M480_FreeRTOS_LwIP_Http_Server

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	This code is an http server that is implemented with LwIP under FreeRTOS to control a LED on evaluation board.
BSP Version	M480 Series BSP CMSIS V3.04.000
Hardware	NuMaker-PFM-M487

1 Function Description

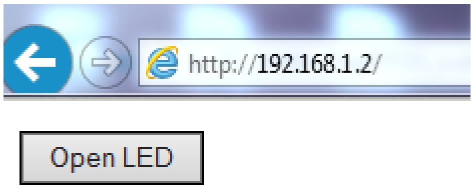
1.1 Introduction

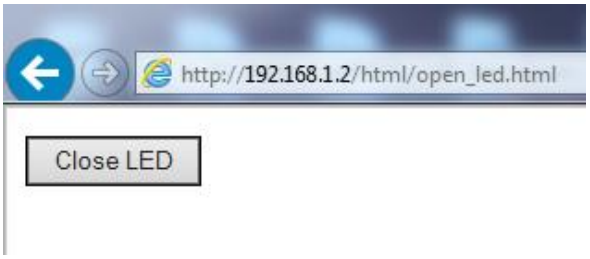
This code is an http server that is implemented with LwIP under FreeRTOS. This FreeRTOS system creates a task that control with a LED on evaluation board.

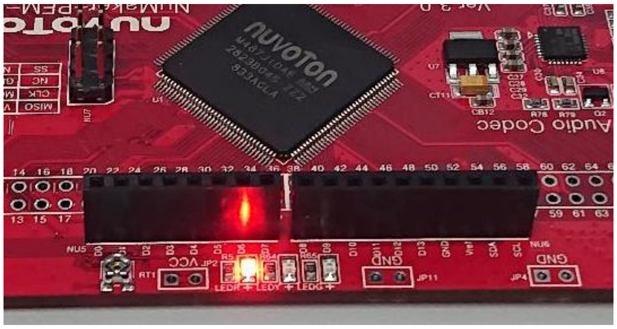
1.2 Principle

This FreeRTOS sample code creates a task. This task acts as an http server, which is implemented with LwIP. It is configured statically to IP address 192.168.1.2:80. The PC could use a web browser to connect with this http server by the webpage http://192.168.1.2/. When user clicks the open LED button, the LED on evaluation board will be turn on. Then, the webpage will change to a close LED page. User also could click the close LED button to turn off the LED. And the webpage will back to the open LED page.

1.3 Demo Result







2 Code Description

Set LwIP network interface and create task for http server：

```
static void vWebTask(void *pvParameters)
{
    ip_addr_t ipaddr;
    ip_addr_t netmask;
    ip_addr_t gw;
    /*IP address setting*/
    IP4_ADDR(&gw, 192,168,1,1);
    IP4_ADDR(&ipaddr, 192,168,1,2);
    IP4_ADDR(&netmask, 255,255,255,0);
    printf("Local IP:192.168.1.2\n");
    /*network interface initial*/
    tcpip_init(NULL, NULL);
    netif_add(&netif, &ipaddr, &netmask, &gw, NULL, ethernetif_init, tcpip_input);
    netif_set_default(&netif);
    netif_set_up(&netif);

    /*EMAC interrupt enable*/
    NVIC_SetPriority(EMAC_TX_IRQn, configLIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY + 1);
    NVIC_EnableIRQ(EMAC_TX_IRQn);
    NVIC_SetPriority(EMAC_RX_IRQn, configLIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY + 1);
    NVIC_EnableIRQ(EMAC_RX_IRQn);

    http_server_netconn_init();  /*Create http_server task*/
    vTaskSuspend(NULL);
}
```

