와이파이 기반 아두이노 IoT

(weMos weather station)

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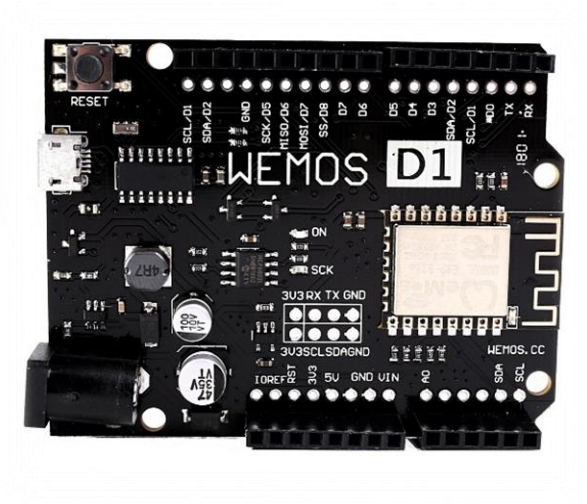
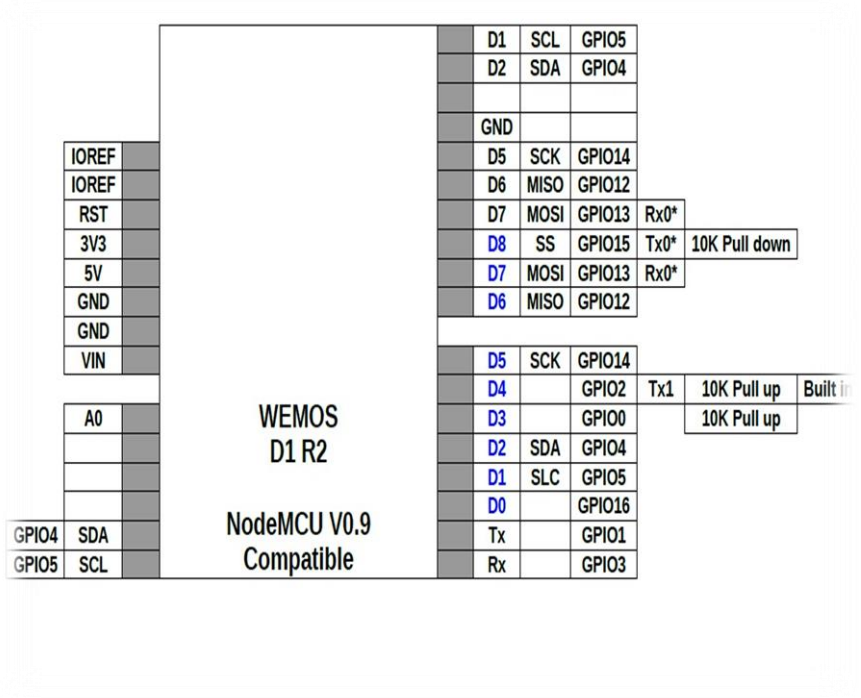


VS

- 펌웨어 개발 없이 WIFI 사용가능
- 가격이 저렴하다
- 5v 마이크로 USB 케이블 이용

- 현재 상용화 되지 않음
- 가격대가 비쌈
- AB형 USB케이블 이용

weMos 란?



weMos R1 D2란 ?

