



WIZnet Academy
2017

IoT Device! **mbed**로 쉽게 연결하자 !

정찬미

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목차

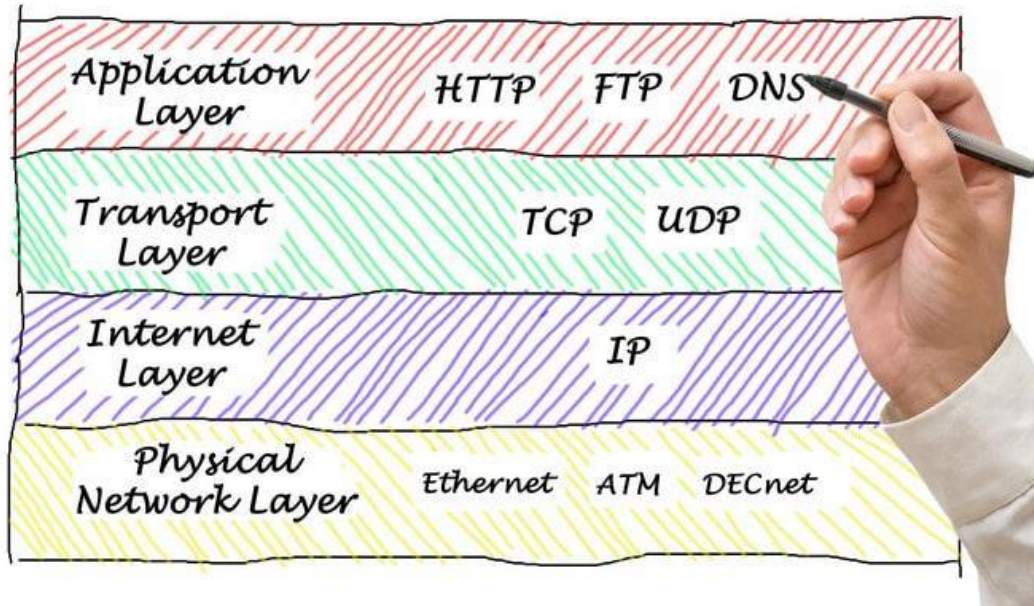


- IoT Network 상식
 - TCP/UDP, DHCP, DNS, HTTP 알아보기
- mbed로 IoT Device 개발하기
 - Ethernet Interface
- IoT Device 실습
 - Web Client 개념 이해하기
 - Web Client 실습
 - Web Server 개념 이해하기

IoT Network 상식

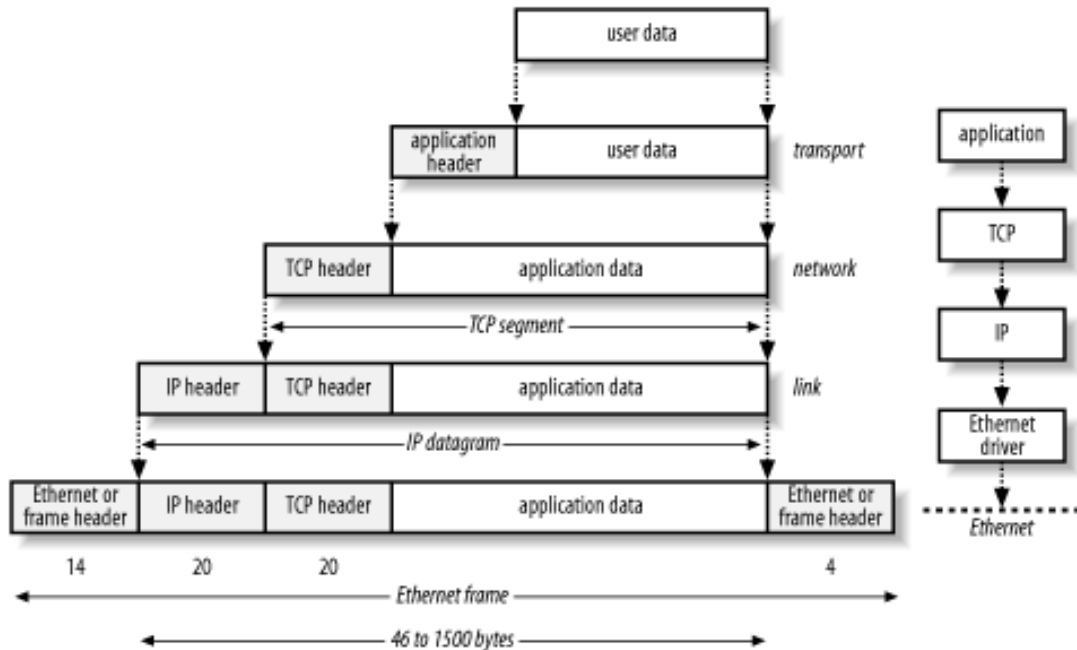
IoT Network 상식

» Network layer



IoT Network 상식

» Network layer



IoT Network 상식

» TCP vs UDP

TCP (Transmission Control Protocol)	UDP (User Datagram Protocol)
연결형 프로토콜	비연결형 프로토콜
신뢰성 있는 데이터 전송 (데이터의 재전송 존재)	비신뢰성 데이터 전송 (데이터의 재전송 없음)
1 : 1통신(Unicast)	1 : 1통신 (Unicast) 1 : N 통신 (Broadcast) N : N 통신 (Multicast)

