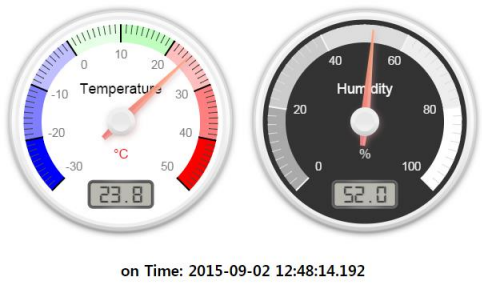
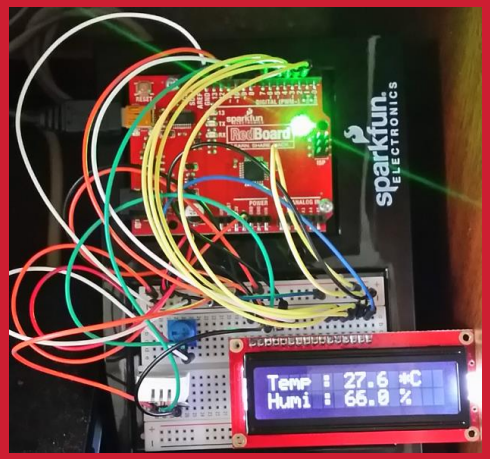
Healthcare-IOT
[wk11]





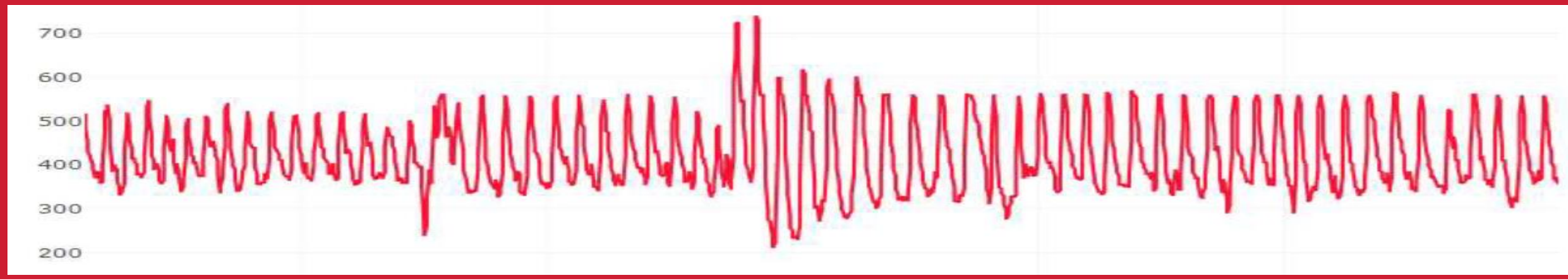
Data visualization using plotly.js III.

Visualization of Healthcare Signals using Arduino & Node.js

HCit, INJE University

1st semester, 2018

Email : chaos21c@gmail.com



My ID

오전

성명	ID
김민선	HS01
김영걸	HS02
김주란	HS03
김주현	HS04
김태민	HS05
여준하	HS06
이수민	HS07
정민지	HS08
정유현	HS09
정재은	HS10
주하영	HS11
한준영	HS12

오후

성명	ID
신영주	HS21
오가영	HS22
윤민수	HS23
윤진아	HS24
이진영	HS25
임상은	HS26
임재형	HS27
최민영	HS28
황유빈	HS29

주간계획서

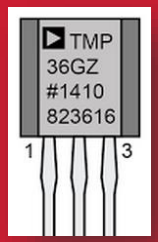
주간계획서			
주차	수업방법	수업내용	과제물
1	강의/실습	수업 및 실습 안내 -포터블 소프트웨어 설치	
2	강의/실습	Node.js I - Node.js 코드의 기본 구조 - 기초 Node 서버 및 클라이언트	실습확인
3	강의/실습	Node.js II - Node.js Express 서버	실습확인
4	강의/실습/발표	Arduino I - 아날로그 신호 회로 - LCD를 이용한 센서 신호 모니터링	실습확인
5	강의/실습	Arduino II - 단일 센서 회로와 Node.js 연결 - 다중 센서 회로와 Node.js 연결	실습확인
6	강의/실습	프로젝트1 - 생체 센서 회로와 Node.js 연결 - 생체 신호 소개	프로젝트1
7	강의/실습/발표	IOT 데이터 시각화 I (Plotly.js) - 데이터 및 시계열 차트 - 데이터 스트리밍	실습확인
8	시험	중간고사	
9	강의/실습	IOT 데이터 시각화 II (Plotly.js) - 다중 센서 데이터 시각화 - 다중 센서 데이터 스트리밍	실습확인
10	강의/실습/발표	프로젝트II - 생체 센서 데이터 시각화 - 생체 센서 데이터 스트리밍	프로젝트II
11	강의/실습	IOT 데이터 저장과 처리 - MongoDB 설치 및 Mongo shell - MongoDB와 Node.js 연결 및 데이터 저장	실습확인
12	강의/실습	프로젝트III - MongoDB에 IOT 데이터 저장 및 모니터링 - 생체 센서 데이터 저장 및 시각화	프로젝트III
13	강의/실습	IOT 데이터 마이닝 - 아두이노에서 발생된 데이터 관리 - 데이터마이닝 소개	실습확인
14	강의/실습/발표	프로젝트IV - 생체 센서 데이터 관리 - 생체 센서 데이터 마이닝	프로젝트IV
15	시험	기말고사	

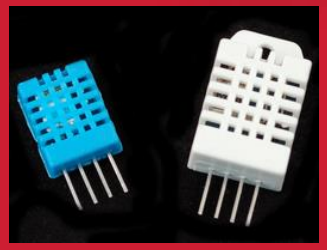
Purpose of HS

주요 수업 목표는 다음과 같다.

1. Node.js를 이용한 아두이노 센서 신호 처리
2. Plotly.js를 이용한 아두이노 센서 신호 시각화
3. MongoDB에 아두이노 센서 데이터 저장 및 처리
4. 생체 센서 발생 신호 처리, 시각화 및 저장
5. 생체 센서 발생 신호 저장 및 분석
6. 생체 신호 장비 활용 능력

[Review]





- [wk10]
  - RT Data Visualization with node.js
  - Usage of gauge.js
  - Complete your real-time WEB charts
  - Upload file name : HSnn_Rpt08.zip

[wk10] Practice-08 HSnn_Rpt08.zip

- **[Target of this week]**
  - Complete your charts
  - Save your outcomes and compress them.

제출파일명 : **HSnn_Rpt08.zip**

- 압축할 파일들

① HSnn_DS_30timestamps.png

② HSnn_DS_multiple_axis.png

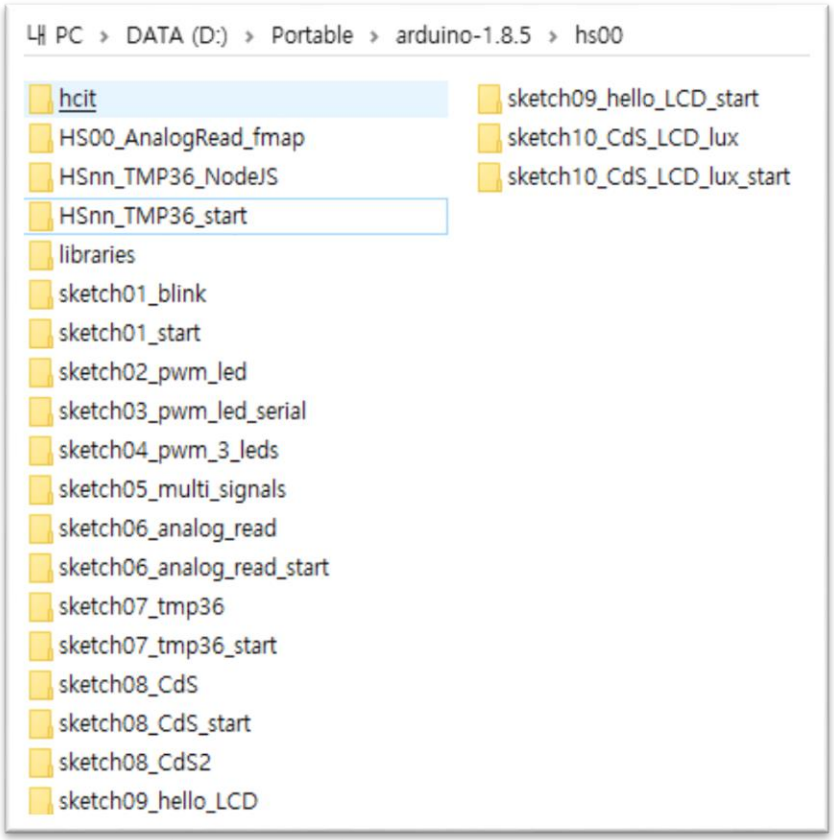
③ HSnn_cds_gauge.png

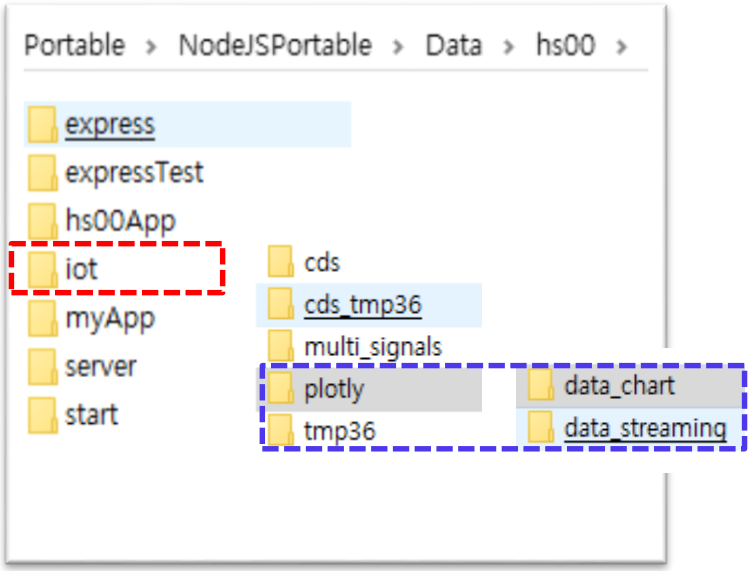
④ HSnn_cds_change.png

Email : chaos21c@gmail.com

[제목 : id, 이름 (수정)]

[My working folder – wk10]