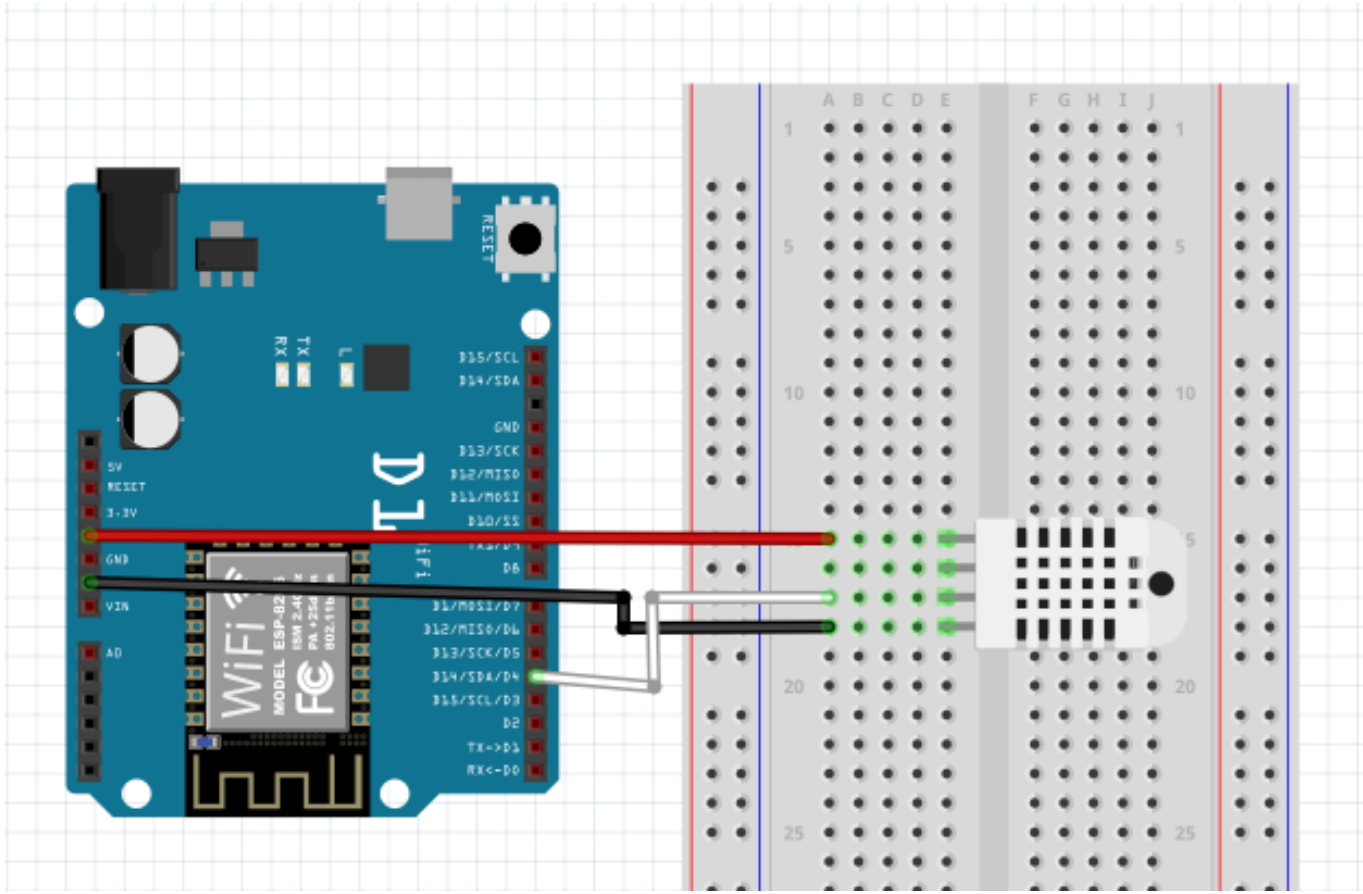
아두이노 우노 보드에 ESP-8266이 결합된 보드

- 아두이노 IDE 지원
- 16개의 GPIO를 가지고 있음

GPIO
<General-Purpose Input/Output>

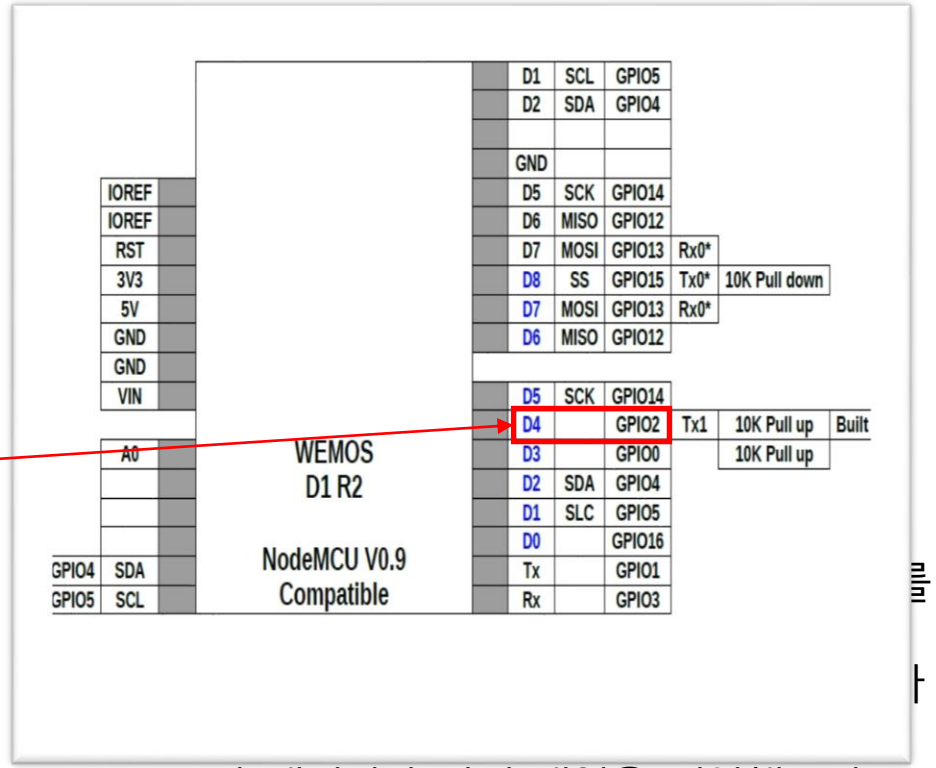
프로세서나 컨트롤러 등에서 입력을 받거나 출력으로 특정 장치를 제어하여 사용하도록 준비된 입출력 포트

회로도


RESET
D15/SCL
D14/SDA
GND
D13/SCK
D12/MISO
D11/MOSI
D10/SS
D8
D7
D6
D5
D4
D3
D2
TX->D1
RX<-D0
5V
RESET
3.3V
GND
VIN
A0
A B C D E
F G H I J
1
5
10
20
25

아두이노 소스 (전역 변수)

```
#include <ESP8266WiFi.h>
#include "DHT.h"
#define DHTTYPE DHT22

const char* ssid = "SSID";
const char* password = "Password";

WiFiServer server(80);

const int DHTPin = 2  // wemos 핀맵에따라 D4에 연결한다.

DHT dht(DHTPin, DHTTYPE);

static char celsiusTemp[7];
static char fahrenheitTemp[7];
static char humidityTemp[7];
```



를 불러온다

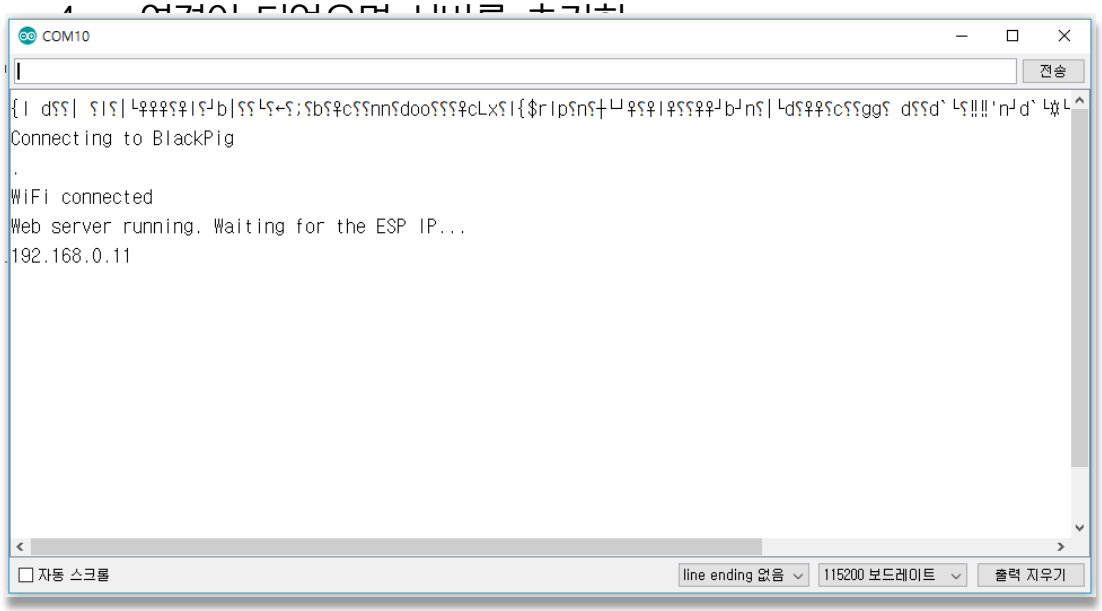
가

- 각 데이터가 담길 배열을 선언해준다

아두이노 소스 (Set up)