IoT Network 상식

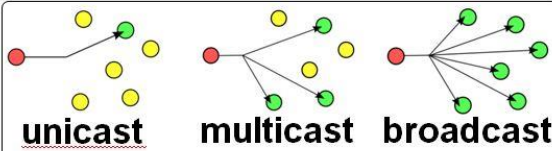
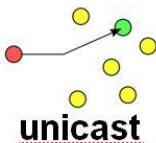
» TCP vs UDP



- **Slower but reliable transfers**
- **Typical applications:**
 - Email
 - Web browsing



- **Fast but non-guaranteed transfers (“best effort”)**
- **Typical applications:**
 - VoIP
 - Music streaming



IoT Network 상식

» DNS(Domain name system)

WHO CARES ABOUT NAVER SERVER IP ADDRESS ?????



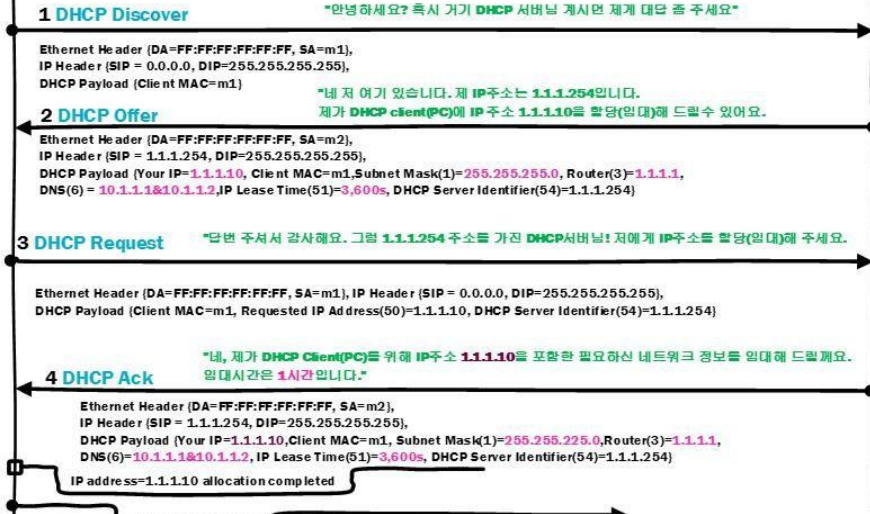
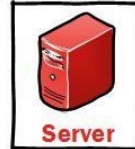
IoT Network 상식

» DHCP(Dynamic Host Configuration Protocol)

DHCP Client
W7500 MAC=m1

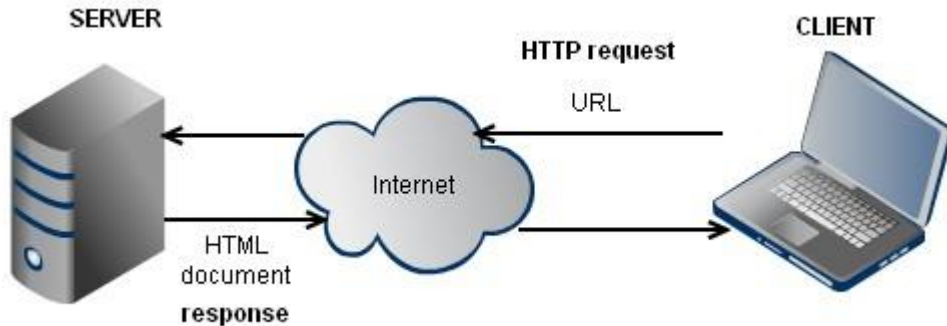


DHCP Server IP=1.1.1.254
DHCP Server MAC=m2



IoT network 상식

» HTTP (Hypertext Transfer Protocol)



- 인터넷에서 hypertext 문서를 교환하기 위하여 사용되는프로토콜
- TCP 기반 통신방식
- Connectionless
- Stateless
- Request-Response

IoT Network 상식

» HTTP Method

- GET
 - Web Server에 있는 특정 URI가 가지고 있는 Data를 얻기 위한 방법
- POST
 - Web Server에 있는 특정 URI가 가지고 있는 Data를 변경하기 위한 방법
- PUT
 - Web Server에 있는 특정 URI에 Data를 저장하기 위한 방법
- DELETE
 - Web Server에 있는 특정 URI에 있는 Data를 지우기 위한 방법