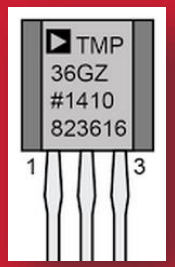


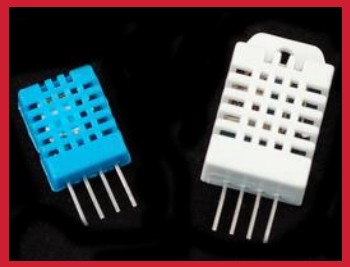


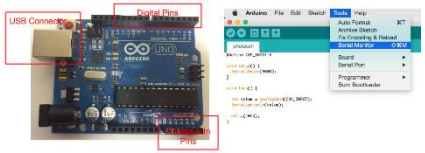
Arduino

+ Node.js

+ plotly.js







IOT: HSC

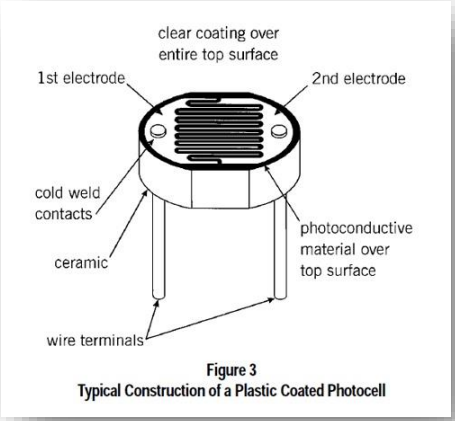
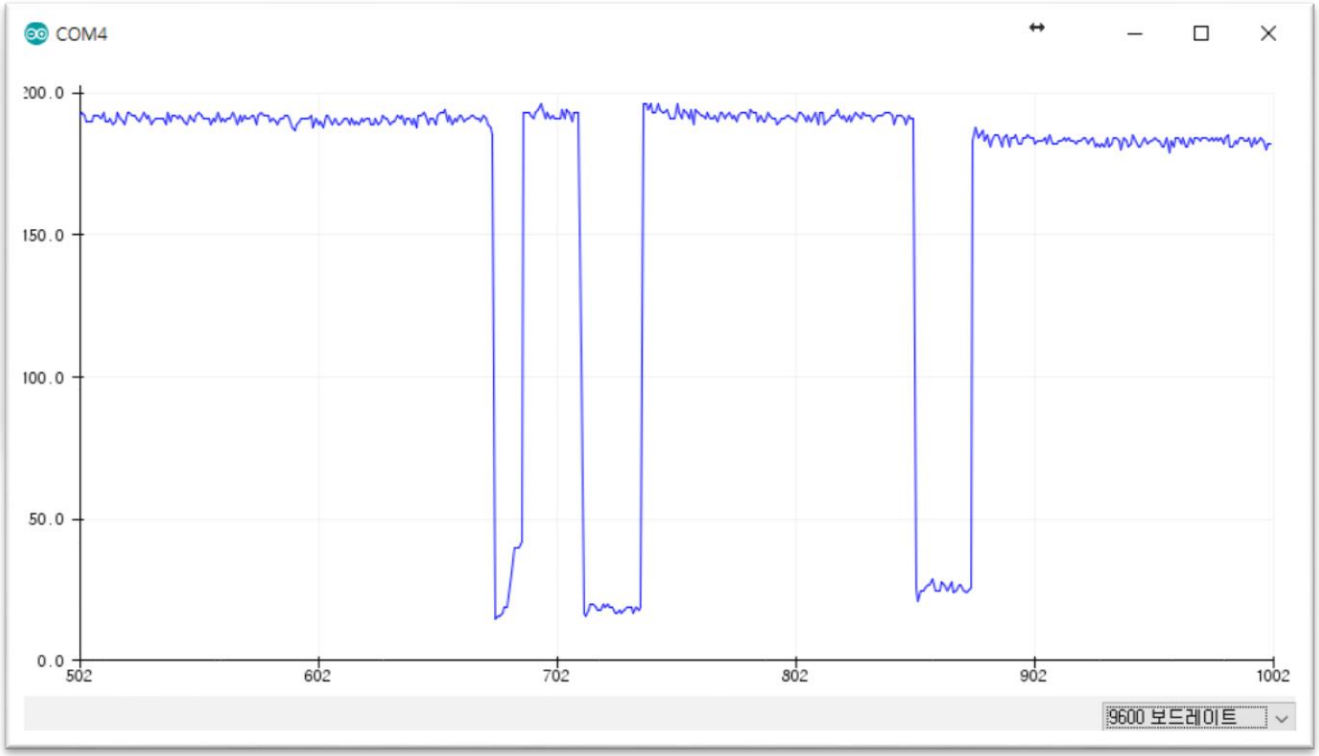
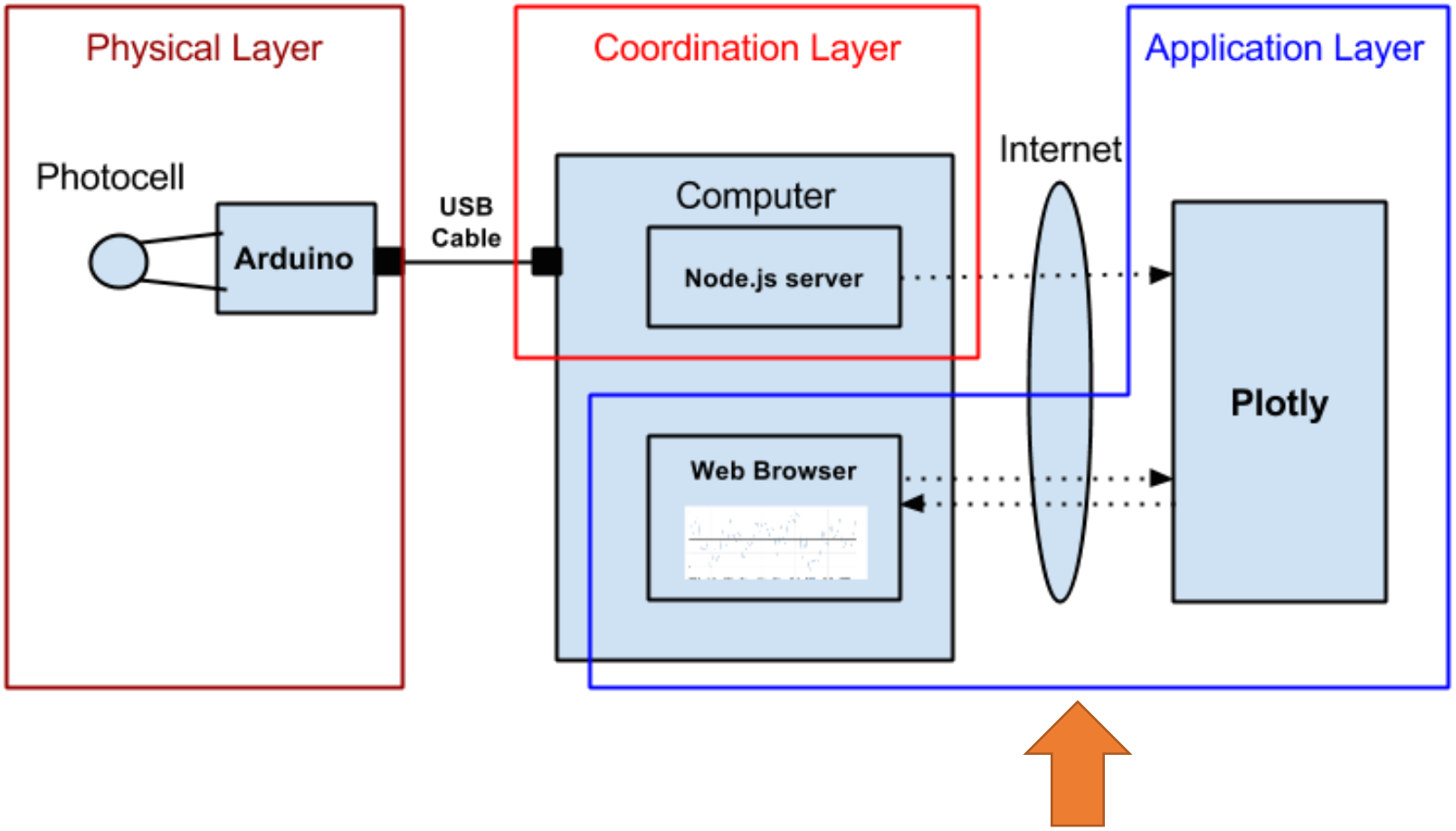


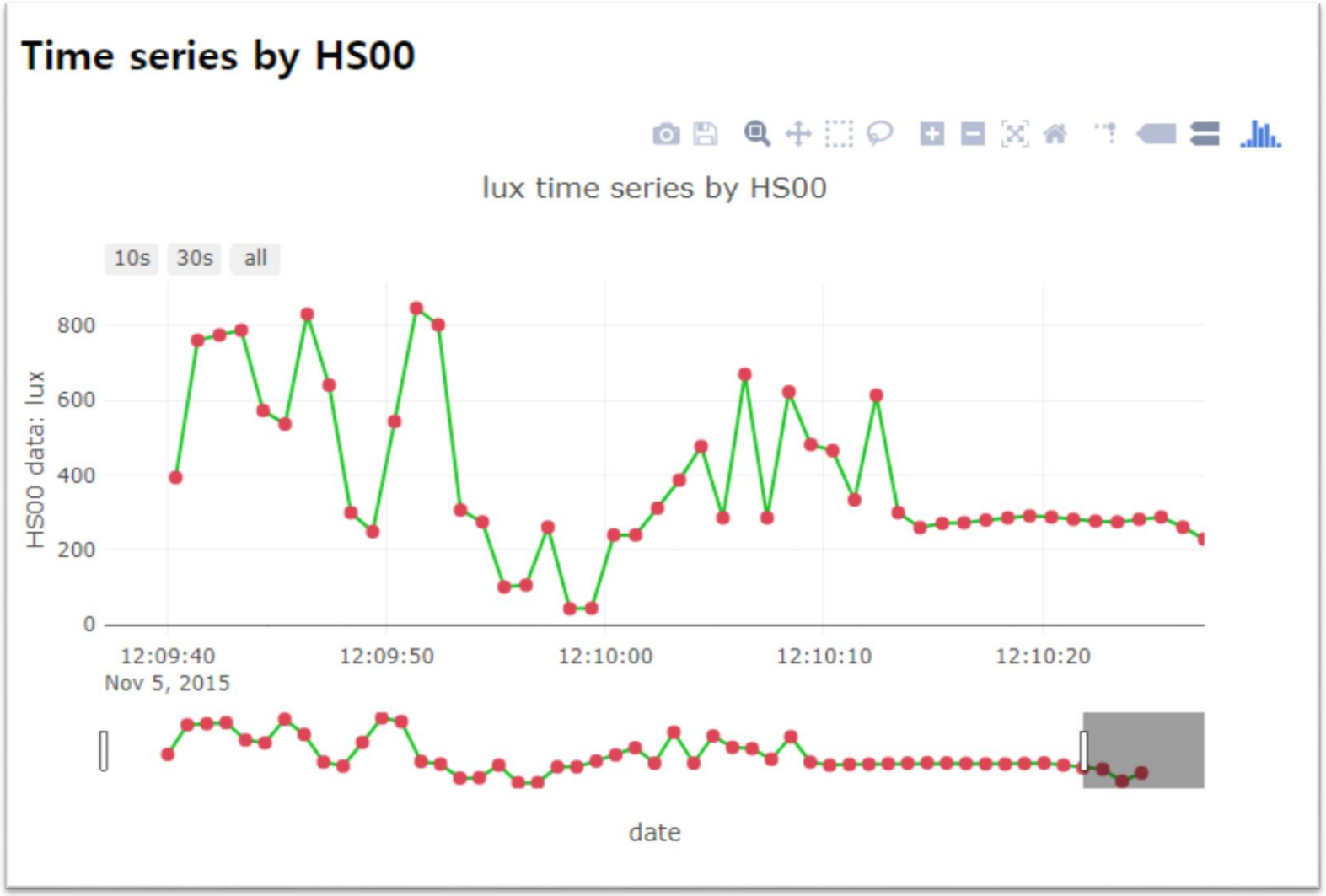
Figure 3
Typical Construction of a Plastic Coated Photocell



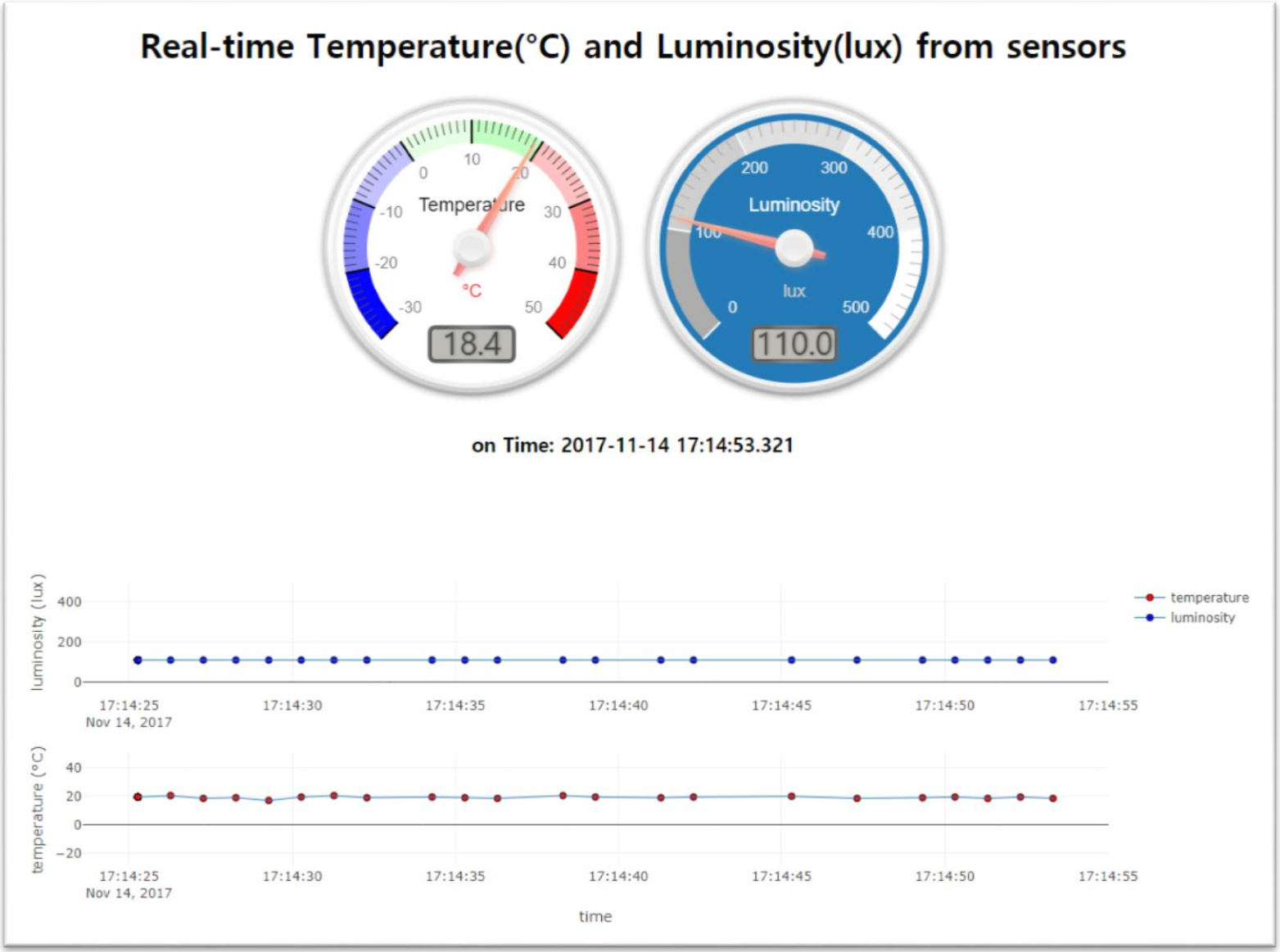
Layout [H S C]


Physical Layer
Photocell
Arduino
USB Cable
Coordination Layer
Computer
Node.js server
Web Browser
Internet
Application Layer
Plotly

