTO": "DHCP", "IPADDR": "192.168.3.1", "GATEWAY": "192.168.3.1", "SSID": "NT_ZY", "AUTH_MODE": "WPA2PSK",
"ENCRYPT_TYPE": "AES", "AUTH_KEY": "12345678", "WPS_TRIG_KEY": "HOME", "AP_SSID": "Sky Eye", "AP_CHANNEL": "AUTO",
"AP_AUTH_KEY": "12345678", "AP_CHANNEL": "AUTO"}
```

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/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	Soft AP's channel

Return Value

Name	Value	Description
value	0	Success
value	Others	Failure

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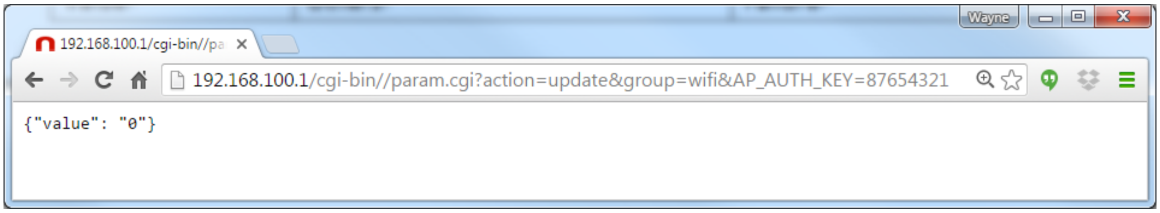
Example Request String



192.168.100.1/cgi-bin//param.cgi?action=update&group=wifi&AP_AUTH_KEY=87654321

```
{"value": "0"}
```

2.3.3 List all stream parameters

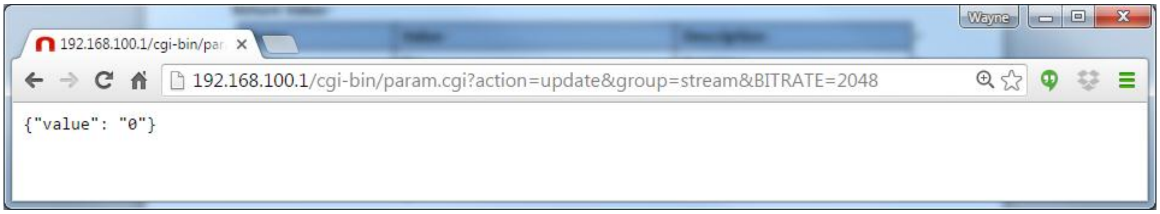
Available Parameter List

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



192.168.100.1/cgi-bin/param.cgi?action=update&group=stream&BITRATE=2048

```
{"value": "0"}
```

2.4 Subsystem

2.4.1 Restart

Request String

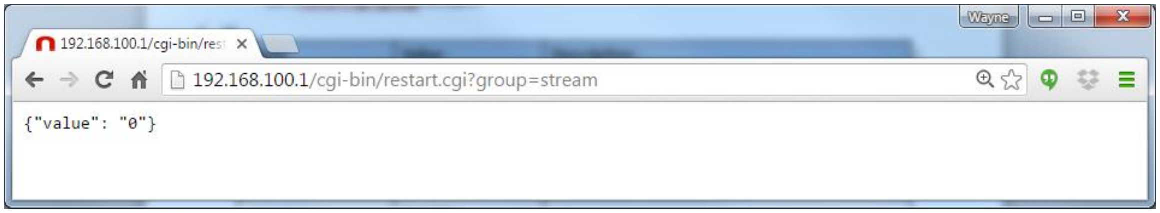
http://<IP-Address>/cgi-bin/restart.cgi?group={Name}

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


192.168.100.1/cgi-bin/rest
Wayne
192.168.100.1/cgi-bin/restart.cgi?group=stream

```
{"value": "0"}
```

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.

Configuration in /mnt/nuwicam/etc/ser2net.conf