IoT Network 상식

» HTTP Response Structure

HTTP/1.1 200 OK

Date: Sun, 08 Feb xxxx 01:11:12 GMT

Server: Apache/1.3.29 (Win32)

Last-Modified: Sat, 07 Feb xxxx

ETag: "0-23-4024c3a5"

Accept-Ranges: bytes

Content-Length: 35

Connection: close

Content-Type: text/html

<h1>My Home page</h1>

Status Line

Response Headers

Response
Message
Header

A blank line separates header & body

Response Message Body

mbed로 IoT Device 개발하기

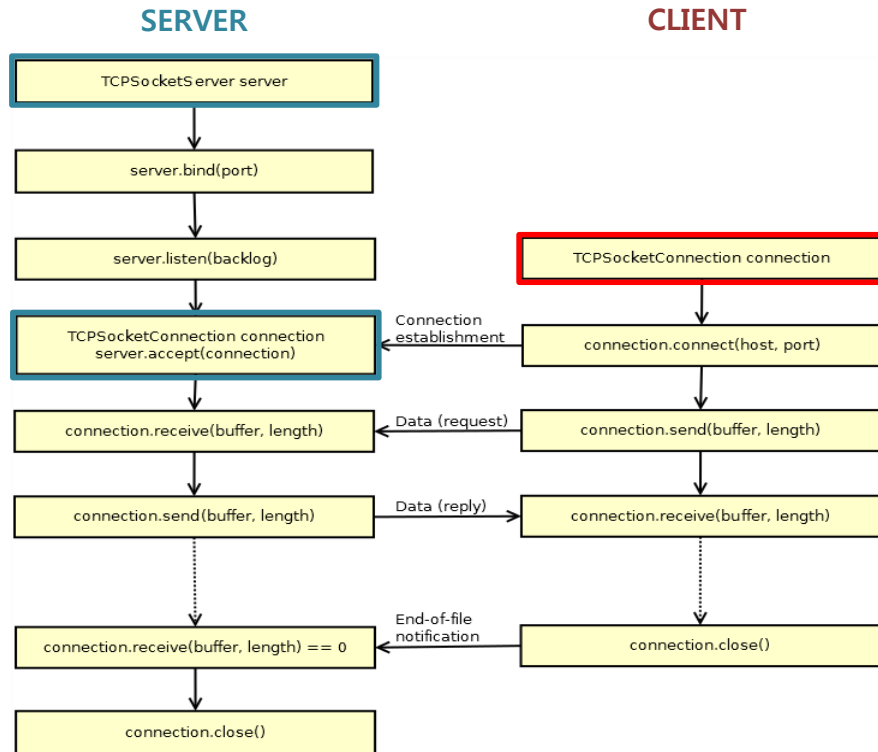
mbed로 IoT Device 개발하기

» Ethernet Interface

- mbed에서 제공하는 소프트웨어 스택을 사용하기 위해서 사용하는 라이브러리 *EthernetInterface*
- WIZnet 칩을 사용하여 하드웨어 스택을 사용하기 위해서 사용하는 라이브러리 *WIZnetInterface*
- 사용되는 Class 들
 - [EthernetInterface](#) Network 세팅을 위한 클래스
 - [TCPSocketServer](#) TCP Server 클래스
 - [TCPSocketConnection](#) TCP 연결 성립과 데이터를 주고 받기 위한 클래스

mbed로 IoT Device 개발하기

» Ethernet Interface



mbed로 IoT Device 개발하기

» Ethernet Interface

ETHERNET CLASS

```
EthernetInterface eth;
```

```
#ifdef DHCP
    eth.init(mac_addr);
#else
    eth.init(mac_addr, ip_addr, subnet_mask, gateway_addr);
#endif
```

```
if(eth.link() == true);
eth.connect();
```

SERVER CLASS

```
#ifdef SERVER
    TCPSocketServer server;
    server.bind(SERVER_PORT);
    server.listen();
#else
    TCPSocketConnection client;
    client.connect(SERVER_IP, SERVER_PORT);
#endif
```