Http server task function：

```
static void http_server_netconn_thread(void *arg)
{
    struct netconn *conn, *newconn;
    err_t err;

    /* Create a new TCP connection handle */
    conn = netconn_new(NETCONN_TCP);

    if(conn!= NULL) {
        /* Bind to port 80 (HTTP) with default IP address */
        err = netconn_bind(conn, NULL, 80);
        if(err == ERR_OK) {
            /* Put the connection into LISTEN state */
            netconn_listen(conn);
            while(1) {
                /* accept any incoming connection */
                netconn_accept(conn,&newconn);
                if(newconn) {
                    /* serve connection */
                    http_server_serve(newconn);

                    /* delete connection */
                    netconn_delete(newconn);
                }
            }
        } else {
            printf("can not bind netconn");
        }
    } else {
        printf("can not create netconn");
    }
    while(1);
}

/*Webpage data*/
static const char* close_led = "<html><body><form name='input' action='/html/open_led.html' method='get'><input type='submit' value='Open LED' /></form></body></html>";
static const char* open_led = "<html><body><form name='input' action='/html/close_led.html' method='get'><input type='submit' value='Close LED' /></form></body></html>";


void http_server_serve(struct netconn *conn)
{
    struct netbuf *inbuf;
    char* buf;
    u16_t buflen;
    struct fs_file * file;

    /* Read the data from the port, blocking if nothing yet there.
     We assume the request is in one netbuf */
    netconn_recv(conn,&inbuf);
    if(inbuf != NULL) {
        if(netconn_err(conn) == ERR_OK) {
            netbuf_data(inbuf, (void**)&buf, &buflen);

            /* Is this an HTTP GET command? (only check the first 5 chars, since
            there are other formats for GET, and we're keeping it very simple )*/
            if((buflen >=5) && (strncmp(buf, "GET /", 5) == 0)) {
                /* Check if request to get html data */
                if(strncmp((char const *)buf,"GET /html/open_led.html", strlen("GET
                           /html/open_led.html")) == 0) {
                    netconn_write(conn, (const unsigned char*)open_led,
                                  (size_t)strlen(open_led), NETCONN_NOCOPY);
                    PH0 = 0;  //Open led
                } else if(strncmp(buf, "GET /html/close_led.html", strlen("GET
                                  /html/close_led.html")) == 0) {
                    netconn_write(conn, (const unsigned char*)close_led,
                                  (size_t)strlen(close_led), NETCONN_NOCOPY);
                    PH0 = 1;  //Close led
                } else if((strncmp(buf, "GET /index.html", 15) == 0)||(strncmp(buf, "GET /
                                   ", 6) == 0)) {
                    netconn_write(conn, (const unsigned char*)close_led,
                                  (size_t)strlen(close_led), NETCONN_NOCOPY);
                    PH0 = 1;  //Close led
                } else {
                    /* Load Error page */
                    file = fs_open("/404.html");
                    netconn_write(conn, (const unsigned char*)(file->data), (size_t)file-
                                  >len, NETCONN_NOCOPY);
                    fs_close(file);
                }
            }
        }
    }
    /* Close the connection (server closes in HTTP) */
    netconn_close(conn);

    /* Delete the buffer (netconn_recv gives us ownership,
     so we have to make sure to deallocate the buffer) */
    netbuf_delete(inbuf);
}
```

3 Software and Hardware Environment

● Software Environment

- BSP version
  - M480 Series BSP CMSIS V3.04.000
- IDE version
  - Keil uVersion 5.26

● Hardware Environment

- Circuit components
  - NuMaker-PFM-M487 v3.0
- Diagram

M480		Ethernet jack (CN1)
PA.6	←	RMII_RXERR
PA.7	←	RMII_CRSDV
PC.6	←	RMII_RXD1
PC.7	←	RMII_RXD0
PC.8	←	RMII_REFCLK
PE.8	→	RMII_MDC
PE.9	↔	RMII_MDIO
PE.10	→	RMII_TXD0
PE.11	→	RMII_TXD1
PE.12	→	RMII_TXEN

4 Directory Information

🗁 EC_M480_FreeRTOS_LwIP_Http_Server_V1.00			
	🗁 Library		Sample code header and source files
		🗁 CMSIS	Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
		🗁 Device	CMSIS compliant device header file
		🗁 StdDriver	All peripheral driver header and source files
	🗁 SampleCode		
		🗁 ExampleCode	Source file of example code
	🗁 ThirdParty		
		🗁 FreeRTOS	A real time operating system available for free download. Its official website is: http://www.freertos.org/
		🗁 lwIP	A widely used open source TCP/IP stack designed for embedded systems. Its official website is: http://savannah.nongnu.org/projects/lwip/

5 How to Execute Example Code

1. Browsing into sample code folder by Directory Information (section 4) and double click M480_FreeRTOS_LwIP_Http_Server.uvproj.
2. Enter Keil compile mode
   a. Build
   b. Download
   c. Start/Stop debug session
3. Enter debug mode
   a. Run

6 Revision History

Date	Revision	Description
Oct. 11, 2019	1.00	1. Initially issued.

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