Arduino data + plotly

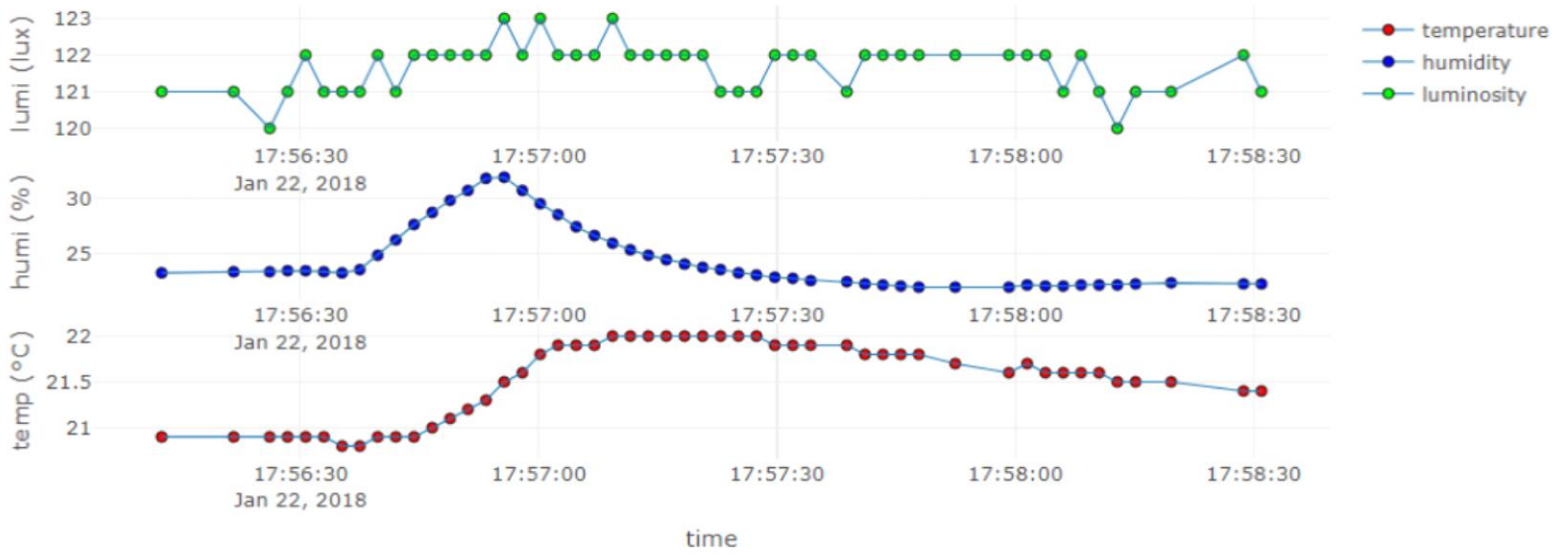


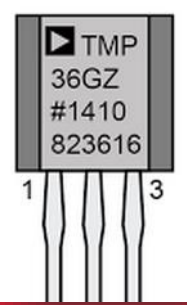
Arduino: node.js + plotly

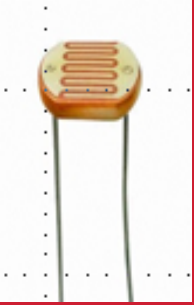


Real-time Weather Station from sensors

on Time: 2018-01-22 17:58:31.012

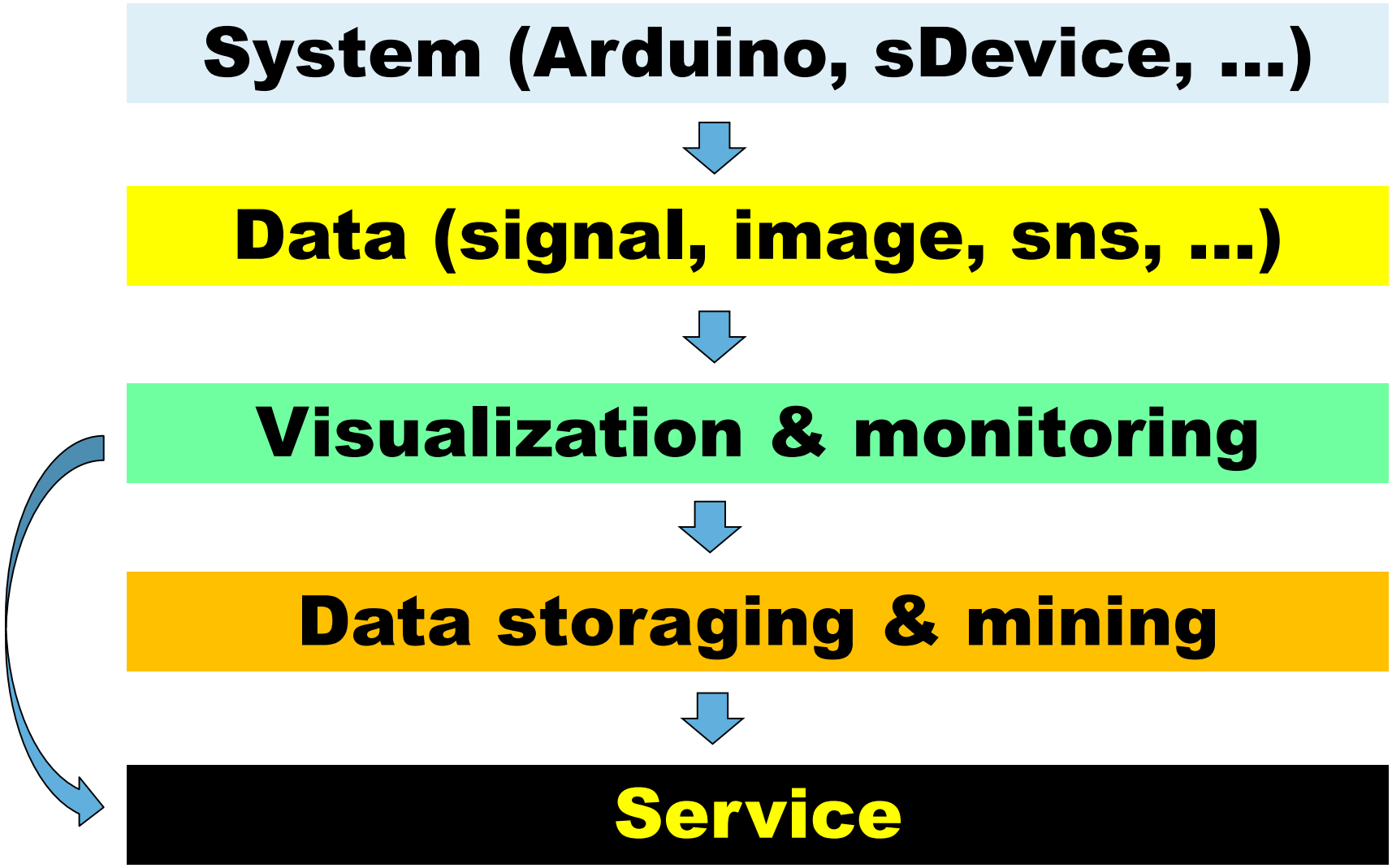




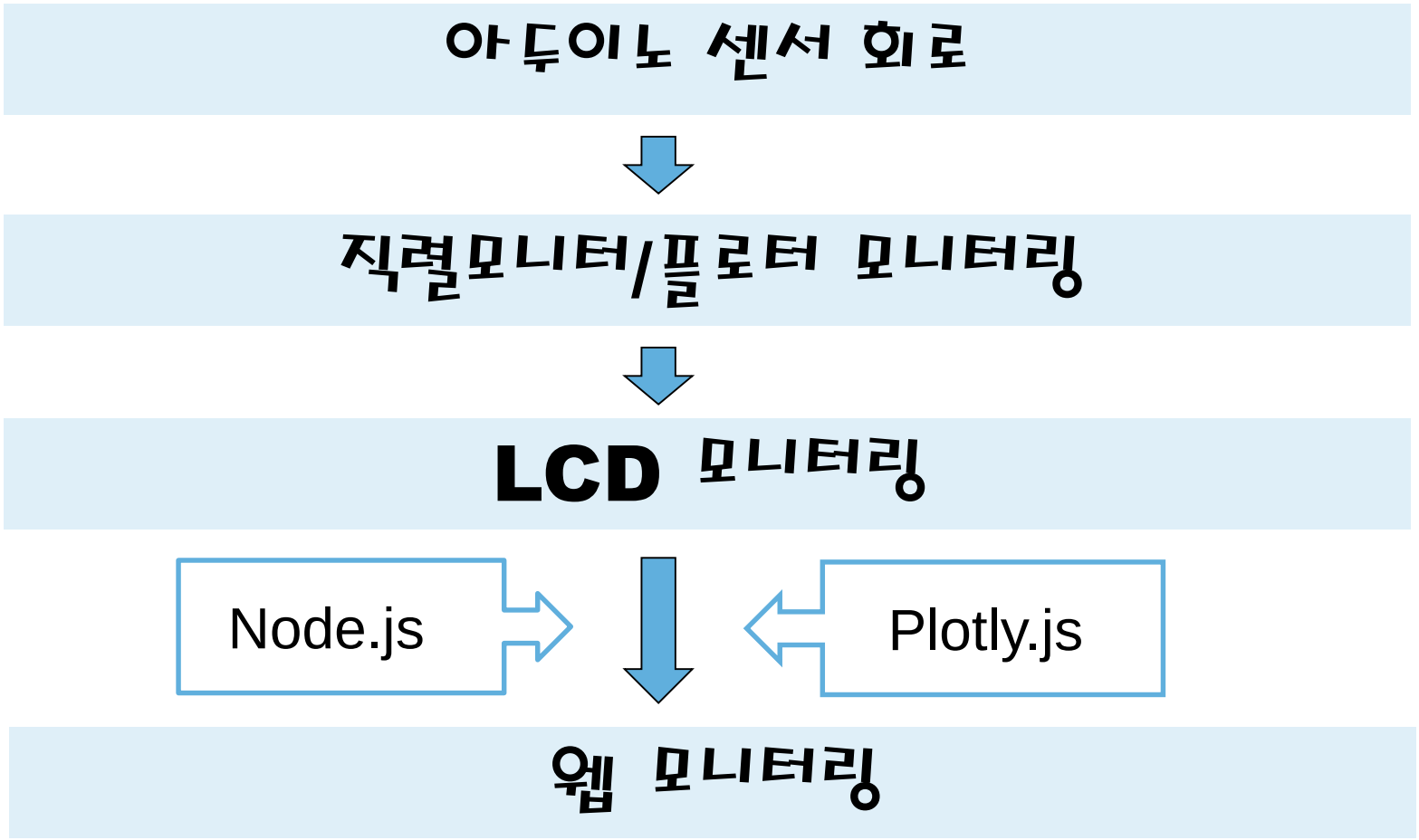


Data visualization using plotly.js

A5. Introduction to visualization



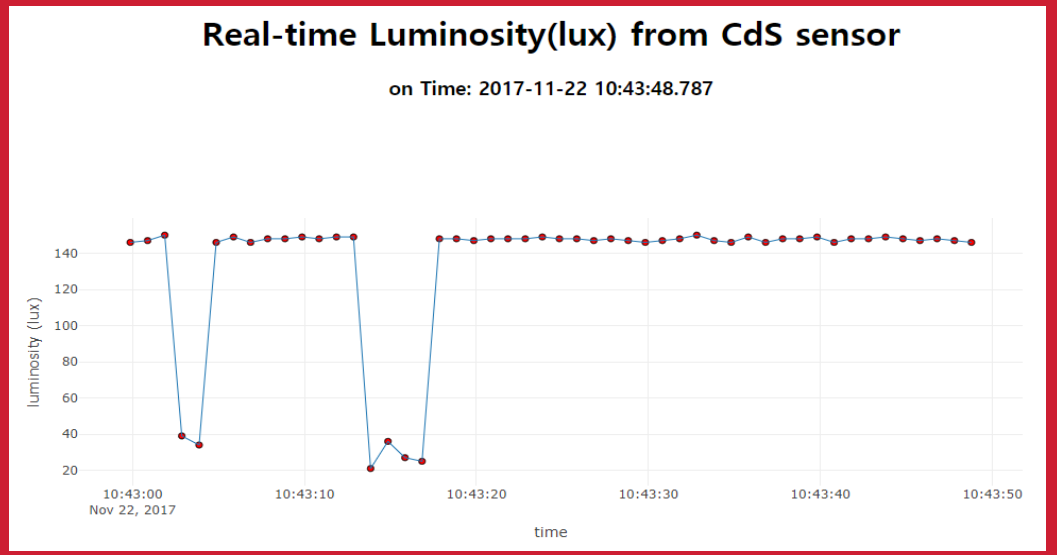
A5.1. Introduction to data visualization



Arduino sensor data

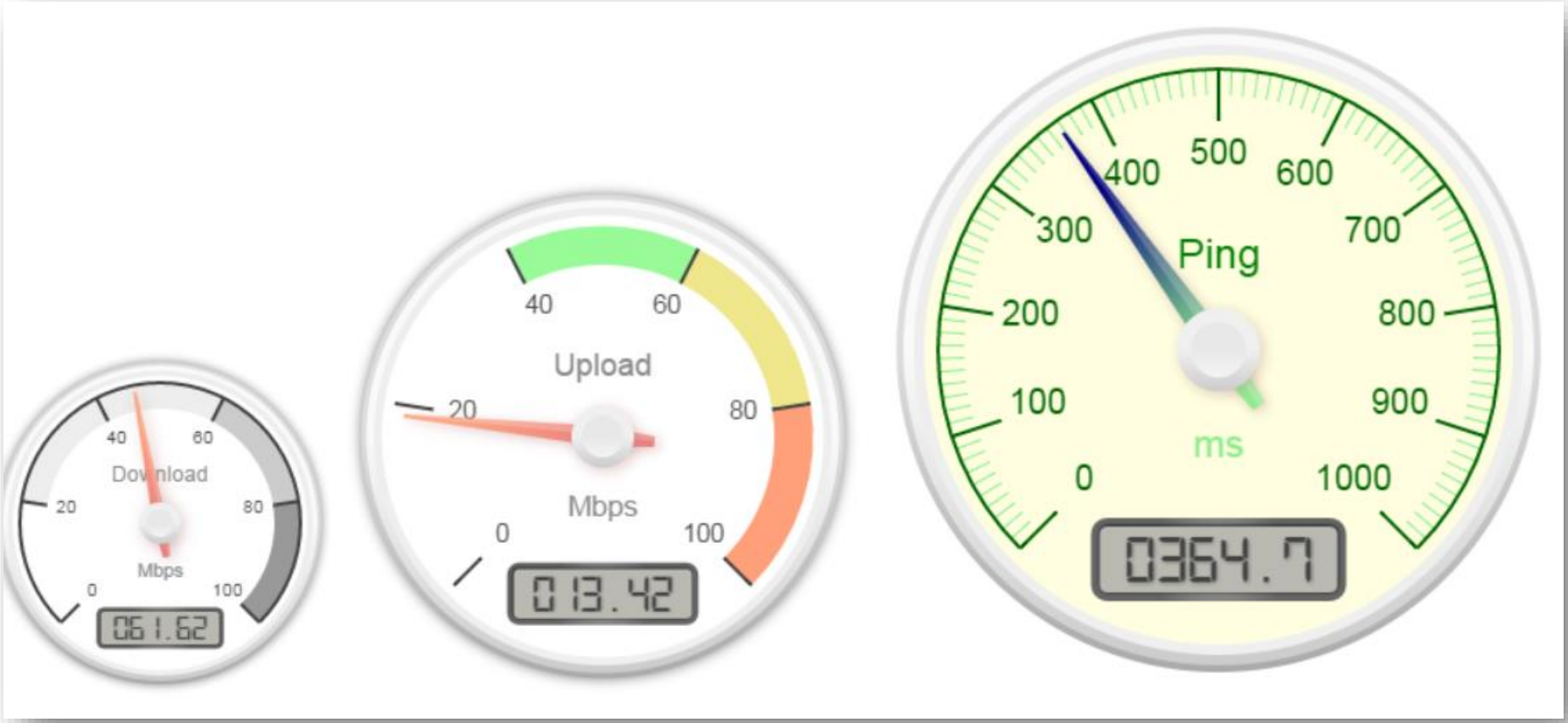
RT visualization using plotly.js

```
AA00,2017-11-22 10:43:11.859,149
AA00,2017-11-22 10:43:12.851,149
AA00,2017-11-22 10:43:13.845,21
AA00,2017-11-22 10:43:14.854,36
AA00,2017-11-22 10:43:15.844,27
AA00,2017-11-22 10:43:16.837,25
AA00,2017-11-22 10:43:17.846,148
AA00,2017-11-22 10:43:18.839,148
AA00,2017-11-22 10:43:19.847,147
```