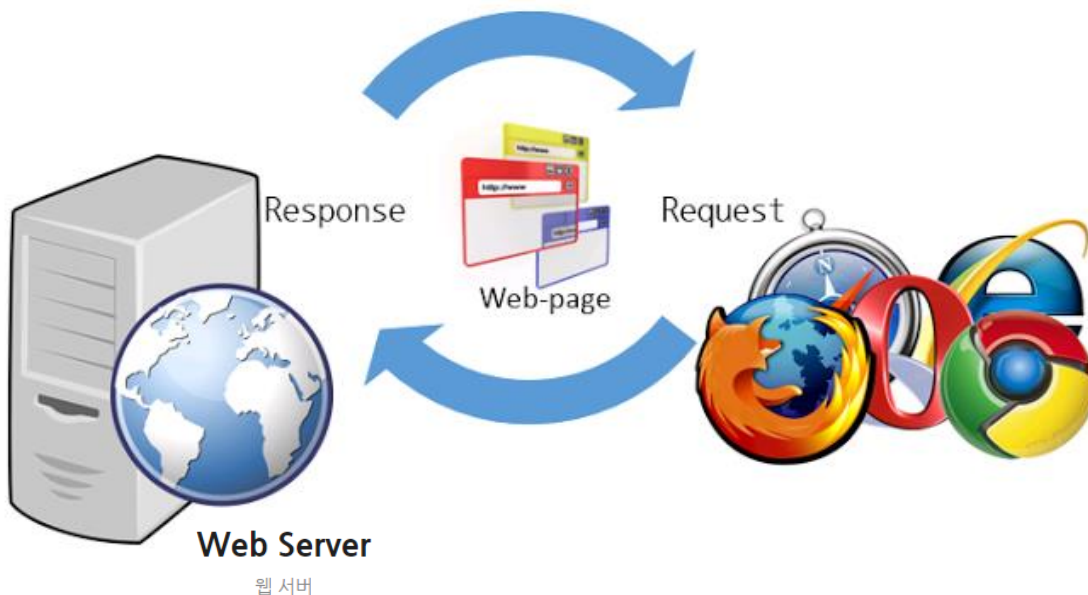
CLIENT CLASS

IoT Device 실습

Web Server, Web Client

Web Server, Web Client

>> 개요

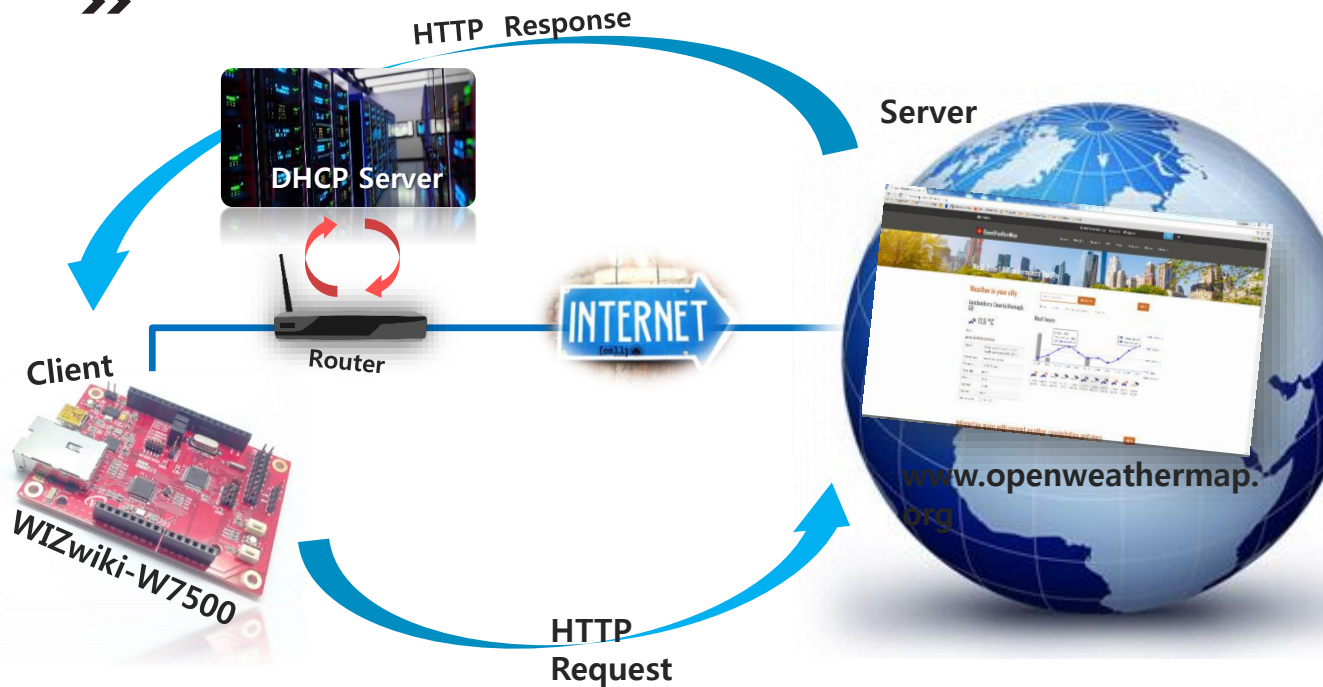


인터넷 서비스를 하기 위한 서버의 일종으로서, Web Client(웹 브라우저)에게 콘텐츠를 제공하는 서버로서, 정적인 HTML이나 jpeg, gif 같은 이미지를 HTTP 프로토콜을 통해 웹 브라우저에 전송한다.

