

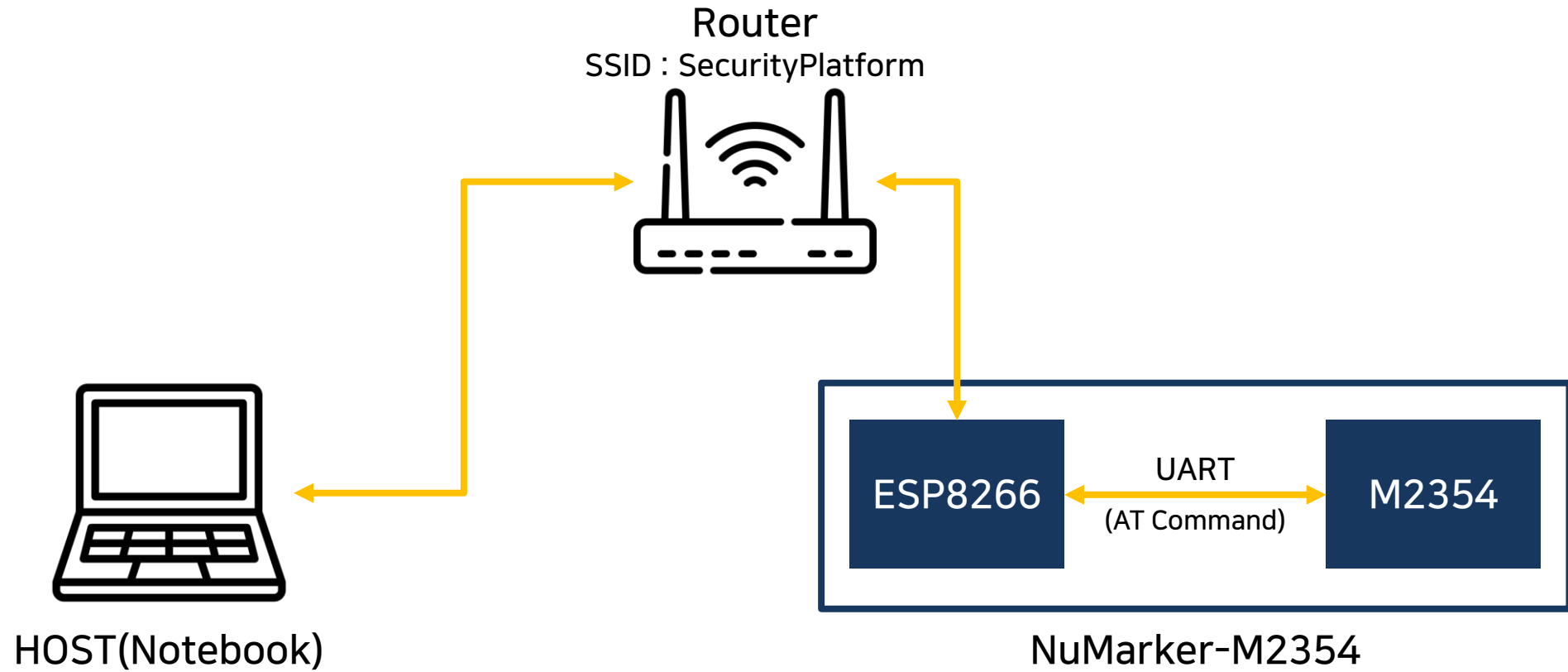
시큐리티 플랫폼 2021 인턴 Wi-Fi Apps 개발

김은주

01

살펴보기

구성도



목표

Echo Server 개발

Wi-Fi Apps 개발 순서

- 1 Notebook 에서 TCP/IP Echo Server & Client 개발 및 테스트
- 2 Notebook (Server), M2354 (Client) 개발 및 테스트
- 3 Notebook (Client), M2354(Server) 개발 및 테스트

Wi-Fi 연결 시 코드 흐름

```
wifi connect {ssid} {pwd}
```

sys/wifi/cmd_wifi.c의 cmd_wifi 함수

boards/Numaker_PFM_M2354/wifi.c의 wifi_connect_ap 함수

drivers/esp8266/esp8266.c의 esp8266_init 함수

esp8266_init 함수 내에서 AT Command 실행

02

TCP/IP Echo Server & Client

Server : C - Client : C

한 대의 컴퓨터에서 두 개의 터미널

Server	Client
eunju@DESKTOP-QI1S4R0:/mnt/c/Users/sherl	eunju@DESKTOP-QI1S4R0:/mnt/c/Users/sherl
Server : 0.0.0.0	input message : Hi
wait...	read : Hi
New Client : 127.0.0.1	input message : Server : 127.0.0.1
receive message : Hi	read : Server : 127.0.0.1
receive message : Server : 127.0.0.1	input message : Client : 127.0.0.1
receive message : Client : 127.0.0.1	read : Client : 127.0.0.1
receive message : Server:C - Client:C	input message : Server:C - Client:C
receive message : bye	read : Server:C - Client:C
	input message : bye
	read : bye