Canvas Gauge

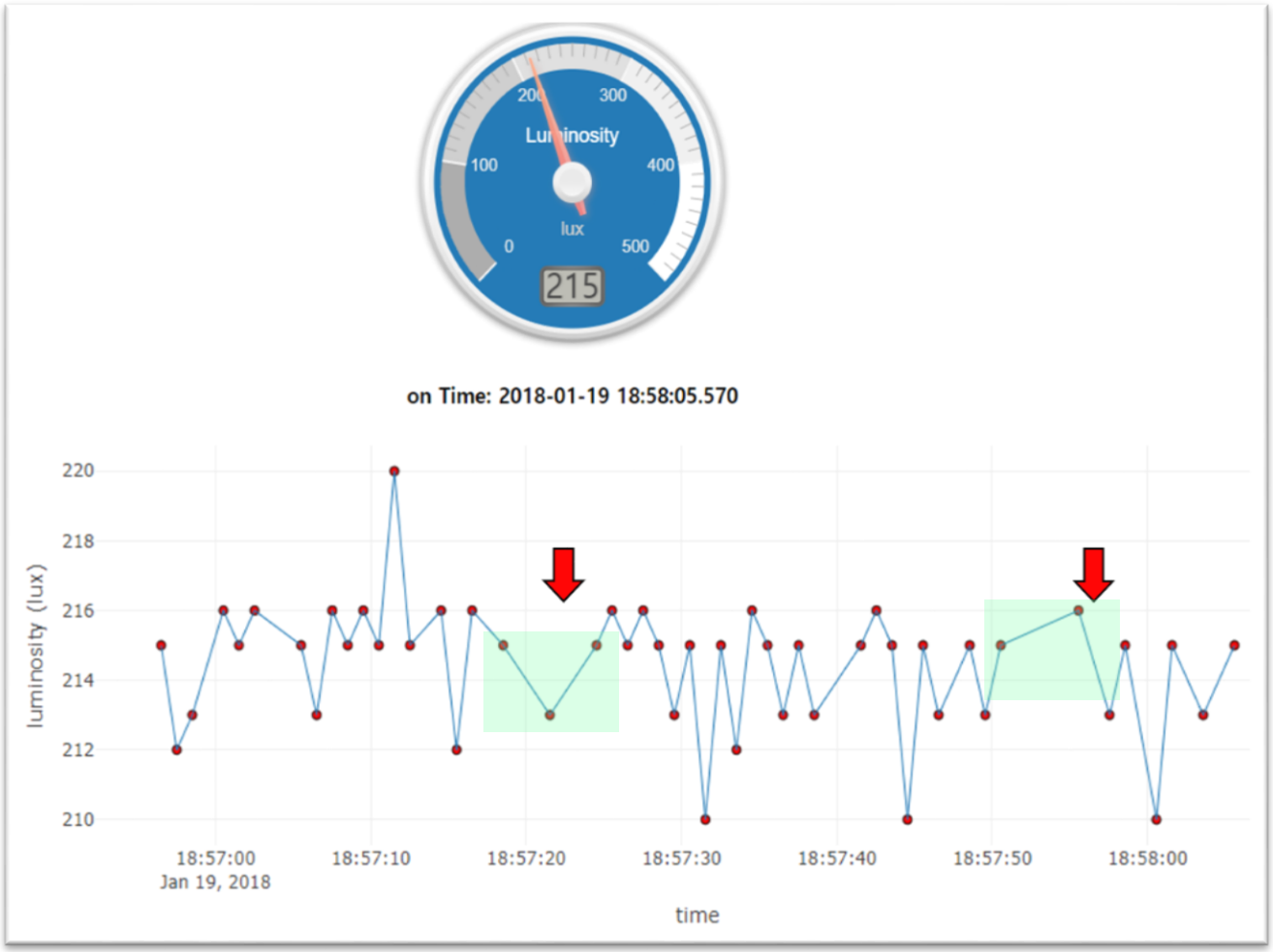
[1] Canvas gauge javascript library : example



http://ru.smart-ip.net/gauge.html

A5.5.9.3 RT sensor-data streaming in Arduino

[DIY] Client html : client_cds_change.html (detecting change)



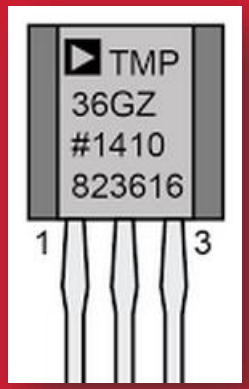
측정되는 주변광의 밝기가 일정 시간 유지되다가 변하는 그래프를 캡처하여 HSnn_cds_change.png 로 저장

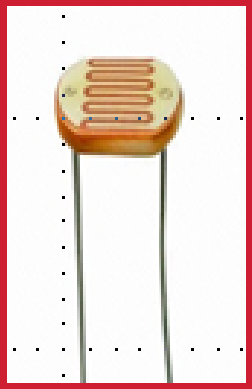
Multiple sensors

CdS + TMP36

+ plotly.js

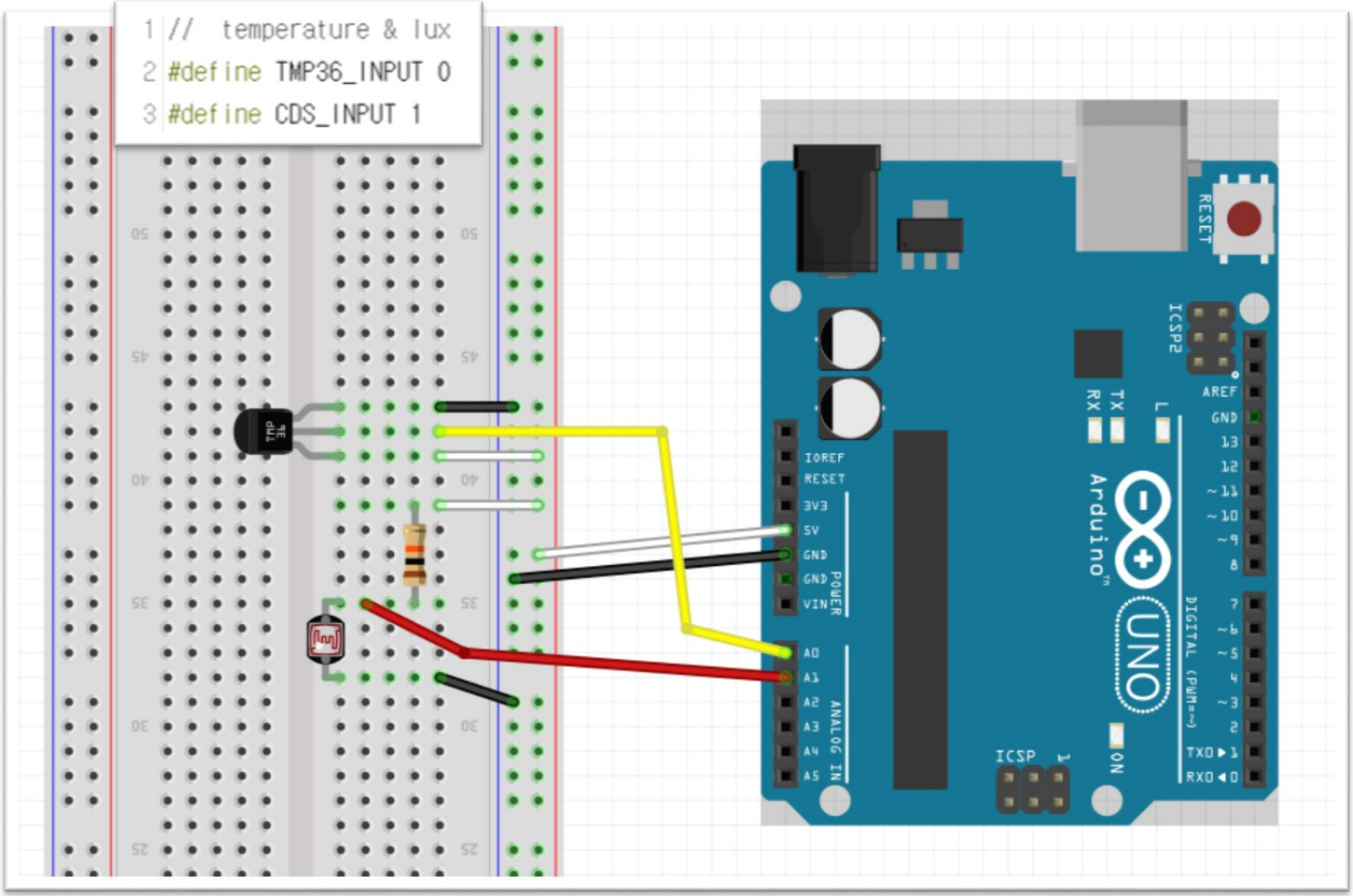
Node project





A4.3.1 TMP36 + CdS : circuit

```
1 //  temperature & lux
2 #define TMP36_INPUT 0
3 #define CDS_INPUT 1
```



A4.3.2 TMP36 + CdS : code

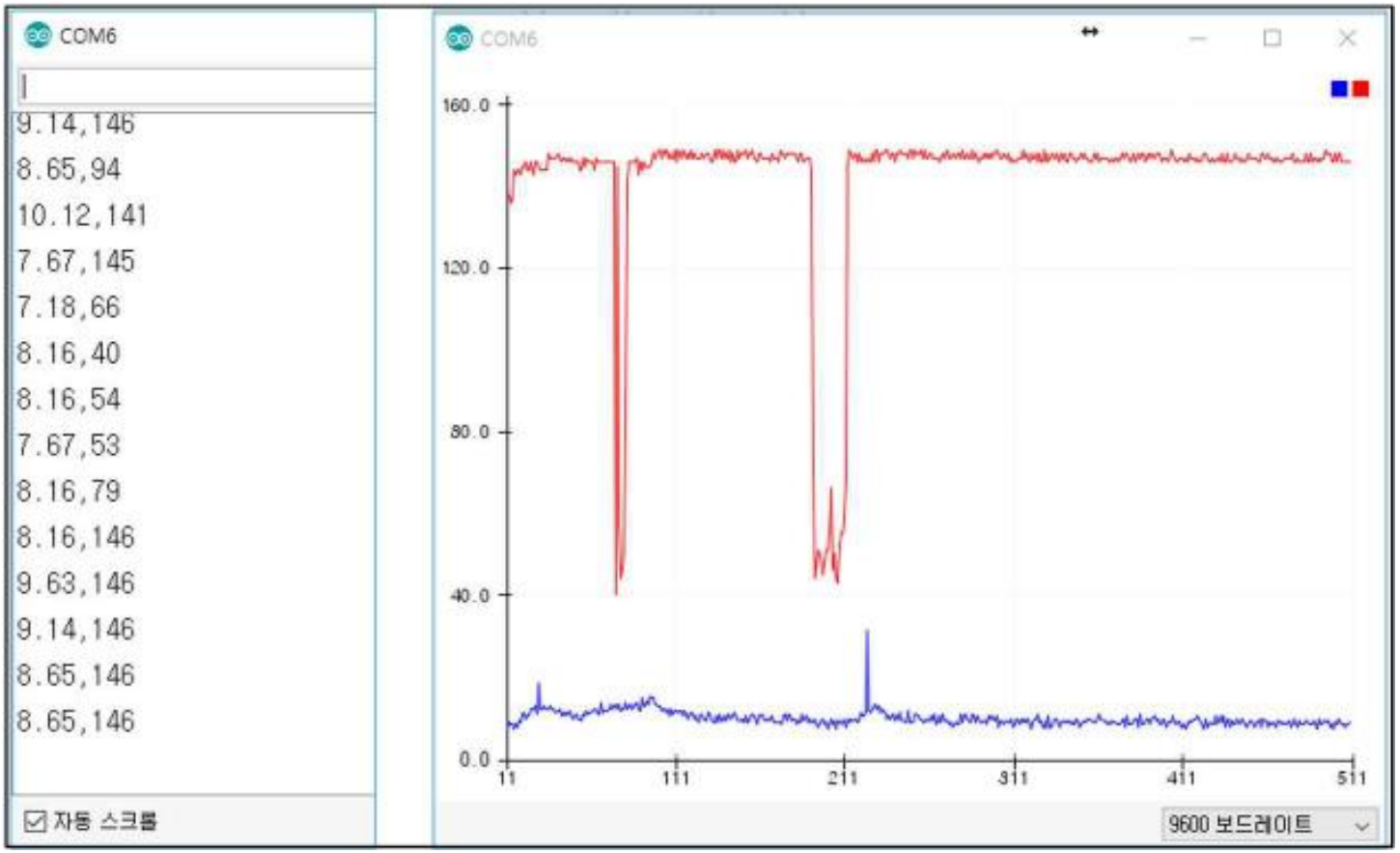
AAnn_TMP36_CdS §

```
1  //  temperature & lux
2  #define TMP36_INPUT 0
3  #define CDS_INPUT 1
4
5  void setup() {
6    Serial.begin(9600);
7  }
```