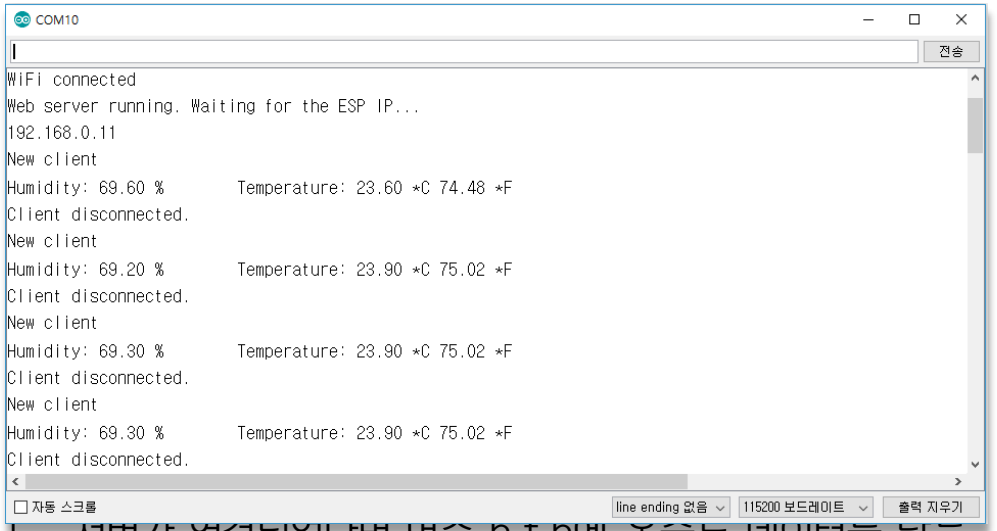
```
void setup() {
  Serial.begin(115200);
  delay(10);

  dht.begin();

  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  delay(10000);

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");

  server.begin();
  Serial.println("Web server running. Waiting for the ESP IP...");
  delay(10000);

  Serial.println(WiFi.localIP());
}
```

1. dht 온습도 센서를 초기화
2. 공유기에 접속을 시도
3. 연결이 되지 않으면 “.”을 출력



아두이노 소스 (loop)

```
void loop() {
  WiFiClient client = server.available();

  if (client) {
    Serial.println("New client");

    boolean blank_line = true;
    while (client.connected()) {
      if (client.available()) {
        char c = client.read();

        if (c == '\n' && blank_line) {

            float h = dht.readHumidity();
            float t = dht.readTemperature();
            float f = dht.readTemperature(true);

            if (isnan(h) || isnan(t) || isnan(f)) {
              Serial.println("Failed to read from DHT sensor!");
              strcpy(celsiusTemp,"Failed");
              strcpy(fahrenheitTemp, "Failed");
              strcpy(humidityTemp, "Failed");
            }
            else{
              dtostrf(t, 6, 2, celsiusTemp);
              dtostrf(f, 6, 2, fahrenheitTemp);
              dtostrf(h, 6, 2, humidityTemp);

              Serial.print("Humidity: ");
              Serial.print(h);
              Serial.print(" %\t Temperature: ");
              Serial.print(t);
              Serial.print(" *C ");
              Serial.print(f);
              Serial.println(" *F");
            }
```



1. 서버가 연결되었다면 변수 h,t,h에 온습도 데이터를 담는다

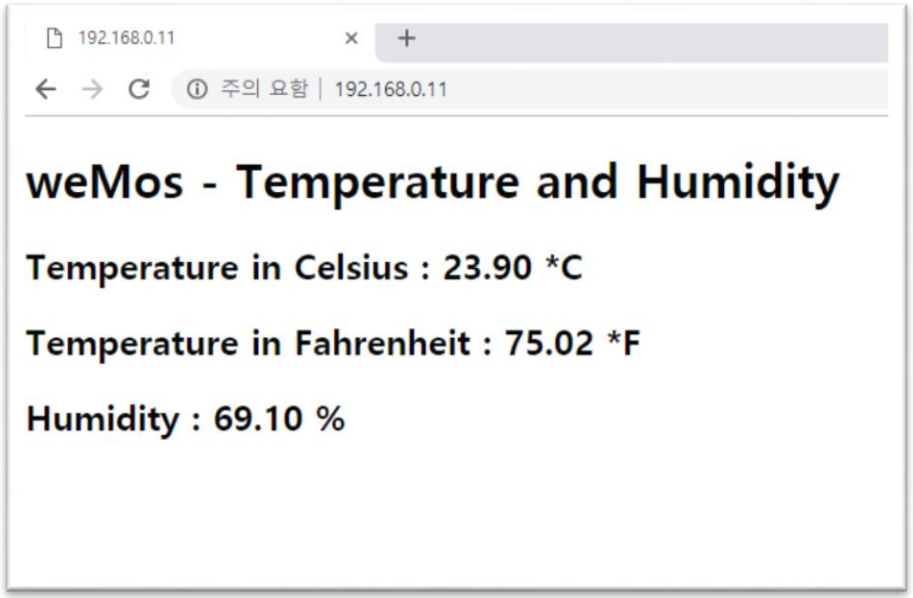
2. isnan(not a number)함수를 사용하여 각 데이터값이 제대로 들어왔는지 확인.

3. 제대로 들어온 데이터를 dtostrf 함수를 사용하여 배열에 담는다

4. 시리얼 모니터로 각각의 값을 확인

아두이노 소스 (loop)

```
            client.println("HTTP/1.1 200 OK");
            client.println("Content-Type: text/html");
            client.println("Connection: close");
            client.println("Refresh: 2");
            client.println();

            client.println("<!DOCTYPE HTML>");
            client.println("<html>");
            client.println("<head></head>");
            client.print("<body><h1>weMos - Temperature and Humidity</h1>");
            client.print("<dl id='data'><dt class='Celsius'>");
            client.print("<h2>Temperature in Celsius : ");
            client.print(celsiusTemp);
            client.print(" *C</h2></dt><dt class='Fahrenheit'>");
            client.print("<h2>Temperature in Fahrenheit : ");
            client.print(fahrenheitTemp);
            client.print(" *F</h2></dt><dt class='Humidity'>");
            client.print("<h2>Humidity : ");
            client.print(humidityTemp);
            client.print(" %</h2></dt></dl>");
            client.print("</body>");
            client.println("</html>");
            break;
          }
          if (c == '\n') {
            blank_line = true;
          }
          else if (c != '\r') {
            blank_line = false;
          }
        }
      }
      delay(1);
      client.stop();
      Serial.println("Client disconnected.");
    }
  }
```



2. HTTP 프로토콜 셋팅을 하고 웹 페이지가 2초마다 refresh되도록 설정

3. 클라이언트로 접속했을 때 생성된 웹 페이지와 데이터 값을 확인할 수 있다

Node.js 소스 (package)

```
    "dependencies": {
        "cookie-parser": "~1.4.3",
        "debug": "~2.6.9",
        "http-errors": "~1.6.2",
        "jade": "~1.11.0",
        "morgan": "~1.9.0",
        "request": "^2.88.0",
        "cheerio": "^1.0.0-rc.2",
        "cors": "^2.8.4",
        "express": "^4.15.2",
        "socket.io": "^1.7.3"
    }
}
```