Server Addr = htonl(INADDR_ANY)
또는 = inet_addr("127.0.0.1")

1. Server-Client 연결 후, Client가 message 입력
2. Server : 받은 message 출력 후 그대로 다시 write
3. Client : 받은 message 출력

Server : C - Client : C

두 대의 컴퓨터에서 각각의 터미널

Server	Client
<pre>eunju@ubuntu:~/Desktop\$./server Server : 192.168.122.124 wait... New Client : 192.168.122.107 receive message : Hi receive message : Server : 192.168.122.124 receive message : Client : 192.168.122.107 receive message : Server:C - Client:C receive message : bye</pre>	<pre>in read : Hi input message : Server : 192.168.122.124 read : Server : 192.168.122.124 input message : Client : 192.168.122.107 read : Client : 192.168.122.107 input message : Server:C - Client:C read : Server:C - Client:C input message : bye read : bye</pre>

Server : Python - Client : Python

한 대의 컴퓨터에서 두 개의 터미널

<pre>(base) C:\Users\user>python server.py [*] Started listening on 127.0.0.1 : 9999 Connected by ('127.0.0.1', 49896) received message : Hi received message : Server : 127.0.0.1 received message : Client : 127.0.0.1 received message : Server:Python - Client:Python received message : bye</pre>	<pre>>>>Hi Received 'Hi' >>>Server : 127.0.0.1 Received 'Server : 127.0.0.1' >>>Client : 127.0.0.1 Received 'Client : 127.0.0.1' >>>Server:Python - Client:Python Received 'Server:Python - Client:Python' >>>bye</pre>
Server	Client

두 대의 컴퓨터에서 각각의 터미널

<pre>(base) C:\Users\user>python server.py [*] Started listening on 192.168.122.154 : 9999 Connected by ('192.168.122.107', 55063) received message : Hi received message : Server : 192.168.122.124 received message : Client : 192.168.122.154 received message : Server:Python - Client:Python received message : bye</pre>	<pre>021>python client.py >>>Hi Received 'Hi' >>>Server : 192.168.122.124 Received 'Server : 192.168.122.124' >>>Client : 192.168.122.154 Received 'Client : 192.168.122.154' >>>Server:Python - Client:Python Received 'Server:Python - Client:Python' >>>bye</pre>
Server	Client

Server : C - Client : Python

한 대의 컴퓨터에서 두 개의 터미널

Server	Client
<pre>eunju@DESKTOP-QI1S4R0:/mnt/c Server : 0.0.0.0 wait... New Client : 127.0.0.1 receive message : Hi receive message : Server : 127.0.0.1 receive message : Client : 127.0.0.1 receive message : Server:C - Client:Python receive message : bye</pre>	<pre>(base) C:\Users\swsher1\WD >>Hi Received 'Hi' >>Server : 127.0.0.1 Received 'Server : 127.0.0.1' >>Client : 127.0.0.1 Received 'Client : 127.0.0.1' >>Server:C - Client:Python Received 'Server:C - Client:Python' >>bye</pre>

두 대의 컴퓨터에서 각각의 터미널

Server	Client
<pre>File Edit View Search Terminal eunju@ubuntu:~/Desktop\$./Server Server : 192.168.122.124 wait... New Client : 192.168.122.107 receive message : Hi receive message : Server : 192.168.122.124 receive message : Client : 192.168.122.107 receive message : Server:C - Client:Python receive message : bye</pre>	<pre>(base) C:\Users\swsher1\WD >>Hi Received 'Hi' >>Server : 192.168.122.124 Received 'Server : 192.168.122.124' >>Client : 192.168.122.107 Received 'Client : 192.168.122.107' >>Server:C - Client:Python Received 'Server:C - Client:Python' >>bye</pre>

Server : Python - Client : C

한 대의 컴퓨터에서 두 개의 터미널

<pre> (base) C:\Users\sherl\Documents\2021>python ex_ser wait... [*] Started listening on 192.168.122.107 : 9999 Connected by ('192.168.122.107', 63166) received message : Hi received message : Server : 192.168.122.107 received message : Client : 192.168.122.107 received message : Server:Python - Client:C received message : bye </pre>	<pre> eunju@DESKTOP-QI1S4R0:/mnt/c/Users/sherl/Docu input message : Hi read : Hi input message : Server : 192.168.122.107 read : Server : 192.168.122.107 input message : Client : 192.168.122.107 read : Client : 192.168.122.107 input message : Server:Python - Client:C read : Server:Python - Client:C input message : bye read : bye </pre>
Server	Client