HSnn_tmp36_cds.ino

```
8  void loop() {
9    // Temperature from TMP36
10   int temp_value = analogRead(TMP36_INPUT);
11   // converting that reading to voltage
12   float voltage = temp_value * 5.0 * 1000;  // in mV
13   voltage /= 1023.0;
14   float tempC = (voltage - 500) / 10 ;
15
16   // Lux from CdS (LDR)
17   int cds_value = analogRead(CDS_INPUT);
18   int lux = int(luminosity(cds_value));
19 //  Serial.print("HSnn,");
20   Serial.print(tempC);
21   Serial.print(",");
22   Serial.println(lux);
23
24   delay(1000);
25 }
26
27 //Voltage to Lux
28 double luminosity (int RawADC0){
29   double Vout=RawADC0*5.0/1023.0;  // 5/1023 (Vin = 5 V)
30   int lux=(2500/Vout-500)/10;
31   // lux = 500 / Rldr, Vout = Ildr*Rldr = (5/(10 + Rldr))*Rldr
32   return lux;
33 }
```

A4.3.2 TMP36 + CdS : result



A4.5.1 CdS + TMP36 + Node project

1. Make cds_tmp36 node project
   - md cds_tmp36 in iot folder
   - cd cds_tmp36
2. Go to cds_tmp36 subfolder
   - npm init

```
"main":
"cds_tmp36_node.js"
"author": "hsnn"
```

name : cds_tmp36

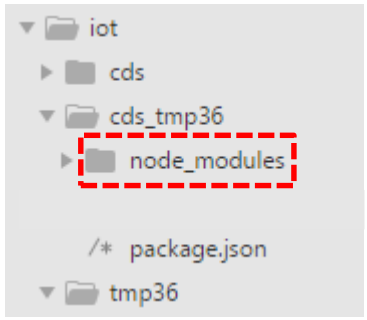
description : cds-tmp36-node project

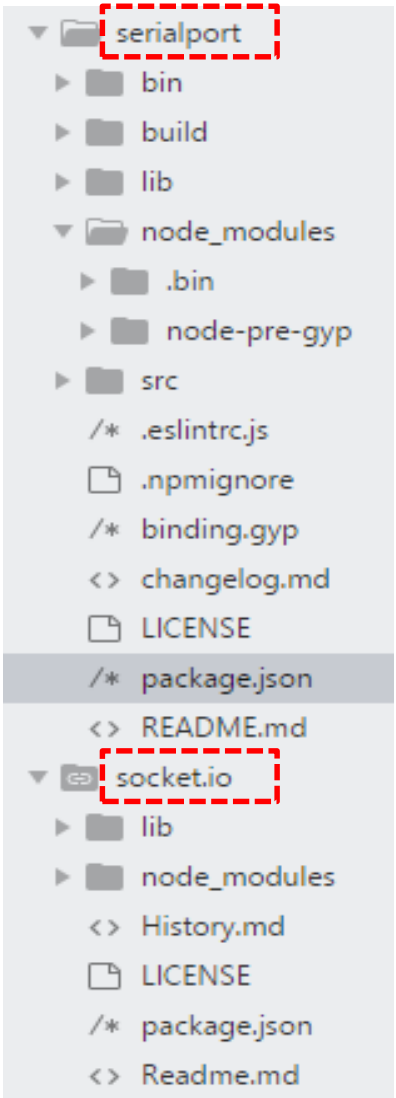
entry point : cds_tmp36_node.js

author : hsnn

A4.5.2 CdS + TMP36 + Node project

1. Make cds_tmp36 node project
   - md cds_tmp36 in iot folder
   - cd cds_tmp36
2. Go to cds_tmp36 subfolder
   - npm init
   - **npm install –save serialport@4.0.7**
   - **npm install –save socket.io@1.7.3**





You can check version of each module by browing package.json in each module subfolder.

A4.5.3 CdS + TMP36 + Node project

1. **Make cds_tmp36 node project**
   - **md cds_tmp36**
   - **cd cds_tmp36**
2. **Go to cds_tmp36 subfolder**
   - **npm init**
   - **npm install –save serialport@4.0.7**
   - **npm install –save socket.io@1.7.3**

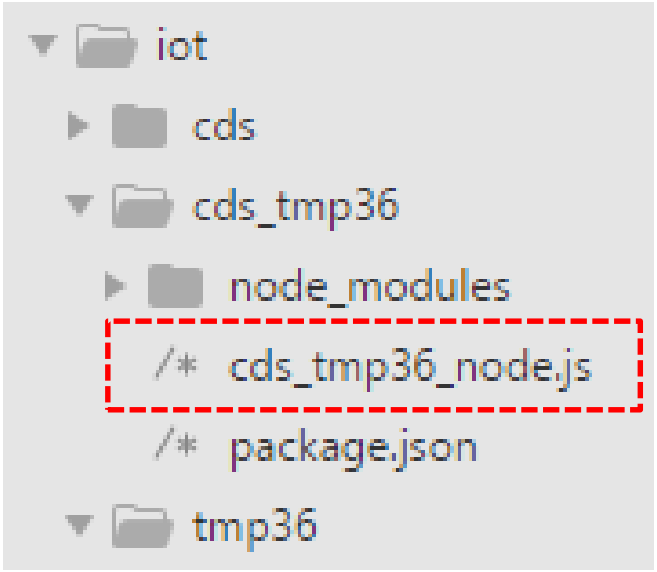
package,json

```
{
  "name": "cds_tmp36",
  "version": "1.0.0",
  "description": "cds-tmp36-node project",
  "main": "cds_tmp36_node.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "keywords": [
    "cds",
    "tmp36",
    "node"
  ],
  "author": "hs00",
  "license": "MIT",
  "dependencies": {
    "serialport": "^4.0.7",
    "socket.io": "^1.7.3"
  }
}
```

A4.5.4 CdS + TMP36 + Node project

Recycling code:

Save cds_node.js as
cds_tmp36_node.js



A4.5.5.1 CdS + TMP36 + Node project : code-1

cds_tmp36_node.js

cds_tmp36_node.js

```
1  // cds_tmp36_node.js
2
3  var serialport = require('serialport');
4  var portName = 'COM6';  // check your COM port!!
5  var port     =   process.env.PORT || 3000;
6
7  var io = require('socket.io').listen(port);
8
9  // serial port object
10 var sp = new serialport(portName,{
11     baudRate: 9600,   // 9600  38400
12     dataBits: 8,
13     parity: 'none',
14     stopBits: 1,
15     flowControl: false,
16     parser: serialport.parsers.readline('\r\n')
17 });
```

A4.5.5.2 CdS + TMP36 + Node project : code-2

cds_tmp36_node.js – parsing data

```
18 var dStr = '';
19 var readData = '';  // this stores the buffer
20 var temp ='';
21 var lux ='';
22 var mdata =[]; // this array stores date and data from multiple sensors
23 var firstcommaidx = 0;
24
25 sp.on('data', function (data) { // call back when data is received
26     readData = data.toString(); // append data to buffer
27     firstcommaidx = readData.indexOf(',');
28
29     // parsing data into signals
30     if (firstcommaidx > 0) {
31         temp = readData.substring(0, firstcommaidx);
32         lux = readData.substring(firstcommaidx + 1);
33         readData = '';
34
35         dStr = getDateString();
36         mdata[0]=dStr;  // Date
37         mdata[1]=temp;  // temperature data
38         mdata[2]=lux;   // luminosity data
39         console.log("HSnn," + mdata);
40         io.sockets.emit('message', mdata);  // send data to all clients
41
42     } else {  // error
43         console.log(readData);
44     }
45 });
```

Parsing Data

A4.5.5.3 CdS + TMP36 + Node project : code-3

cds_tmp36_node.js

```
32 // helper function to get a nicely formatted date string for IOT
33 function getDateString() {
34     var time = new Date().getTime();
35     // 32400000 is (GMT+9 Korea, GimHae)
36     // for your timezone just multiply +/-GMT by 3600000
37     var datestr = new Date(time +32400000).
38     toISOString().replace(/T/, ' ').replace(/Z/, '');
39     return datestr;
40 }
41
42 io.sockets.on('connection', function (socket) {
43     // If socket.io receives message from the client browser then
44     // this call back will be executed.
45     socket.on('message', function (msg) {
46         console.log(msg);
47     });
48     // If a web browser disconnects from Socket.IO then this callback is called.
49     socket.on('disconnect', function () {
50         console.log('disconnected');
51     });
52 });
```

A4.5.6 CdS + TMP36 + Node project : result

Node cmd 에서 실행

```
node cds_tmp36_node
```

```
NodeJS - node  cds_tmp36_node

D:\Portable\NodeJSPortable\Data\aa00\iot\cds_tmp36>node cds_tmp36_node
AA00,2018-01-15 15:50:06.345,10.12,141
AA00,2018-01-15 15:50:07.337,9.63,141
AA00,2018-01-15 15:50:08.344,9.63,138
AA00,2018-01-15 15:50:09.352,9.63,138
AA00,2018-01-15 15:50:10.359,10.61,139
AA00,2018-01-15 15:50:11.367,10.12,32
```

IOT data format

시간, 온도,조도

A5.6.1 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

```
<!DOCTYPE html>
<head>
  <meta charset="utf-8">
  <title>plotly.js client: Real time signals from sensors</title>
  <script src="https://cdn.plot.ly/plotly-latest.min.js"></script>
  <script type="text/javascript" src="https://cdnjs.cloudflare.com/ajax/libs/
  socket.io/1.3.6/socket.io.js"></script>

  <script src="gauge.min.js"></script>

  <style>body{padding:0;margin:30;background:#fff}</style>
</head>

<body>  <!-- style="width:100%;height:100%"> -->
<!-- Plotly chart will be drawn inside this DIV -->
<h1 align="center">Real-time Temperature(°C) and Luminosity(lux) from sensors</h1>
<div align="center">
    <!-- 1st gauge -->
    <canvas id="gauge1"> </canvas>
    <!-- 2nd gauge -->
    <canvas id="gauge2"> </canvas>
</div>

<h3 align="center"> on Time: <span id="time"> </span> </h3>

<div id="myDiv"></div> <!-- graph here! -->

<hr>
```

A5.6.2 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

```
<script>
/* JAVASCRIPT CODE GOES HERE */
  var streamPlot = document.getElementById('myDiv');
  var ctime = document.getElementById('time');

  var tArray = [], // time of data arrival
      xTrack = [], // value of sensor 1 : temperature
      yTrack = [], // value of sensor 2 : Luminosity
      numPts = 50, // number of data points in x-axis
      dtda = [],  // 1 x 3 array : [date, data1, data2] from sensors
      preX = -1,
      preY = -1,
      initFlag = true;
```

A5.6.3 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

```
var socket = io.connect('http://localhost:3000'); // port = 3000
socket.on('connect', function () {
    socket.on('message', function (msg) {
        // initial plot
        if(msg[0]!='' && initFlag){
            dtda[0]=msg[0];
            dtda[1]=parseFloat(msg[1]);  // temperature
            dtda[2]=parseInt(msg[2]);    // Luminosity
            init();  // start streaming
            initFlag=false;
        }
        dtda[0]=msg[0];
        dtda[1] = parseFloat(msg[1]);
        dtda[2] = parseInt(msg[2]);
```

A5.6.4 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

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

            ctime.innerHTML = dtda[0];
            gauge_temp.setValue(dtda[1])  // temp gauge
            gauge_lux.setValue(dtda[2]);  // lux gauge
            //nextPt();
            tArray = tArray.concat(dtda[0]);  // time
            tArray.splice(0,1);
            xTrack = xTrack.concat(dtda[1])   // temp
            xTrack.splice(0, 1)  // remove the oldest data
            yTrack = yTrack.concat(dtda[2])   // lux
            yTrack.splice(0, 1)

            var update = {
                x: [tArray, tArray],
                y: [xTrack, yTrack]
            }
            Plotly.update(streamPlot, update);
        }
    });
});
```

A5.6.5 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

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

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

A5.6.6 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

```
// data
var data = [{
    x : tArray,
    y : xTrack,
    name : 'temperature',
    mode: "markers+lines",  // "l
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(255, 0, 0)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
}, {
    x : tArray,
    y : yTrack,
    name : 'luminosity',
    xaxis: 'x2',
    yaxis : 'y2',
    mode: "markers+lines",  // "l
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(0, 0, 255)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
}];
```