Web Client 실습

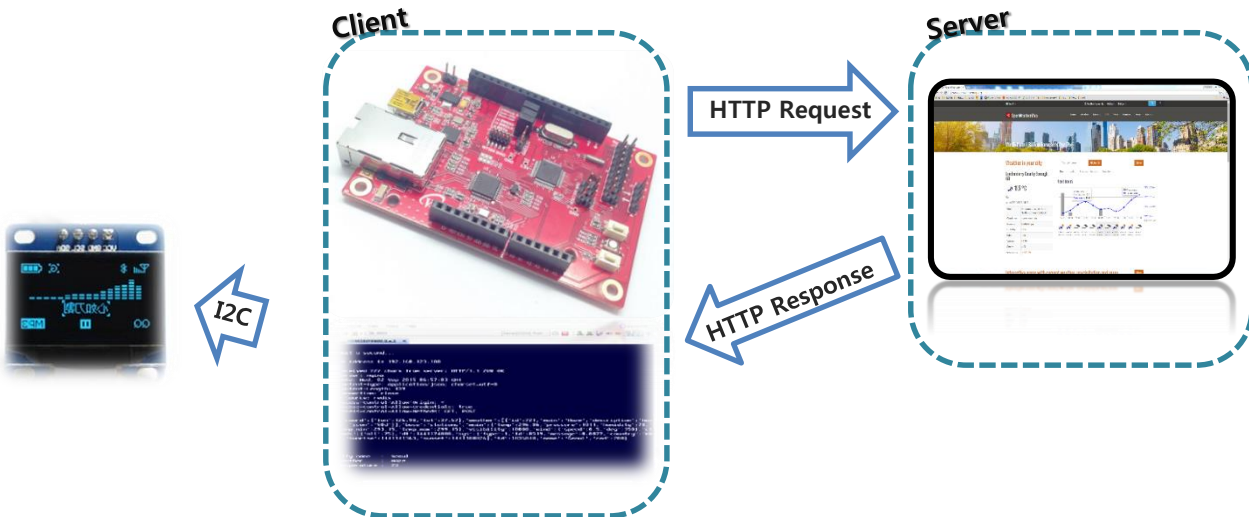
Web Client 실습

>>



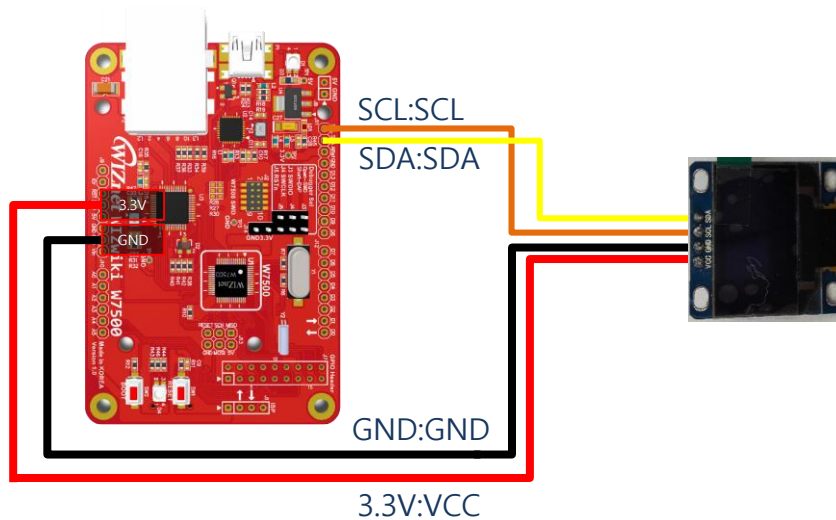
Web Client 실습

>> Weather forecast 개요



Web Client 실습

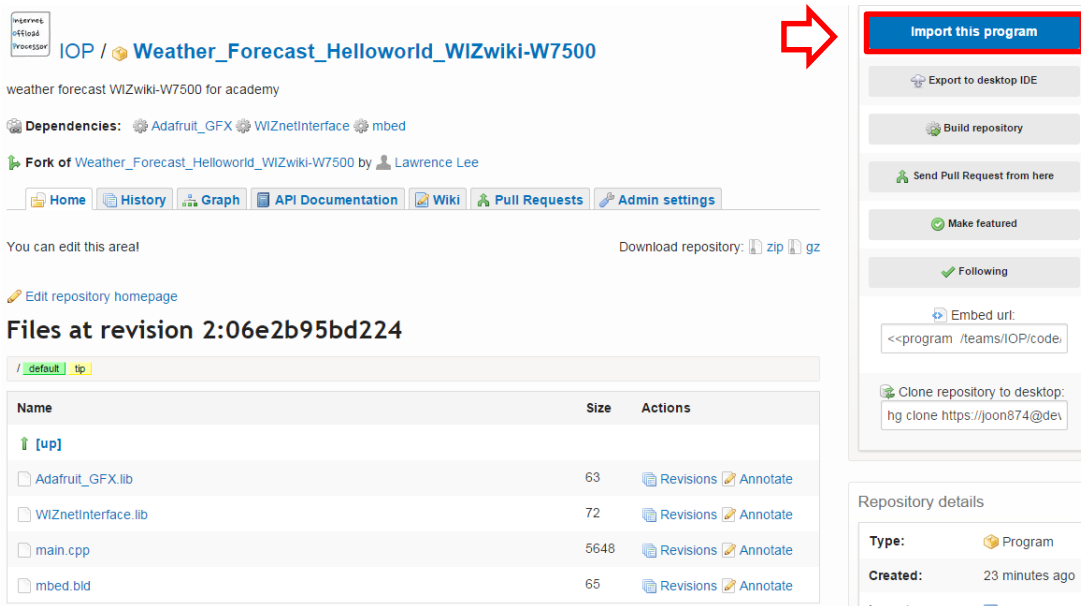
>> HW



Web Client 실습

>> Import Project

<https://os.mbed.com/teams/IOP/code/HTTPWebClient-WIZwiki-7500/>



Weather_Forecast_Helloworld_WIZwiki-W7500

weather forecast WIZwiki-W7500 for academy

Dependencies: Adafruit_GFX WIZnetInterface mbed

Fork of Weather_Forecast_Helloworld_WIZwiki-W7500 by Lawrence Lee

Home History Graph API Documentation Wiki Pull Requests Admin settings

You can edit this area

Download repository: zip gz

Edit repository homepage

Files at revision 2:06e2b95bd224

/ default tip

Name	Size	Actions
↑ [up]		
Adafruit_GFX.lib	63	Revisions Annotate
WIZnetInterface.lib	72	Revisions Annotate
main.cpp	5648	Revisions Annotate
mbed.bld	65	Revisions Annotate

Import this program

Export to desktop IDE

Build repository

Send Pull Request from here

Make featured

Following

Embed url:
 <<program /teams/IOP/code>

Clone repository to desktop:
 hg clone https://joon874@dev

Repository details

Type: Program

Created: 23 minutes ago

Web Client 실습

>> Openweather Map

<http://openweathermap.org/>





Web Client 실습

>> Openweather Map

<http://openweathermap.org/>

Setup **API keys** My Services My Payments Billing plans Map editor Block logs Logout