두 대의 컴퓨터에서 각각의 터미널

<pre> (base) C:\Users\kej0428\Desktop\new>python ex_server.py wait... [*] Started listening on 192.168.122.154 : 9999 Connected by ('192.168.122.107', 63170) received message : Hi received message : Server : 192.168.122.154 received message : Client : 192.168.122.107 received message : Server:Python - Client:C received message : bye </pre>	<pre> eunju@DESKTOP-QI1S4R0:/mnt/c/Users/sherl/Docu input message : Hi read : Hi input message : Server : 192.168.122.154 read : Server : 192.168.122.154 input message : Client : 192.168.122.107 read : Client : 192.168.122.107 input message : Server:Python - Client:C read : Server:Python - Client:C input message : bye read : bye </pre>
Server	Client

03

HOST:Server - Board:Client

Server : Python - Client : C

한 개의 컴퓨터에서 Anaconda Prompt 프로그램과 Putty를 이용

Anaconda Prompt (anaconda3)

```
(base) C:\Users\sherl\Documents\2021>python ex_server.py
wait...
[*] Started listening on 192.168.122.107 : 9999
Connected by ('192.168.122.14', 35956)
received message : hello
```

Server

COM3 - PuTTY

```
> wifi client
[ESP8266] at_send_cmd [AT+CIPSTART=4,"TCP","192.168.122.107",9999]
status 0
[ESP8266] at_send_cmd [AT+CIPSEND=4,5]
buf = hello
[ESP8266] recv 5/256 bytes
```

Client

- Server의 IP Addr : 192.168.122.107
- Server의 Port : 9999
- Client의 IP Addr : 192.168.122.14

Putty 출력

```
[ESP8266] at_send_cmd [AT+CIPSTA?]
{
+CIPSTA ip:"192.168.122.14"
+CIPSTA:gateway:"192.168.122.1"
+CIPSTA:netmask:"255.255.255.0"
```

Anaconda Prompt (anaconda3)

```
(base) C:\Users\sherl\Documents>python ex_server.py
wait...
[*] Started listening on 192.168.122.107 : 9999
Connected by ('192.168.122.14', 35956)
received message : hello
```

Server

Board가 Client일 때 Wi-Fi 연결

[Basic AT Commands]

- ATE0 : Switch echo off
- AT+GMR : ESP8266 펌웨어 버전 표시

[Wifi AT Commands]

- AT+CWMODE=1 : WIFI station mode 설정
- AT+CWDHCP=1,1 : ESP8266 Station, Enables DHCP
- AT+CWJAP=[ssid],[pwd] : connects to an AP

[TCP/IP AT Commands]

- AT+CIPSTATUS : 연결 상태 확인
- AT+CIFSR : 연결 해제
- AT+CIPSTA? : 자동 AP 연결 설정 정보 조회
- AT+CIPMUX=1 : Multiple TCP Connections 설정
- AT+CIPDINFO=1 : 접속한 IP, Port 정보 반환

Board가 Client일 때 Socket 통신

[Connect Server]

AT+CIPSTART="TCP", "192.123.124.12", 8080

[Send Data to Server]

AT+CIPSEND=4 : 데이터 길이(ex. 4)

>test : 보내는 데이터(ex. test)

[Received Data from Server]

+IPD, 7:abcdefg : 받은 데이터(ex. 7-byte의 abcdefg)

[End Connection]

AT+CIPCLOSE

esp8266.c의 esp8266_init 함수

AT+GMR

ESP8266 펌웨어 버전 표시

AT+CWMODE=3

Wi-Fi Station+AP mode 설정

AT_CWJAP = “{SSID}”, “{Password}”

Connects to an AP

AT+CIPSTATUS

연결 상태 확인

AT+CIFSR

연결 해제

AT+CIPMUX=1

Multiple TCP Connections 설정

AT+CWDHCP=1, 1

ESP8266 Station, Enables DHCP

AT+CIPDINFO=1

접속한 IP, Port 정보 반환

Server : Python - Client : C

Board에서 입력한 Message 전송 후 다시 받기

Anaconda Prompt (anaconda3)