```
var layout = {
  xaxis : {
      title : 'time',
      domain : [0, 1]
  },
  yaxis : {
      title : 'temperature (°C)',
      domain : [0, 0.4],
      range : [-30, 50]
  },
  xaxis2 : {
      title : '',
      domain : [0, 1],
      position : 0.6
  },
  yaxis2 : {
      title : 'luminosity (lux)',
      domain : [0.65, 1],
      range : [0, 500]
  }
};
```

A5.6.7 TMP36 + CdS streaming project

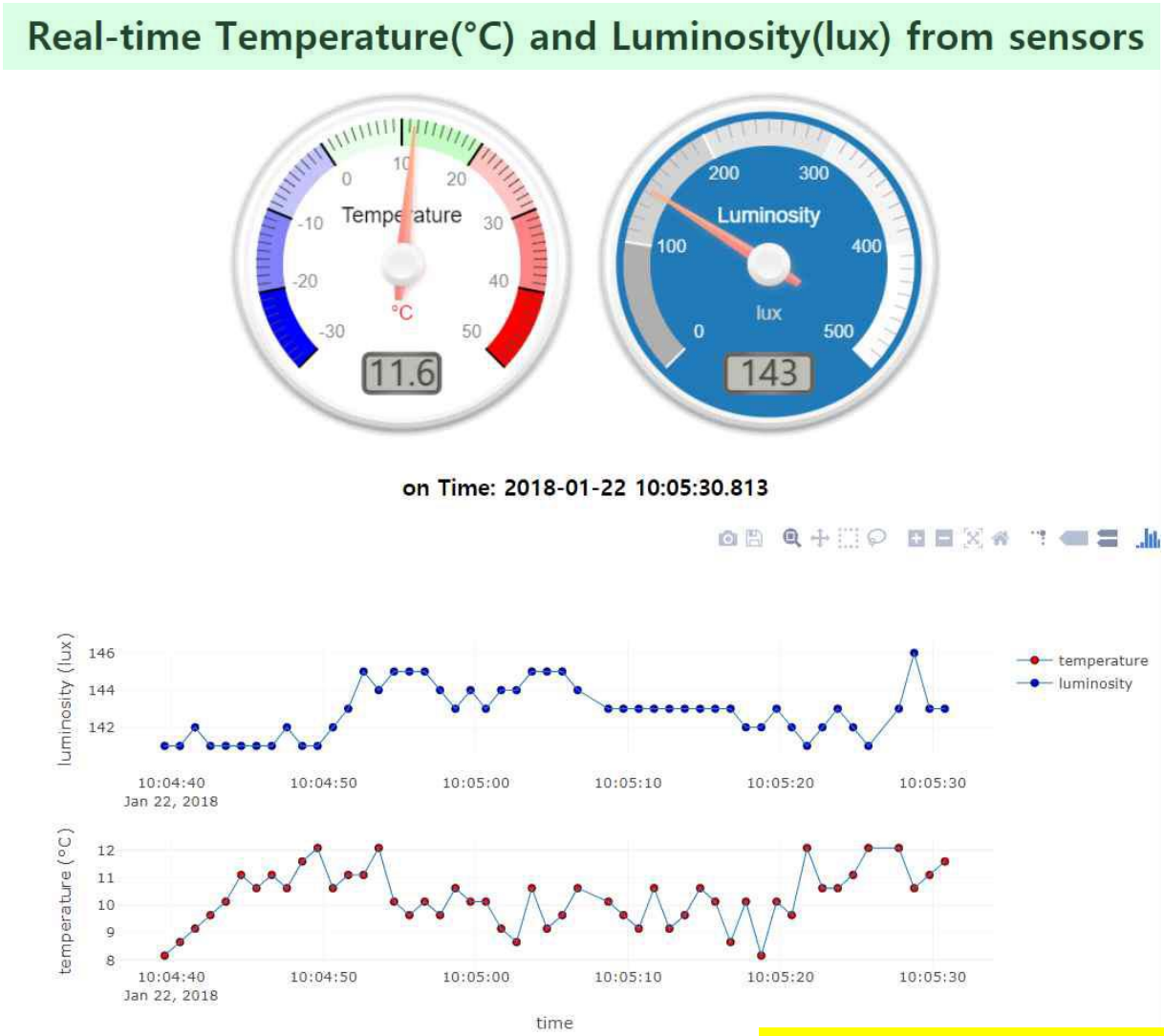
[DIY] Client html : client_cds_tmp36.html (data from multi sensors)

```
// gauge configuration
var gauge_temp = new Gauge({
    renderTo    : 'gauge1',
    width       : 300,
    height      : 300,
    glow        : true,
    units       : '°C',
    valueFormat : { int : 1, dec : 1 },
    title       : "Temperature",
    minValue    : -30,
    maxValue    : 50,
    majorTicks  : ['-30','-20','-10','0','10','20','30','40','50'],
    minorTicks  : 10,
    strokeTicks : false,
    highlights  : [
    { from : -30,   to : -20, color : 'rgba(0, 0, 255, 1)' },
    { from : -20,   to : -10, color : 'rgba(0, 0, 255, .5)' },
    { from : -10, to : 0, color : 'rgba(0, 0, 255, .25)' },
    { from : 0,   to : 10, color : 'rgba(0, 255, 0, .1)' },
    { from : 10, to : 20, color : 'rgba(0, 255, 0, .25)' },
    { from : 20, to : 30, color : 'rgba(255, 0,  0, .25)' },
    { from : 30, to : 40, color : 'rgba(255, 0,  0, .5)' },
    { from : 40, to : 50, color : 'rgba(255, 0,  0, 1)' }
    ],
    colors      : {
        plate      : '#fff',
        majorTicks : '#000',
        minorTicks : '#444',
        title      : '#000',
        units      : '#f00',
        numbers    : '#777',
        needle     : { start : 'rgba(240, 128, 128, 1)',
        end : 'rgba(255, 160, 122, .9)' }
    }
});
gauge_temp.draw();
```