NEW! You can generate as much API keys as needed for your subscription. We accumulate the total loading from all of them.

Key	Name	
a0ca47dd7f6066404629b3e1ad728981	Default	 

2. 코드에 복사

Create key

* Name

Generate

Web Client 실습

>> Server Weather Data

```
Received 785 chars from server: HTTP/1.1 200 OK
Server: nginx
Date: Thu, 03 Sep 2015 00:47:26 GMT
Content-Type: application/json; charset=utf-8
Content-Length: 497
Connection: close
X-Source: redis
Access-Control-Allow-Origin: *
Access-Control-Allow-Credentials: true
Access-Control-Allow-Methods: GET, POST
```

HTTP Header

```
{ "coord": { "lon": 126.98, "lat": 37.57 }, "weather": [ { "id": 701, "main": "Mist", "description": "mist", "icon": "50n" }, { "id": 721, "main": "Haze", "description": "haze", "icon": "50n" } ], "base": "stations", "main": { "temp": 294.83, "pressure": 1012, "humidity": 78, "temp_min": 293.15, "temp_max": 296.15 }, "visibility": 10000, "wind": { "speed": 0.5, "deg": 20 }, "clouds": { "all": 75 }, "dt": 1441237800, "sys": { "type": 1, "id": 8519, "message": 0.0093, "country": "KR", "sunrise": 1441227800, "sunset": 1441274361 }, "id": 1835848, "name": "Seoul", "cod": 200 }
```

HTTP Body

Web Client 실습

>> Weather Data Parsing

```
165     char *date;
166     char *weather;
167     char *city;
168     char *temper;
169
```

Buffer에서 원하는 문자열의 시작주소를 가져오기 위한 포인터 변수

```
170     char cur_date[17] = {0};
171     char weather_con[15] = {0};
172     char city_name[10] = {0};
173     char temper_data[3] = {0};
```