- Node.js 사용
- cheerio, cors, express, socket.io등 필요한 모듈 설치

Node.js 소스 (index.js)

```
1  var cheerio = require('cheerio');
2  var request = require('request');
3  var io = require('socket.io').listen(3000, function (req, res) {
4      console.log('Listening on port 3000');
5  });
6
7  var dht22data = [];
8  var dateStr = '';
9  var CelsiusData = '';
10 var FahrenheitData = '';
11 var HumidityData = '';
12
13
14 var url = 'http://192.168.0.11/';
15
16 var Celsius = '';
17
18 function getCelsius() {
19
20     request(url, function (err, res, body) {
21
22         var $ = cheerio.load(body);
23
24         $('#data .Celsius').each(function () {
25             Celsius = $(this).text().substring(26, 31);
26         });
27     });
28     return Celsius;
29 }
```

```
<dt id="data">
    <dt class="Celsius">
        <h2>Temperature in Celsius : celsiusTemp *C</h2>
    </dt>
```

- 모듈 require
- Socket 포트 설정
- 웹 스크리핑

Node.js 소스 (index.js)

```
79    io.sockets.on('connection', function (socket) {
80
81        socket.on('message', function (msg) {
82            console.log(msg);
83        });
84
85        socket.on('disconnect', function () {});
86    });
88    setInterval(function () {
89        dateStr = getDateString();
90        CelsiusData = getCelsius();
91        FahrenheitData = getFahrenheit();
92        HumidityData = getHumidity();
93        dht22data[0] = dateStr; // Date
94        dht22data[1] = CelsiusData; // temperature data
95        dht22data[2] = FahrenheitData; // Fahrenheit data
96        dht22data[3] = HumidityData; // humidity data
97        io.sockets.emit('message', dht22data);
98        console.log("COMSI," + dht22data);
99    }, 2000);
100
101 });
```

- Socket 기본 설정
- setInterval 함수 사용

웹 클라이언트 소스 (html)

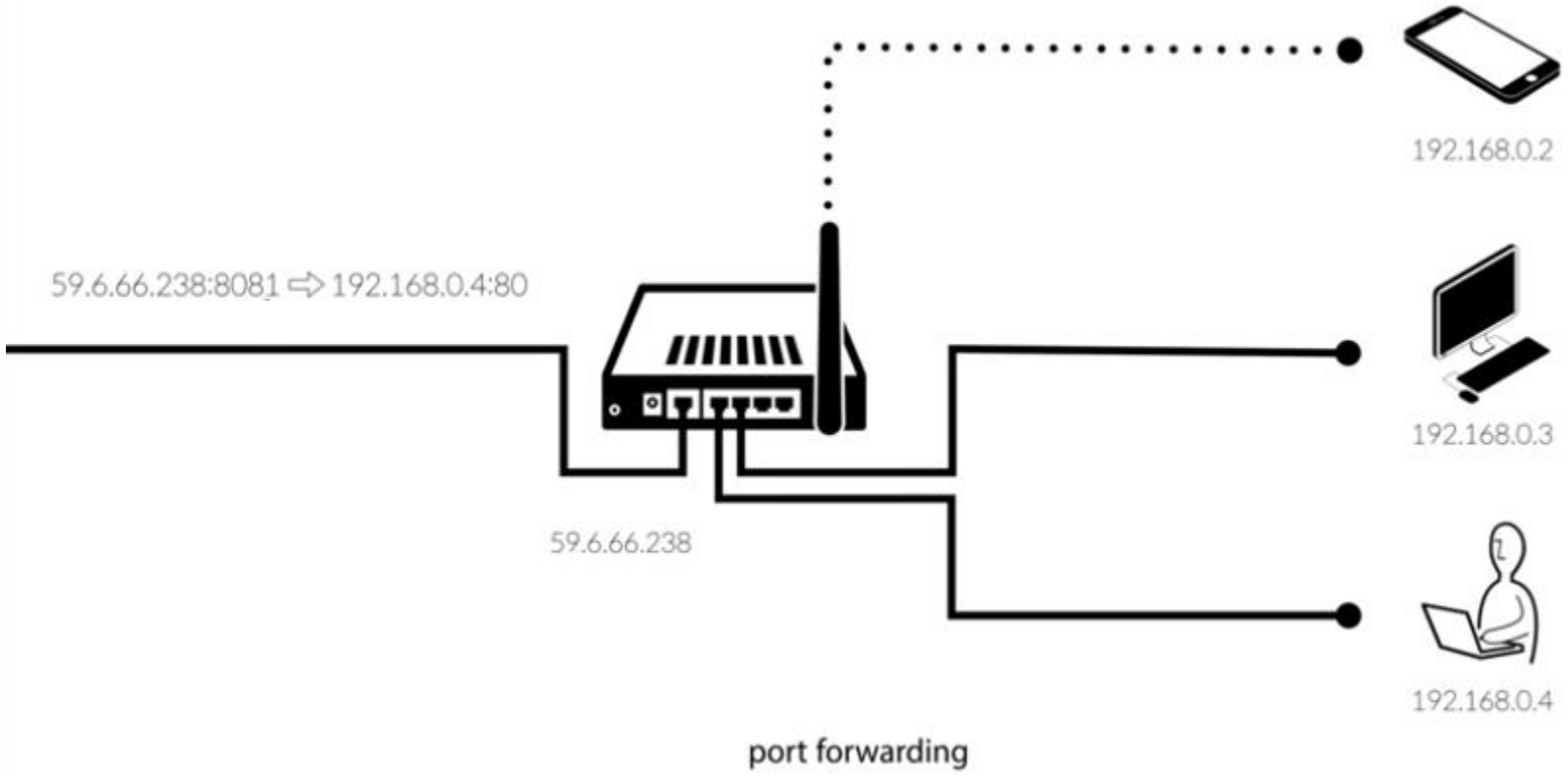
```
37    <script>
38        var streamPlot = document.getElementById('myDiv');
39        var ctime = document.getElementById('time');
40        var tArray = [], // time of data arrival
41            y1Track = [], // value of sensor 1 : temperature
42            y2Track = [], // value of sensor 2 : fahrenheit
43            y3Track = [], // value of sensor 3 : humidity
44            numPts = 50, // number of data points in x-axis
45            dtda = [], // 1 x 4 array : [date, data1, data2, data3] from sensors
46            preX = -1,
47            preY = -1,
48            preZ = -1,
49            initFlag = true;
```

- 데이터 변수 선언

```
51        var socket = io.connect('http://175.199.157.52:3000'); // port = 3000
52        socket.on('connect', function() {
53            socket.on('message', function(msg) {
54                // initial plot
55                if (msg[0] != '' && initFlag) {
56                    dtda[0] = msg[0];
57                    dtda[1] = parseFloat(msg[1]); // temperature
58                    dtda[2] = parseFloat(msg[2]); // fahrenheit
59                    dtda[3] = parseFloat(msg[3]); // humidity
60                    init();
61                    initFlag = false;
62                }
63
64                dtda[0] = msg[0];
65                dtda[1] = parseFloat(msg[1]);
66                dtda[2] = parseFloat(msg[2]);
67                dtda[3] = parseFloat(msg[3]);
68
```

- 소켓서버 연결 및 데이터 파싱

포트 포워딩 이란?