```
var gauge_lux = new Gauge({
    renderTo    : 'gauge2',
    width       : 300,
    height      : 300,
    glow        : true,
    units       : 'lux',
    valueFormat : { int : 3, dec : 0 },
    title       : "Luminosity",
    minValue    : 0,
    maxValue    : 500,  // new
    majorTicks  : ['0','100','200','300','400','500'],
    minorTicks  : 10,
    strokeTicks : false,
    highlights  : [
    { from : 0,   to : 100, color : '#aaa' },
    { from : 100, to : 200, color : '#ccc' },
    { from : 200, to : 300, color : '#ddd' },
    { from : 300, to : 400, color : '#eee' },
    { from : 400, to : 500, color : '#fff' }
    ],
    colors      : {
        plate      : '#1f77b4',
        majorTicks : '#f5f5f5',
        minorTicks : '#aaa',
        title      : '#fff',
        units      : '#ccc',
        numbers    : '#eee',
        needle     : { start : 'rgba(240, 128, 128, 1)',
        end : 'rgba(255, 160, 122, .9)' }
    }
});
gauge_lux.draw();
```

A5.6.8 TMP36 + CdS streaming project

[DIY] Client html : client_cds_tmp36.html (result)



HSnn_DS_cds_tmp36.png 로 저장

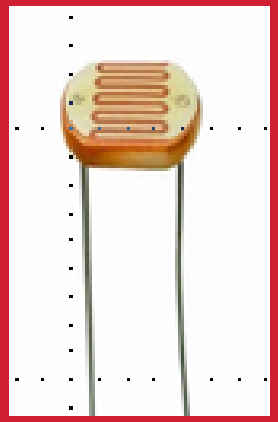
CdS + DHT22

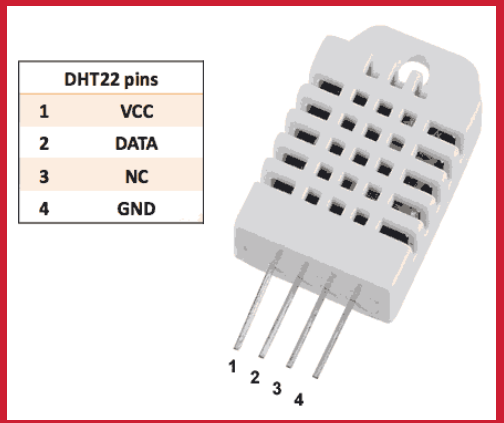
+ plotly.js

Node project

Multi-sensors

DHT22 + CdS





DHT22 pins	
1	VCC
2	DATA
3	NC
4	GND

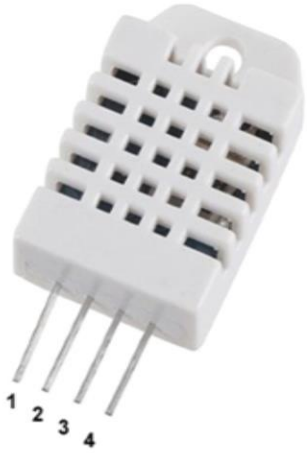
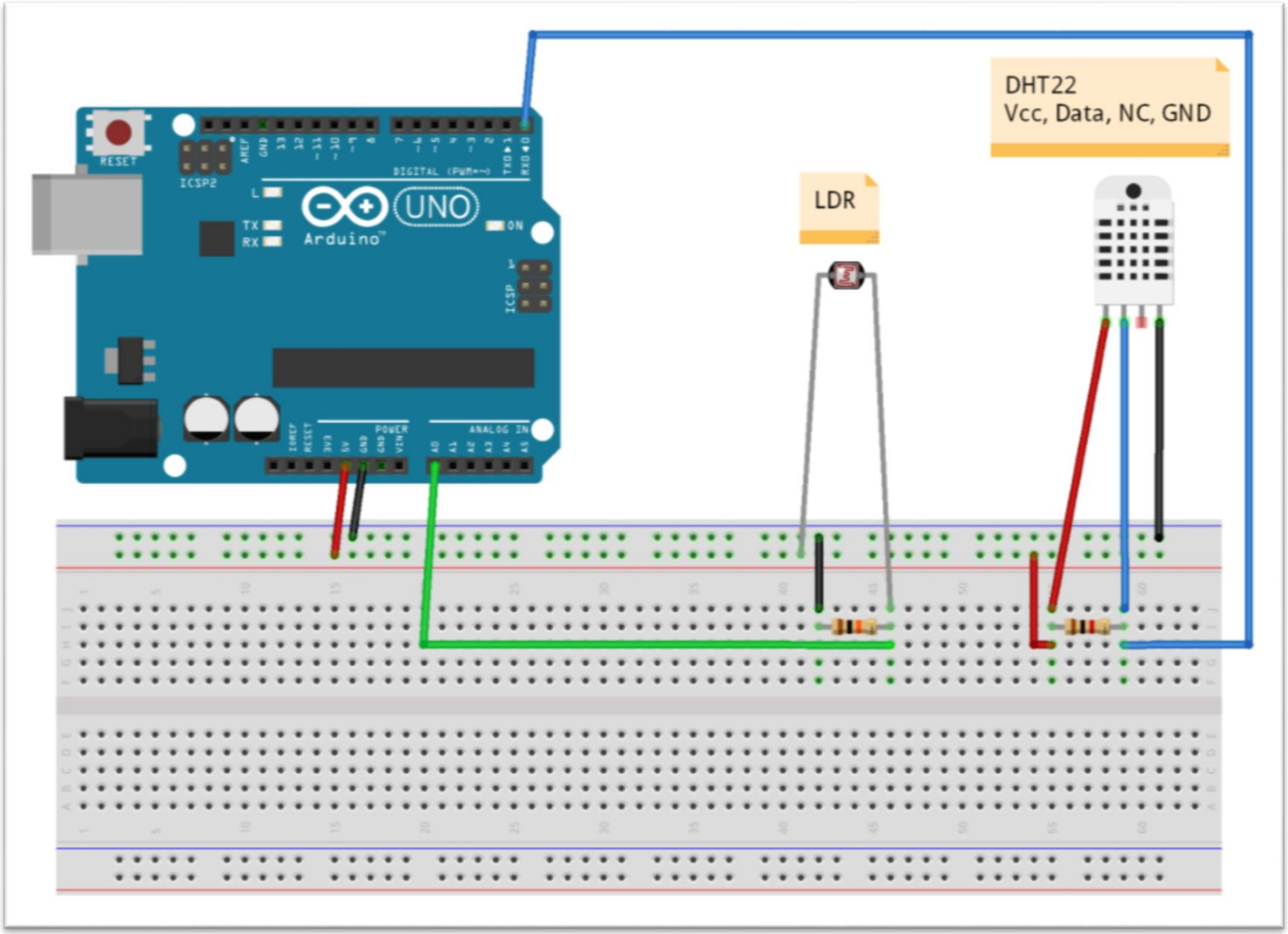


그림 8-7 DHT22 pin 구조

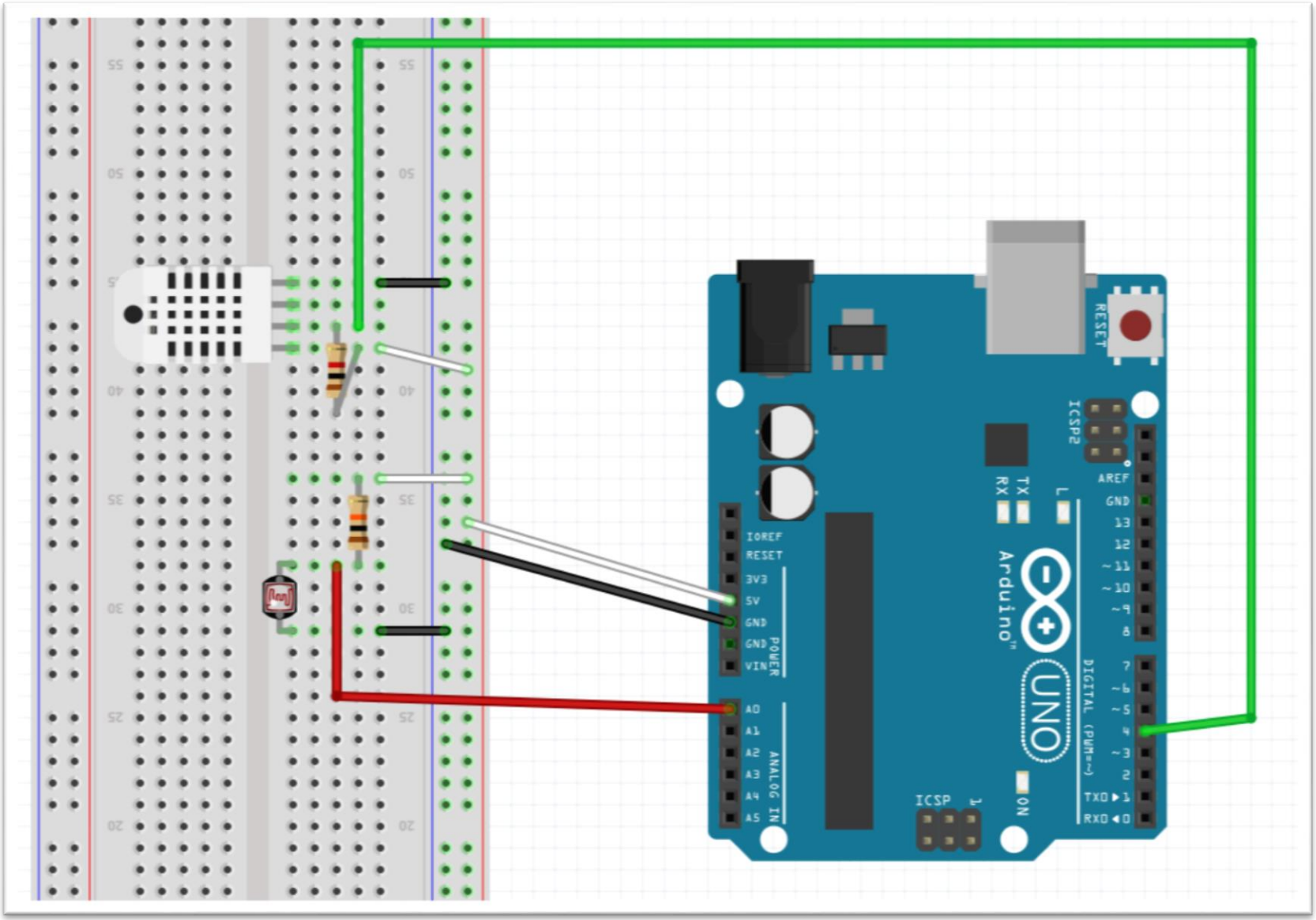
- 3 ~ 5V power and I/O
- 2.5mA max current
- [0-100%] humidity readings with 2-5% accuracy
- [-40 to 80°C] temperature readings ±0.5°C accuracy
- 0.5 Hz sampling rate

https://learn.adafruit.com/dht/overview

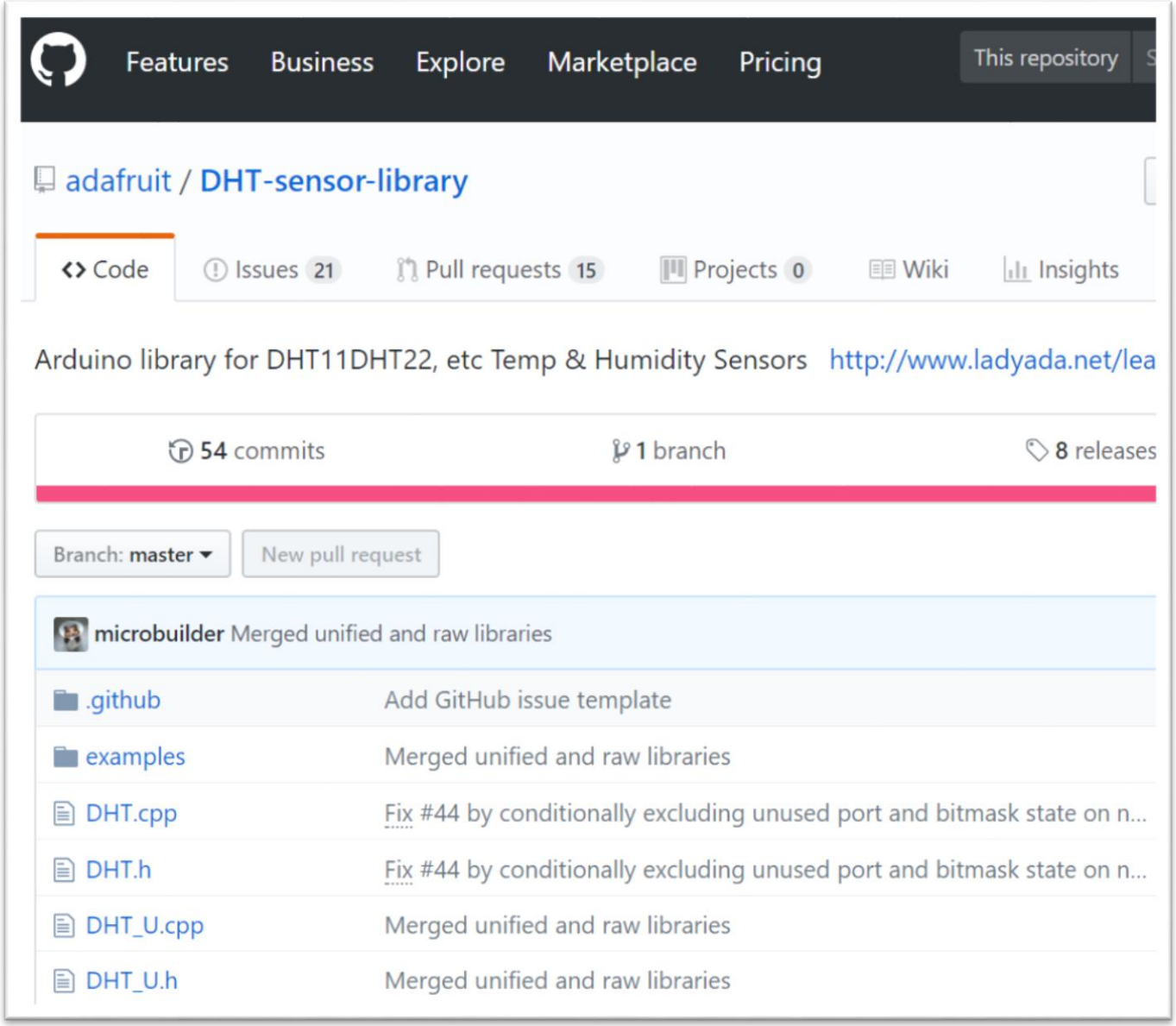
A5.7 DHT22 + CdS streaming project



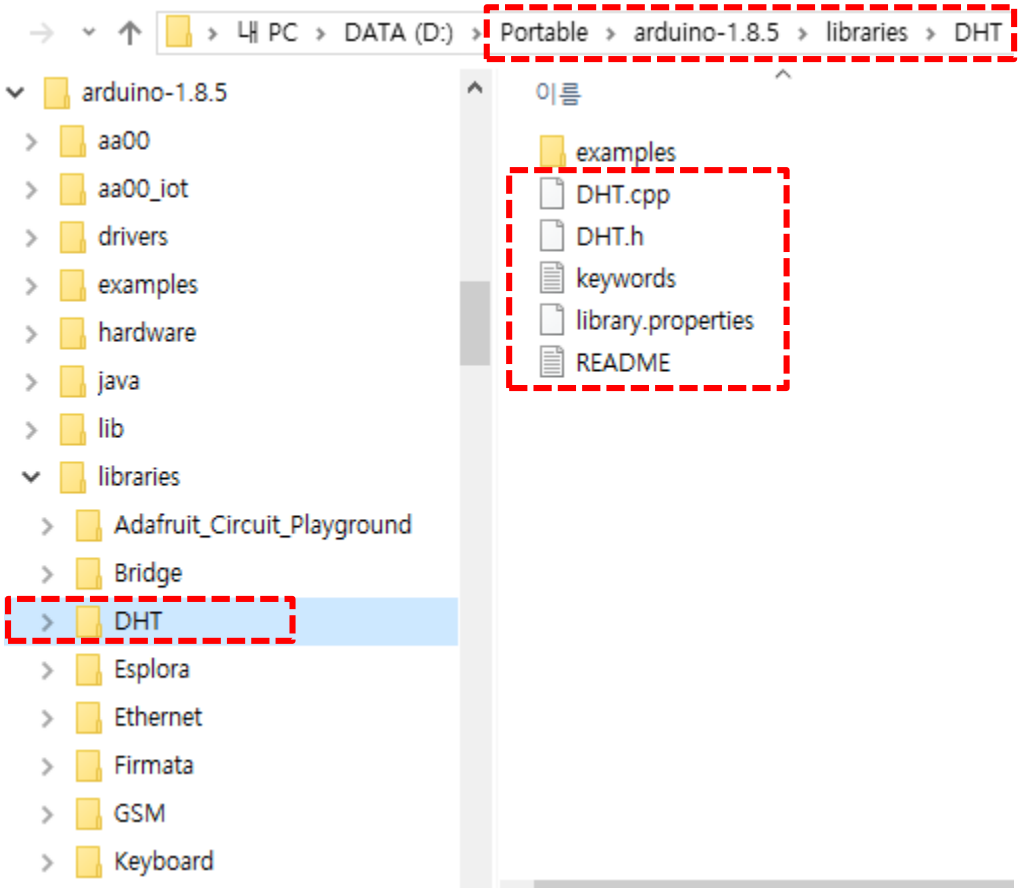
A5.7.1 DHT22 + CdS circuit



A5.7.2 DHT22 + CdS : DHT library



A5.7.3 DHT22 + CdS : DHT library



A5.7.4 DHT22 + CdS : circuit

[1] Arduino code: HSnn_CdS_DHT22.ino

HSnn_CdS_DHT22

```
// DHT22
#include "DHT.h"
#define DHTPIN 4
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);
// CdS (LDR)
#define CDS_INPUT 0

void setup() {
  dht.begin();
  Serial.begin(9600);
}
```

```
//Voltage to Lux
double luminosity (int RawADC0){
  double Vout=RawADC0*5.0/1023.0;  // 5/1023
  double lux=(2500/Vout-500)/10;
  // lux = 500 / Rldr,
  // Vout = Ildr*Rldr = (5/(10 + Rldr))*Rldr
  return lux;
}
```

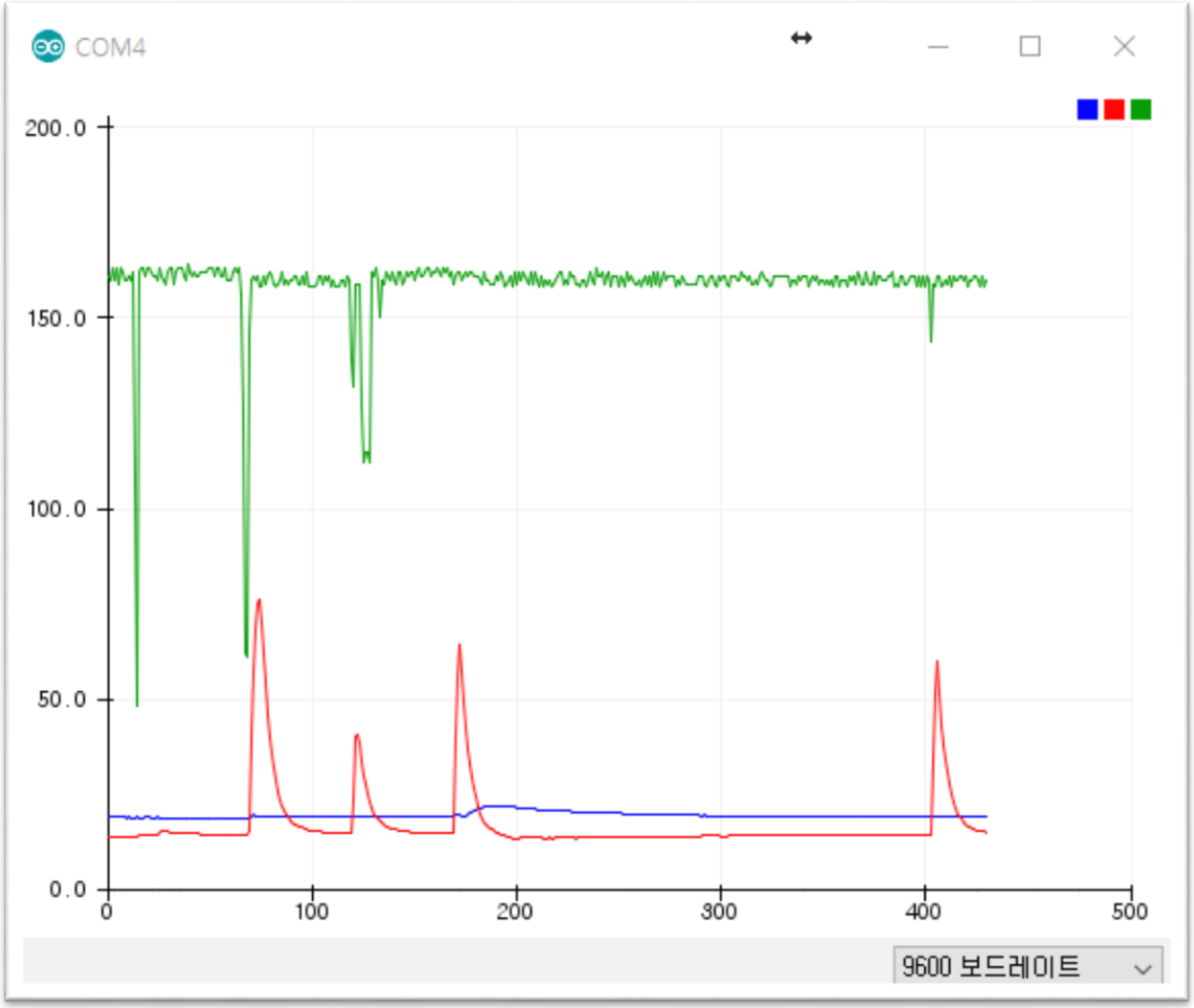
```
void loop() {
  int cds_value, lux;
  float temp, humi;
  // Lux from CdS (LDR)
  cds_value = analogRead(CDS_INPUT);
  lux = int(luminosity(cds_value));
  // Reading temperature or humidity takes a given interval!
  // Sensor readings may also be up to 2 seconds 'old'
  humi = dht.readHumidity();
  // Read temperature as Celsius (the default)
  temp = dht.readTemperature();