Buffer에서 원하는 문자열을 가져오기 위한 배열 선언

```
181     date = strstr(buffer, "Date");
182     for(int x=0; x<17; x++){
183         cur_date[x] = date[x+6];
184     }
```

strsr()을 이용해 Buffer안에 "Data"라는 문자열의 첫번째 주소값 저장
cur_data[x] = Data[x+6]을 통해 저장된 주소에서 다음 6번째 주소부터
차례로 저장

```
189     weather = strstr(buffer, "main");
190     for(int i=0; i<15; i++){
191         weather_con[i] = weather[i+7];
192         if(weather_con[i] == 34){
193             weather_con[i] = 0;
194             break;
195         }
196     }
```

Web Client 실습

>> Temp Data Parsing

```
218  /*
219  *   kelvin to celius converter
220  */
221  num100 = temper_data[0] - 48 - 2;
222  num10 = temper_data[1] - 48 - 7;
223  num1 = temper_data[2] - 48 - 3;
224
225  temp = num100*100 + num10*10 + num1;
```

Char형으로 저장된 변수를 십진수로 변환
또한 -273함으로 절대온도를 섭씨로 변환

```
234  /*
235  *   OLED Display
236  */
237  gOled.begin();
238  gOled.clearDisplay();
239
240  gOled.printf("%s\n", cur_date);
241  gOled.printf("City      : %s\n", city_name);
242  gOled.printf("Weather  : %s\n", weather_con);
243  gOled.printf("Temper   : %d\n", temp);
244  gOled.display();
245  gOled.setCursor(0,0);
```

OLED에 날씨 정보 Display

Web Client 실습 응용

Web Client 실습 응용

>> Country parsing을 추가해보자

```
char *date;  
char *weather;  
char *city;  
char *temper;  
char *country;    country 포인터변수 선언
```

```
char cur_date[17] = {0};  
char weather_con[15] = {0};  
char city_name[10] = {0};  
char temper_data[3] = {0};  
char country_name[5]={0};    country_name 배열 선언  
int temp;  
int num100, num10, num1;
```

```
// parsing country name  
country = strstr(buffer, "country");  
for(int j=0; j<5;j++){  
    country_name[j] = country[j+10];  
    if(country_name[j] == 34){  
        country_name[j] = 0;  
        break;  
    }  
}
```

country 정보 data parsing

Web Client 실습 응용

» Country parsing 추가

```
// Debug message
printf("city name   : %s\r\n", city_name);
printf("country name : %s\r\n", country_name);
printf("weather      : %s\r\n", weather_con);
printf("temperature : %d\r\n\r\n", temp);

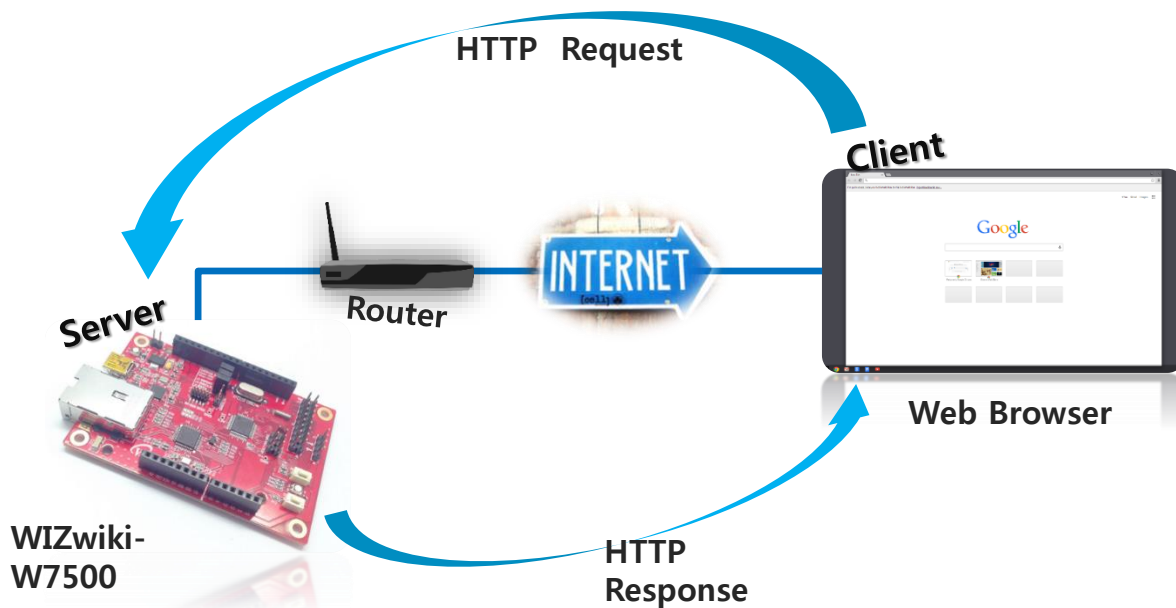
// OLED Display
gOled.begin();
gOled.clearDisplay();
gOled.printf("%s\n\n", cur_date);
gOled.printf("City      : %s\n", city_name);
gOled.printf("Country   : %s\n", country_name);
gOled.printf("Weather  : %s\n", weather_con);
gOled.printf("Temper   : %d\n", temp);
gOled.display();
gOled.setCursor(0,0);
```

country debug message 출력!