59.6.66.238:8081 ⇨ 192.168.0.4:80
59.6.66.238
192.168.0.2
192.168.0.3
192.168.0.4
port forwarding

웹 클라이언트 소스 (html)

```
            // Only when any of temperature or Luminosity is different
            // from the previous one, the screen is redrawed.
            if (dtda[1] != preX || dtda[2] != preY || dtda[3] != preZ) { // any change?
                preX = dtda[1];
                preY = dtda[2];
                preZ = dtda[3];

                // when new data is coming, keep on streaming
                ctime.innerHTML = dtda[0];
                gauge_temperature.setValue(dtda[1]) // temperature gauge
                gauge_fahrenheit.setValue(dtda[2]); // fahrenheit gauge
                gauge_humidity.setValue(dtda[3]); // humidity gauge

                tArray = tArray.concat(dtda[0]);
                tArray.splice(0, 1); // remove the oldest data
                y1Track = y1Track.concat(dtda[1]);
                y1Track.splice(0, 1); // remove the oldest data
                y2Track = y2Track.concat(dtda[2]);
                y2Track.splice(0, 1);
                y3Track = y3Track.concat(dtda[3]);
                y3Track.splice(0, 1);

                var update = {
                    x: [tArray, tArray, tArray],
                    y: [y1Track, y2Track, y3Track]
                }

                Plotly.update(streamPlot, update);
            }

        });
    });
```

```
        function init() { // initial screen ()
            // starting point : first data (temp, lux)
            for (i = 0; i < numPts; i++) {
                tArray.push(dtda[0]); // date
                y1Track.push(dtda[1]); // sensor 1 (temp)
                y2Track.push(dtda[2]); // sensor 2 (humi)
                y3Track.push(dtda[3]); // sensor 3 (lux)
            }

            Plotly.plot(streamPlot, data, layout);
        }
```

- 데이터 업데이트
- 그래프 초기화

Node.js 소스 (server)

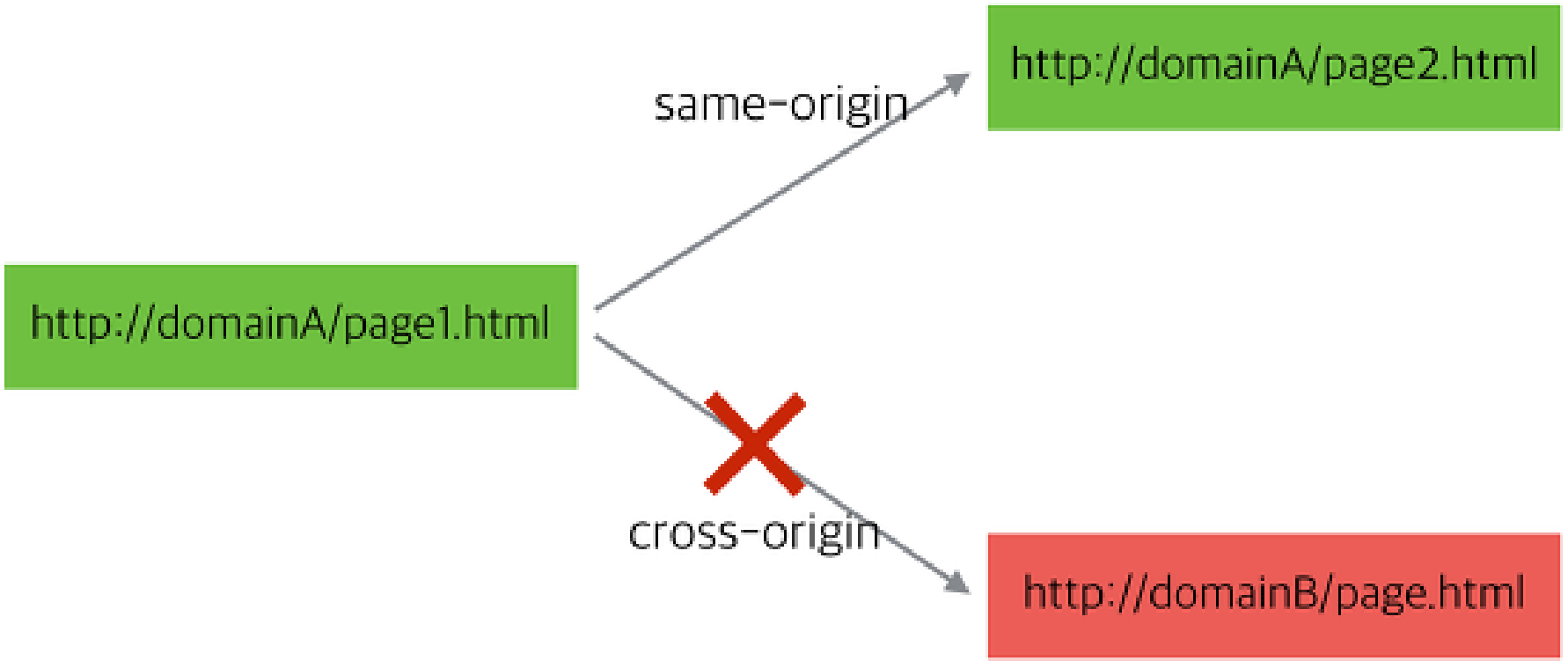
```
7  var indexRouter = require('./routes/index');
8  var app = express();
9
10 var cors = require('cors')();
11 app.use(cors); //Cross-Origin Resource Sharing
12
13 app.use(express.static(path.join(__dirname, 'public')));
14 app.use('/', indexRouter);
```