```
#  <TCP port>:<state>:<timeout>:<device>:<options>
502:raw:60:/dev/ttyS0:115200 NONE 1STOPBIT 8DATABITS
```

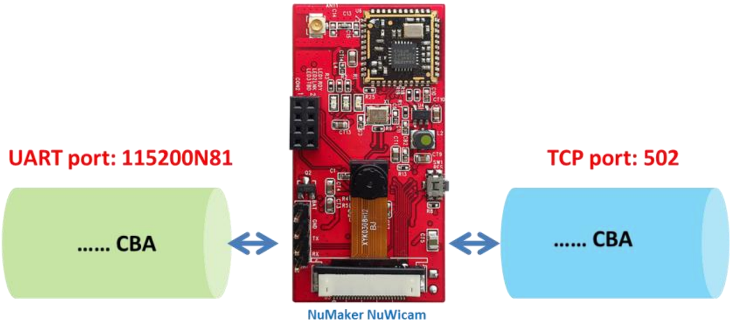
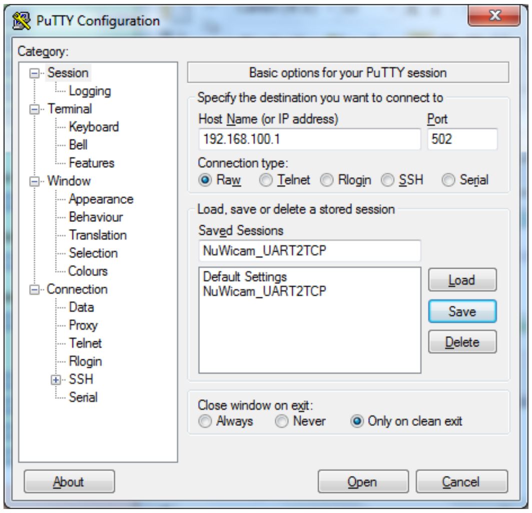


Figure 4-1 UART transparent transmission

4.2 Function test

After associating with NuWicam board over Wi-Fi, please also make sure your PC leased an IP address is leased from NuWicam's DHCP server. we can use '**putty**' utility to test the UART2TCP function. You can refer below configratuin to connect TCP port. The port is 502 by default. Then, press 'Open' button to connect.



Specify the destination you want to connect to

Host Name (or IP address): 192.168.100.1

Port: 502

Connection type: ● Raw ○ Telnet ○ Rlogin ○ SSH ○ Serial

Load, save or delete a stored session

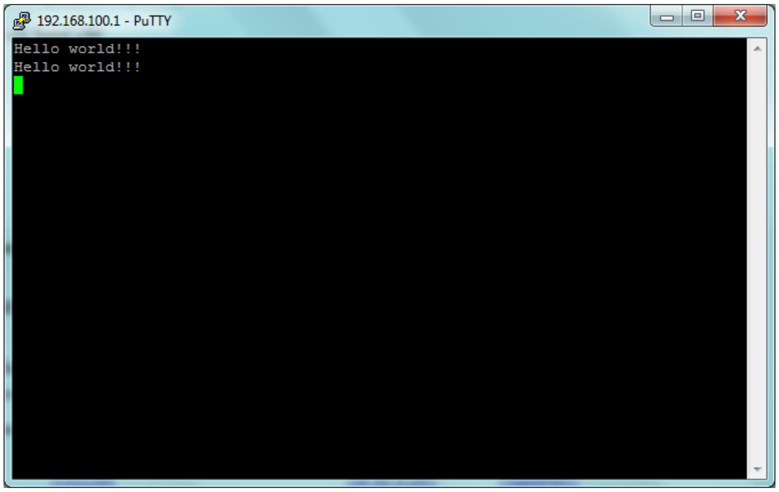
Saved Sessions: NuWicam_UART2TCP

Default Settings
NuWicam_UART2TCP

Close window on exit: ○ Always ○ Never ● Only on clean exit

Figure 4-2 putty configuration for NuWicam UART2TCP connction

If it connected successfully, you can see a terminal window is pop-up. You can type some words and press ‘Enter’ key to send data. These data will be forwarded to UART-TX pin on NuWicam board. If you can short TX pin and RX pin, the terminal will receive the same data is echoed from NuWicam board.



```
Hello world!!!
Hello world!!!
```

Figure 4-3 Putty terminal window

5 OPEN SOURCE LIST

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

6 REVISION HISTORY

Date	Revision	Description
2016.07.31	1.00	1. Initially issued.
2016.08.17	1.01	2. Modify ‘Nuduino’ to ‘NuMaker UNO’
2016.08.31	1.02	3. Add UART2TCP function test.

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