Server

```
(base) C:\Users\sherl\Documents\2021>python ex_server.py
wait...
[*] Started listening on 192.168.122.107 : 9999
Connected by ('192.168.122.14', 8963)
received message : Hi
received message : Server:192.168.122.107
received message : Client:192.168.122.14
received message : Server:HOST-Client:Board
received message : bye
```

wifi open

Server-Client Connect

wifi client {msg}

TCP/IP Socket

wifi close

Server-Client Disconnect

COM3 - PuTTY

Client

```
> wifi open
[ESP8266] at_send_cmd [AT+CIPSTART=4,"TCP","192.168.122.107",9999]
status 0
> wifi echo Hi
[ESP8266] at_send_cmd [AT+CIPSEND=4,2]
buf = Hi
[ESP8266] recv 2/256 bytes
> wifi echo Server:192.168.122.107
[ESP8266] at_send_cmd [AT+CIPSEND=4,22]
buf = Server:192.168.122.107
[ESP8266] recv 22/256 bytes
> wifi echo Client:192.168.122.14
[ESP8266] at_send_cmd [AT+CIPSEND=4,21]
buf = Client:192.168.122.14
[ESP8266] recv 21/256 bytes
> wifi echo Server:HOST-Client:Board
[ESP8266] at_send_cmd [AT+CIPSEND=4,24]
buf = Server:HOST-Client:Board
[ESP8266] recv 24/256 bytes
> wifi echo bye
[ESP8266] at_send_cmd [AT+CIPSEND=4,3]
buf = bye
[ESP8266] recv 3/256 bytes
Socket Closed
```

04

HOST:Client - Board:Server

Board:Server - HOST:Client

esp8266_init 함수에
오른쪽을 추가
=> Client와 연결까지 되어
CONNECT가 출력이 되지만,
데이터 전송이 안됨

```
[ESP8266] at_send_cmd [AT+CIPSTO=20]
CONNECT
920
rett = -1
```

```
if(role == 1)
{
    __send_line("AT+CIPSERVER=1");
    if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
    {
        esp8266_init_fail;
    }
    printf("{\n%s}\n", buf);

    __send_line("AT+CIPSTO=%d", 20);
    if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
    {
        esp8266_init_fail;
    }

    const unsigned char *data = (const unsigned char*)"TEST";
    unsigned int dlen = strlen((const char*)data);

    if(__recv_line("0,CONNECT", 5000))
    {
        printf("CONNECT\n");
        int rett = esp8266_send(4, data, dlen);
        printf("rett = %d\n", rett);
    }
}
```

*role : 0(Client), 1(Server)

서버로 설정

통신모듈이 TCP서버로 동작 시
타임아웃 기간을 설정

Client와 연결되었을 때
"0,CONNECT" 출력됨

Board:Server - HOST:Client

```

if(role == 1)
{
    __send_line("AT+CWMODE=%d", 2); // Station
    if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
    {
        esp8266_init_fail;
    }

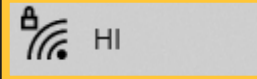
    __send_line("AT+CWSAP_CUR?");
    if (! __recv_line("OK", 5000))
    {
        esp8266_init_fail;
    }
    printf("{\n%s}\n", buf);

    __send_line("AT+CWSAP_CUR=\"%s\", \"%s\", 5, 3, \"HI\", \"1234567890\");
    if (! __recv_line("OK", 5000))
    {
        esp8266_init_fail;
    }

    __send_line("AT+CIPMUX=%d", 1);
    if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
    {
        esp8266_init_fail;
    }

    __send_line("AT+CIPAP_CUR=\"%s\", \"%s\", \"%s\", \"192.168.122.5\", \"192.168.122.1\", \"255.255.255.0\");
    if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
    {
        esp8266_init_fail;
    }
}

```



Wi-Fi 설정

Server 주소

Board:Server - HOST:Client

```
__send_line("AT+CIPSERVER=1");
if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
{
    esp8266_init_fail;
}
printf("{\n%s}\n", buf);

__send_line("AT+CIPSTO=%d", 5000);
if (! __recv_line("OK", ESP8266_AT_DEFAULT_TIMEOUT))
{
    esp8266_init_fail;
}

const unsigned char *data = (const unsigned char*)"TEST";
unsigned int dlen = strlen((const char*)data);

if(__recv_line("0,CONNECT", 5000))
{
    printf("CONNECT\n");
    int rett = esp8266_send(4, data, dlen);
    printf("rett = %d\n", rett);
}
}
```

HOST가 "HI" Wi-Fi에
연결한 뒤,
Client를 실행해도
연결이 안 됨

[참고] [\[제품노트_WIFI-ON V1\] ESP8266 WIFI 모듈 5편](#)
["ESP8266 간 TCP 서버-클라이언트 데이터 송수신"](#)