- Cors 설정

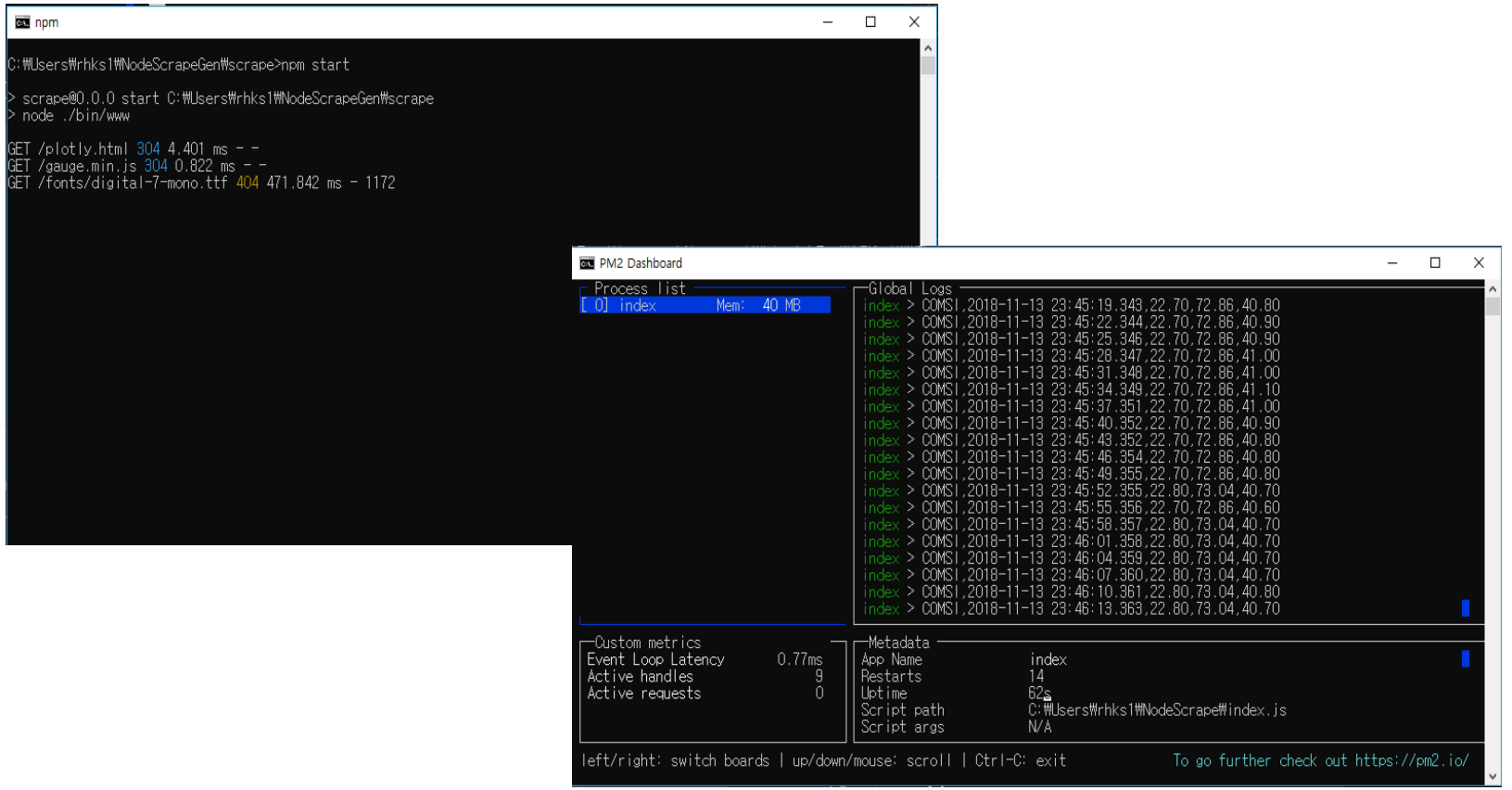
```
15 var port = normalizePort(process.env.PORT || '3030');
16 app.set('port', port);
17
```

- Express 포트 설정

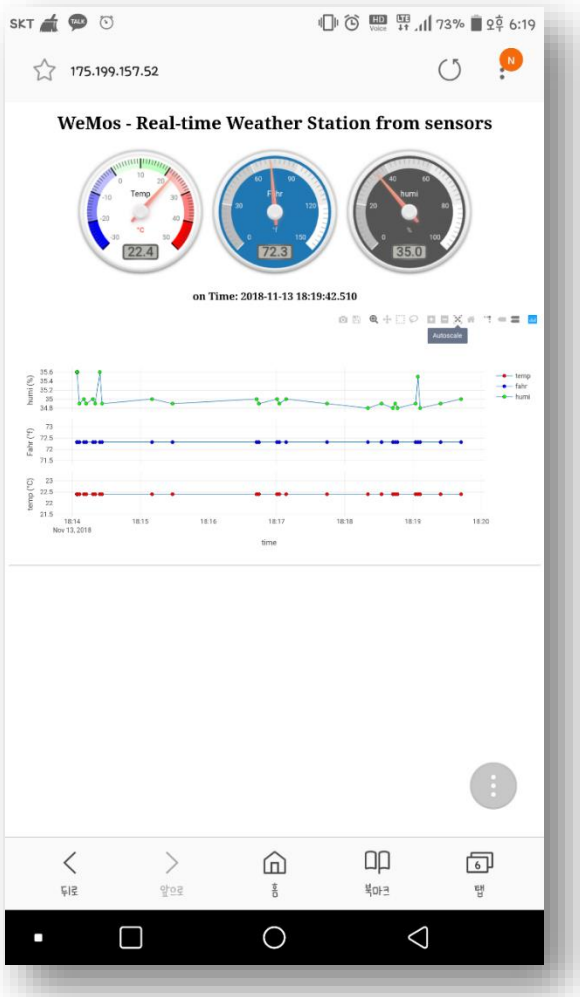
Cors(Cross-Origin Resource Sharing) 란?



