

ARM® 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 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.

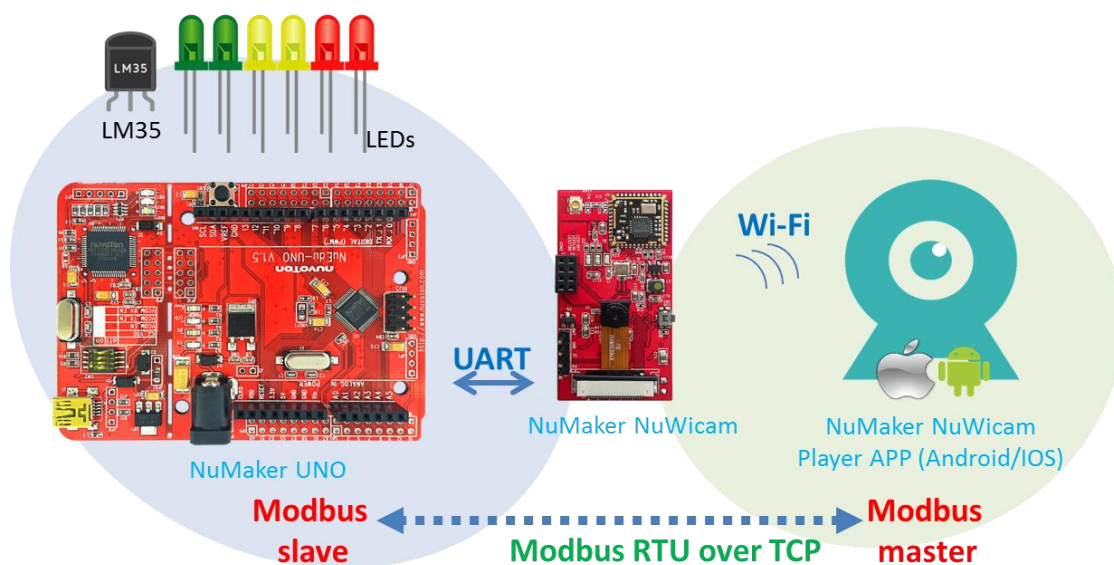


Figure 1-1 NuWicam application scenario

[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

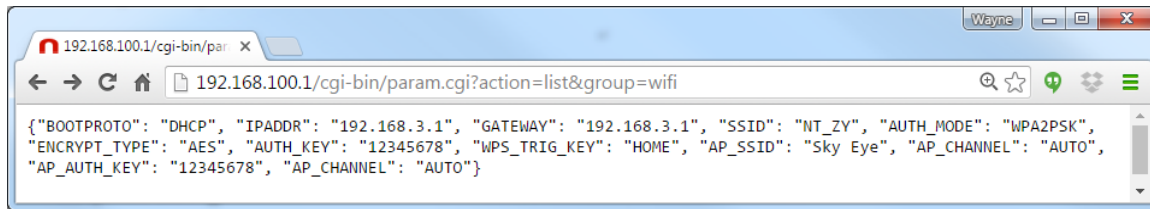
Request String

<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



2.3.2 Update all Wi-Fi parameters

Request String

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

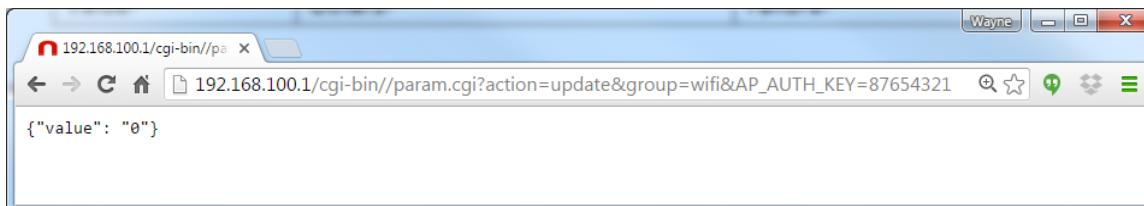
Available Parameter List

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

Example Request String



2.3.3 List all stream parameters

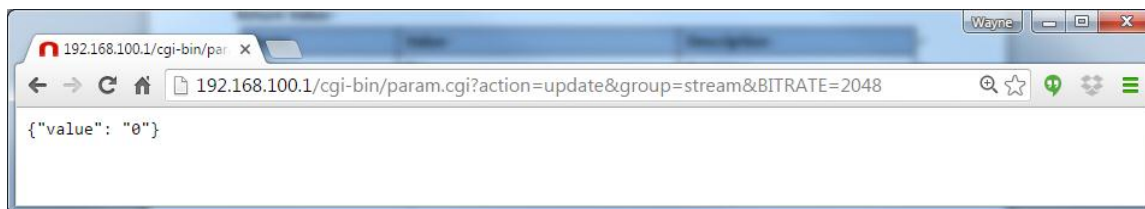
Available Parameter List

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

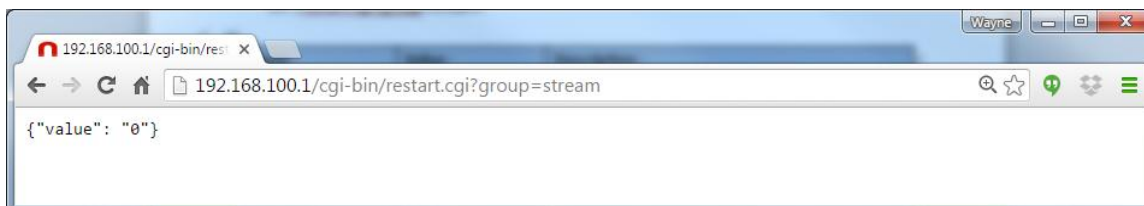
http://<IP-Address>/cgi-bin/restart.cgi?group={Name}

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.

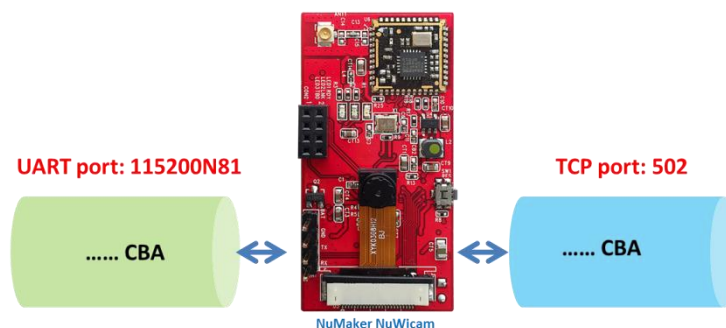


Figure 4-1 UART transparent transmission

5 OPEN SOURCE LIST

Item	Description	URL & Major modification
uclibc-gcc-4.8	GCC toolchain	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'

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