Web Server

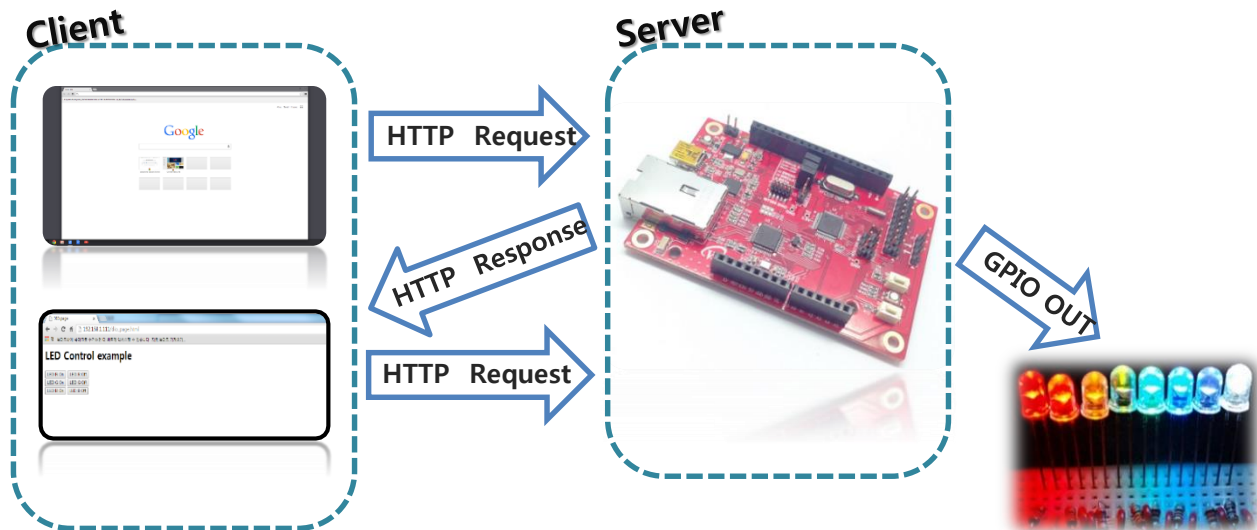
Web Server 실습

» Embedded Web Server



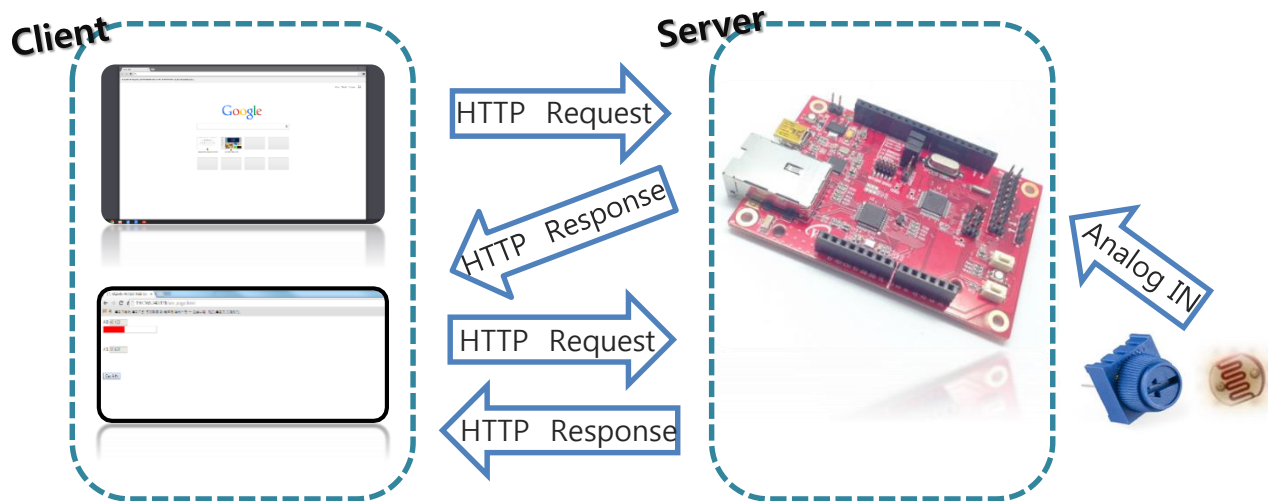
Web Server

» Web page로 Web Server LED 컨트롤



Web Server

» Web page로 Web Server에 Analog Sensor 값 요청





감사합니다

WIZnet Academy 2017

IoT Device! mbed로 쉽게 연결하자!

Thank you

Team SoC
Becky



becky@wiznet.io