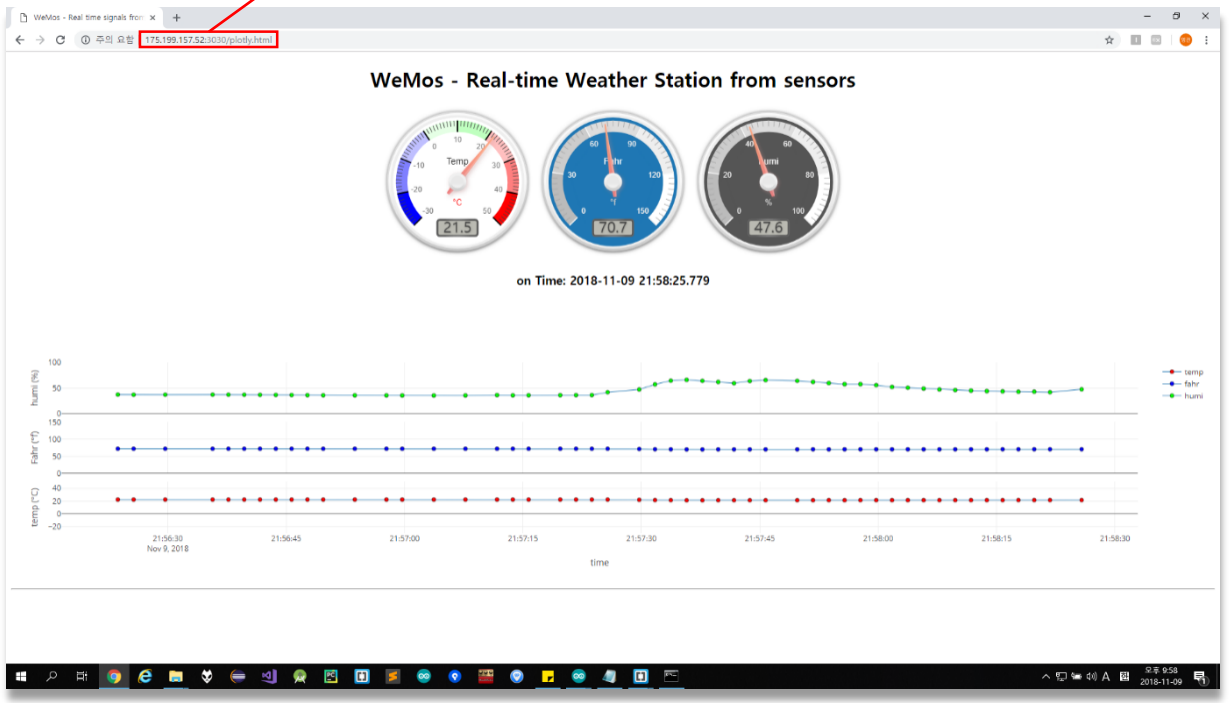
Node.js 소스 (server)



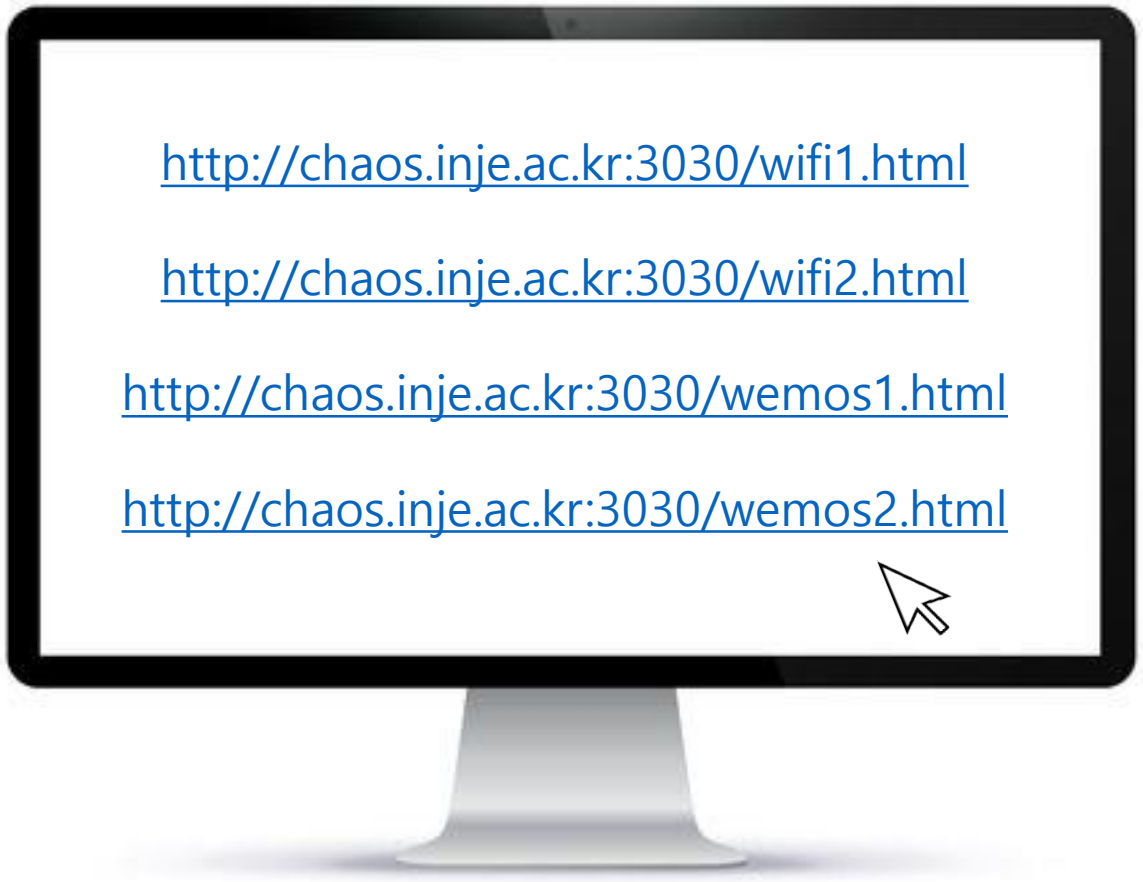
결과 화면



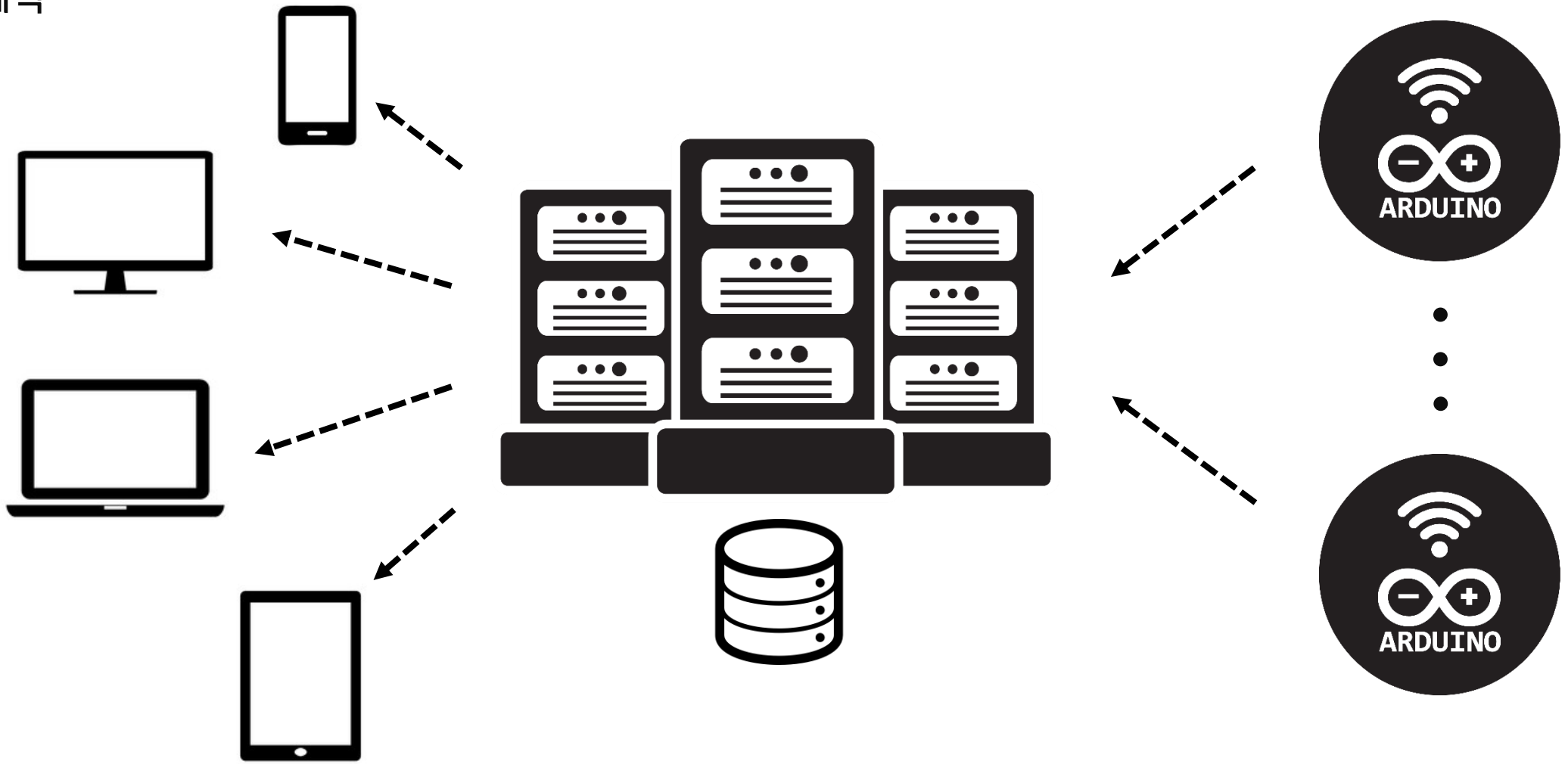
http://175.199.157.52:3030/plotly.html



시연 & 테스트

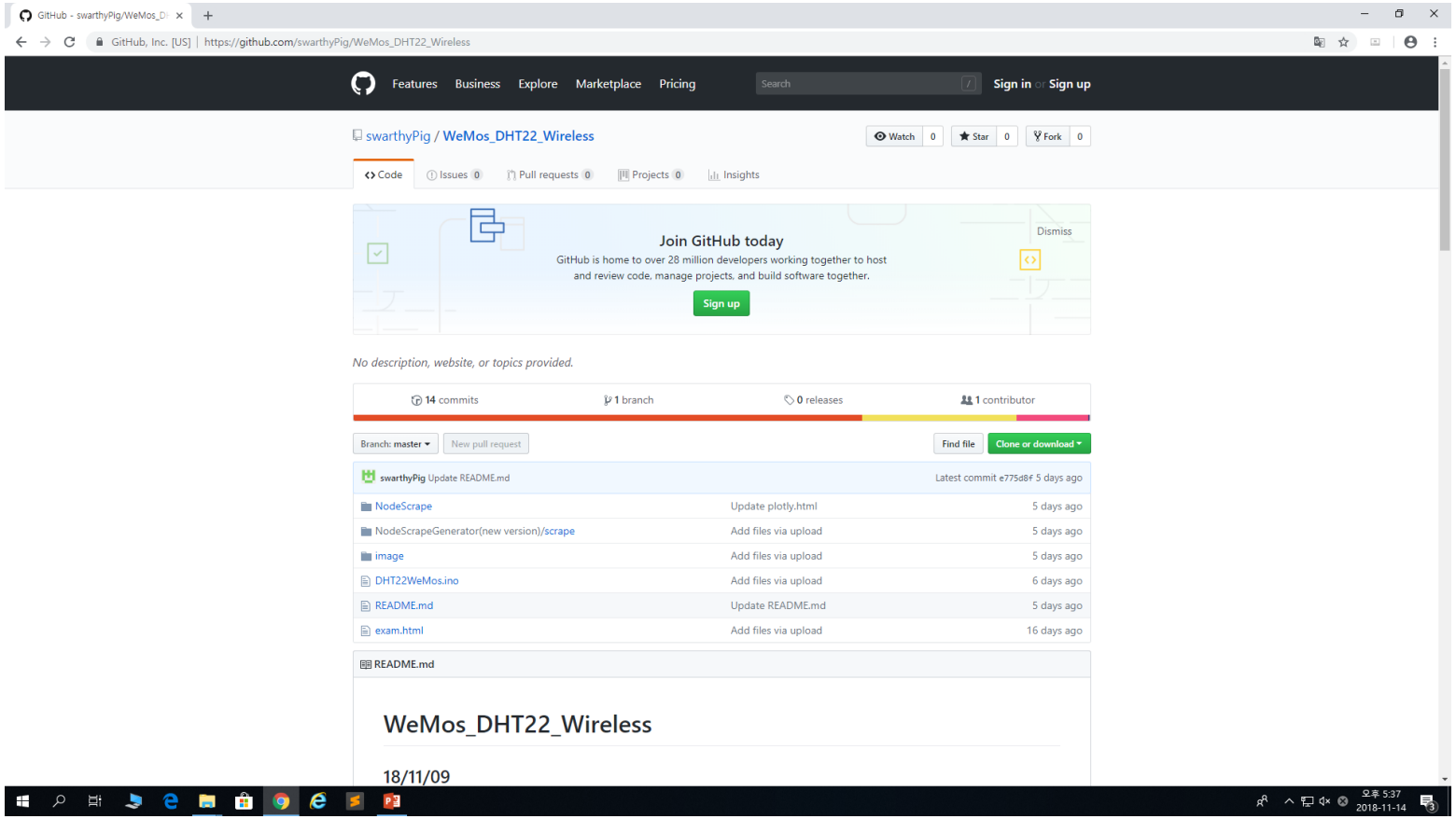

http://chaos.inje.ac.kr:3030/wifi1.html
http://chaos.inje.ac.kr:3030/wifi2.html
http://chaos.inje.ac.kr:3030/wemos1.html
http://chaos.inje.ac.kr:3030/wemos2.html

향후 계획



GitHub 오픈소스

github.com/swarthyPig/WeMos_DHT22_Wireless




Q & A


THANK YOU
(weMos weather station)