  // Check if any reads failed and exit early (to try again).
  if (isnan(humi) || isnan(temp) || isnan(lux)) {
    Serial.println("Failed to read from DHT sensor or CdS!");
    return;
  }
  else {
    Serial.print("HS00,");
    Serial.print(temp,1);  // temperature, float
    Serial.print(",");
    Serial.print(humi,1);  // humidity, float
    Serial.print(",");
    Serial.println(lux);   // luminosity, int
  }
  delay(2000);  // 2000 msec, 0.5 Hz
}
```

A5.7.5 DHT22 + CdS : Serial monitor

[1] Arduino code: HSnn_CdS_DHT22.ino

COM4

```
AA00,21.5,12.1,156
AA00,21.5,12.2,158
AA00,21.5,12.3,158
AA00,21.4,12.3,156
AA00,21.4,12.3,157
AA00,21.3,12.4,157
AA00,21.3,12.5,113
AA00,21.3,12.6,41
AA00,21.2,12.7,157
AA00,21.2,12.7,158
AA00,21.2,12.7,157
AA00,21.1,12.7,157
AA00,21.0,12.6,158
AA00,21.0,12.6,158
AA00,21.0,12.6,157
```



A5.7.6 DHT22 + CdS + Node.js

[2.1] NodeJS project: "cds-dht22-node project“ → package.json

package.json

```
{
  "name": "cds_dht22",
  "version": "1.0.0",
  "description": "cds-dht22-node project",
  "main": "cds_dht22_node.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "hs00",
  "license": "MIT",
  "dependencies": {
    "serialport": "^4.0.7",
    "socket.io": "^1.7.3"
  }
}
```

A5.7.7 DHT22 + CdS + Node.js

[2.2] NodeJS code: cds_dht22_node.js (← cds_tmp36_node.js)

cds_dht22_node.js

```
1  // cds_dht22_node.js
2
3  var serialport = require('serialport');
4  var portName = 'COM4';  // check your COM port!!
5  var port     =   process.env.PORT || 3000;
6
7  var io = require('socket.io').listen(port);
8
9  // serial port object
10 var sp = new serialport(portName,{
11     baudRate: 9600,    // 9600  38400
12     dataBits: 8,
13     parity: 'none',
14     stopBits: 1,
15     flowControl: false,
16     parser: serialport.parsers.readline('\r\n')
17 });
```

A5.7.8 DHT22 + CdS + Node.js

[2.3] NodeJS code: cds_dht22_node.js (Complete your parser code)

```
var readData = '';  // this stores the buffer
var temp ='';
var humi ='';
var lux ='';
var mdata =[]; // this array stores date and data from multiple sensors
var firstcommaidx = 0;

sp.on('data', function (data) { // call back when data is received
    readData = data.toString(); // append data to buffer
    firstcommaidx = readData.indexOf(','); // string.indexOf(searchvalue,start)

    // parsing data into signals

    Complete your parser code!!

        //console.log(firstcolonidx + "," + readData.indexOf(':', firstcolonidx+1))
        readData = '';

        dStr = getDateString();
        mdata[0]=dStr;  // Date
        mdata[1]=temp;  // temperature data
        mdata[2]=humi;  // humidity data
        mdata[3]=lux;   // luminosity data
        console.log(mdata);
        io.sockets.emit('message', mdata);  // send data to all clients
    } else {  // error
        console.log(readData);
    }
});
```

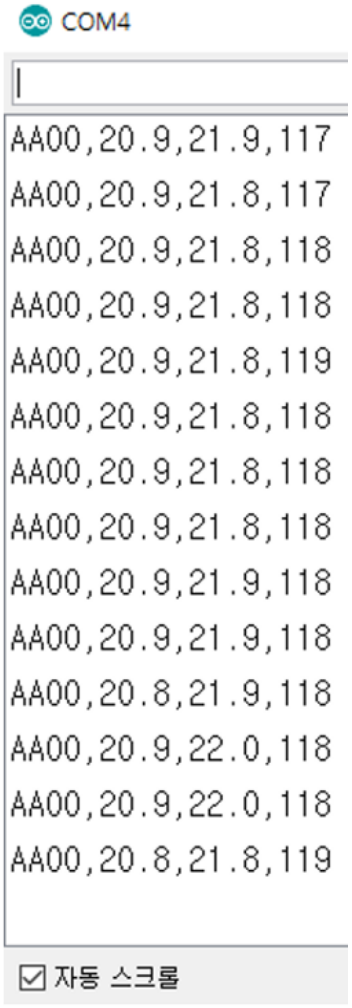
A5.7.9 DHT22 + CdS + Node.js

[2.3] NodeJS code: cds_dht22_node.js (Complete your parser code)

```
var readData = '';  // this stores the buffer
var temp ='';
var humi ='';
var lux ='';
var mdata =[]; // this array stores date and data from multiple sensors
var firstcommaidx = 0;

sp.on('data', function (data) { // call back when data is received
    readData = data.toString(); // append data to buffer
    firstcommaidx = readData.indexOf(','); // string.indexOf(searchvalue,start)

    // parsing data into signals
    if (readData.lastIndexOf(',') > firstcommaidx && firstcommaidx > 0) {
        temp = readData.substring(firstcommaidx + 1, readData.indexOf(',',firstcommaidx+1));
        humi = readData.substring(readData.indexOf(',',firstcommaidx+1) + 1, readData.lastIndexOf(','));
        lux = readData.substring(readData.lastIndexOf(',')+1);
        //console.log(firstcolonidx + "," + readData.indexOf(':', firstcolonidx+1))
        readData = '';

        dStr = getDateString();
        mdata[0]=dStr;  // Date
        mdata[1]=temp;  // temperature data
        mdata[2]=humi;  // humidity data
        mdata[3]=lux;   // luminosity data
        console.log(mdata);
        io.sockets.emit('message', mdata);  // send data to all clients
    } else {  // error
        console.log(readData);
    }
});
```

A5.7.10 DHT22 + CdS + Node.js

[3] Result: Parsed streaming data from dht22 & CdS (Run in Node cmd)



```
NodeJS - node  cds_dht22_node

D:\Portable\NodeJSPortable\Data\aa00\iot\cds_dht22>node cds_dht22_node
[ '2018-01-22 17:22:47.683', '20.7', '23.2', '118' ]
[ '2018-01-22 17:22:49.954', '20.6', '23.2', '116' ]
[ '2018-01-22 17:22:52.227', '20.7', '23.2', '117' ]
[ '2018-01-22 17:22:54.486', '20.7', '23.2', '116' ]
[ '2018-01-22 17:22:56.757', '20.6', '23.2', '117' ]
[ '2018-01-22 17:22:59.031', '20.7', '23.3', '117' ]
[ '2018-01-22 17:23:01.306', '20.7', '23.3', '117' ]
[ '2018-01-22 17:23:03.577', '20.7', '23.3', '117' ]
[ '2018-01-22 17:23:05.851', '20.7', '23.3', '118' ]
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[ '2018-01-22 17:23:10.381', '20.6', '23.2', '113' ]
[ '2018-01-22 17:23:12.655', '20.7', '23.5', '114' ]
[ '2018-01-22 17:23:14.928', '20.7', '23.7', '38' ]
[ '2018-01-22 17:23:17.201', '20.6', '23.9', '117' ]
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[ '2018-01-22 17:23:21.732', '20.7', '25.9', '73' ]
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[ '2018-01-22 17:23:28.553', '21.0', '68.1', '117' ]
[ '2018-01-22 17:23:30.825', '20.9', '76.1', '117' ]
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[ '2018-01-22 17:23:35.355', '21.0', '65.7', '117' ]
[ '2018-01-22 17:23:37.628', '21.0', '57.7', '116' ]
[ '2018-01-22 17:23:39.901', '21.0', '51.2', '116' ]
[ '2018-01-22 17:23:42.175', '21.0', '45.9', '117' ]
[ '2018-01-22 17:23:44.448', '21.0', '41.6', '117' ]
[ '2018-01-22 17:23:46.706', '21.0', '38.3', '116' ]
[ '2018-01-22 17:23:48.979', '21.0', '35.8', '118' ]
```
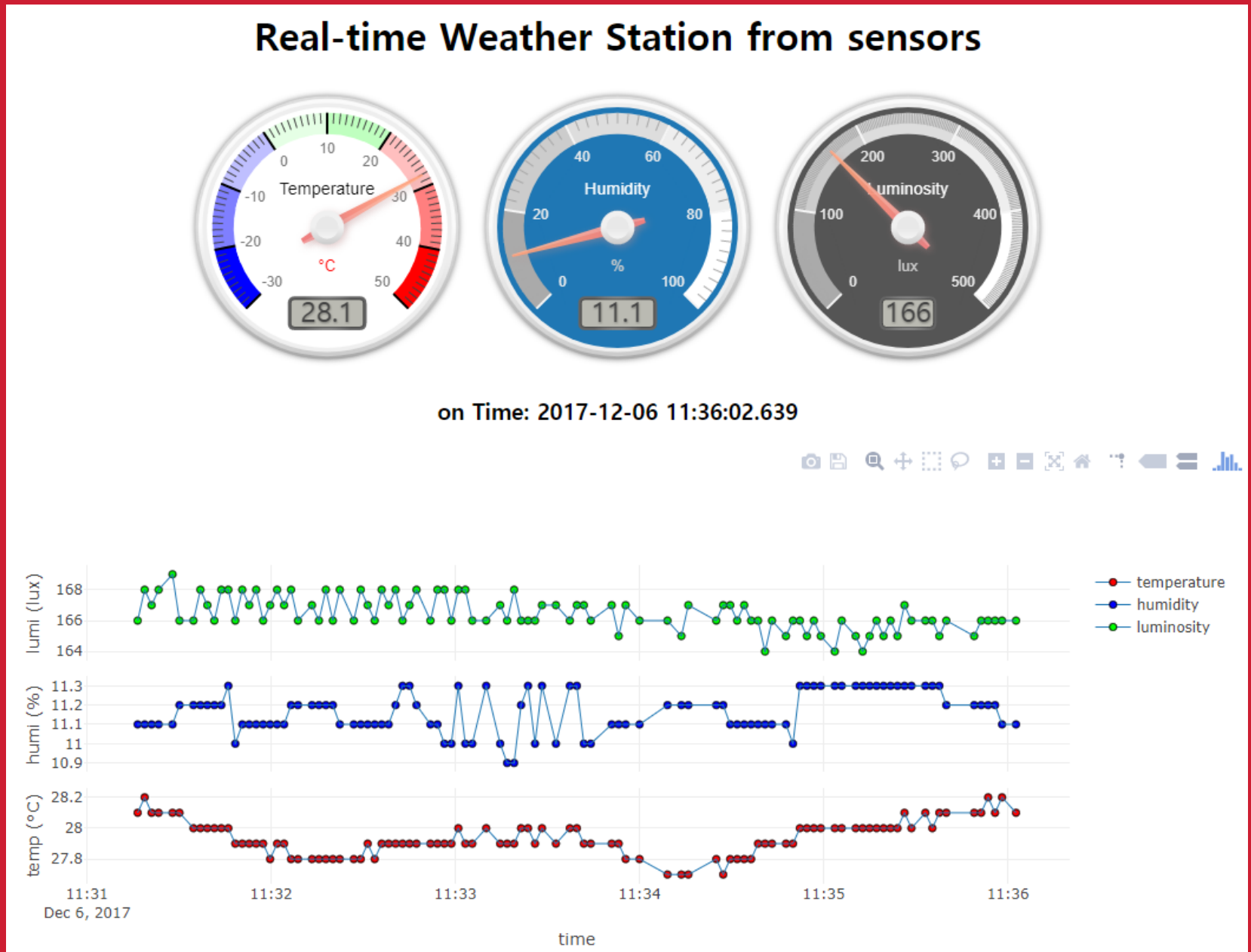

Save as
HSnn_cds_dht22_data.png

WEB client： client_cds_dht22.html



A5.8.1 DHT22 + CdS + Node.js

[4.1] WEB client: client_cds_dht22.html

client_CdS_DHT22.html

```
<!DOCTYPE html>
<head>
  <meta charset="utf-8">
  <title>plotly.js Project: Real time signals from multiple sensors</title>
  <script src="https://cdn.plot.ly/plotly-latest.min.js"></script>
  <script type="text/javascript" src="https://cdnjs.cloudflare.com/ajax/libs
  socket.io.js"></script>

  <script src="gauge.min.js"></script>

  <style>body{padding:0;margin:30;background:#fff}</style>
</head>

<body>  <!-- style="width:100%;height:100%"> -->
    <!-- Plotly chart will be drawn inside this DIV -->
    <h1 align="center">Real-time Weather Station from sensors</h1>
    <!-- 1st gauge -->
    <div align="center">
        <canvas id="gauge1"> </canvas>
        <!-- 2nd gauge -->
        <canvas id="gauge2"> </canvas>
        <!-- 3rd gauge -->
        <canvas id="gauge3"> </canvas>
    </div>
    <!-- <div id="console"> </div> -->
    <h3 align="center"> on Time: <span id="time"> </span> </h3>
    <div id="myDiv"></div>
    <hr>
```

A5.8.2 DHT22 + CdS + Node.js

[4.2] WEB client: client_cds_dht22.html

```
29      <script>
30        /* JAVASCRIPT CODE GOES HERE */
31        var streamPlot = document.getElementById('myDiv');
32        var ctime = document.getElementById('time');
33        var tArray = [], // time of data arrival
34          y1Track = [], //value of sensor 1 : temperature
35          y2Track = [], //value of sensor 2 : humidity
36          y3Track = [], //value of sensor 3 : Luminosity
37          numPts = 50, // number of data points in x-axis
38          dtda = [],  // 1 x 4 array : [date, data1, data2, data3] from sensors
39          preX = -1,
40          preY = -1,
41          preZ = -1,
42          initFlag = true;
```

Check points: tArray

xTrack → y1Track, yTrack → y2Track

& add y3Track & preZ

A5.8.3 DHT22 + CdS + Node.js

[4.3] WEB client: client_cds_dht22.html

```
var socket = io.connect('http://localhost:3000'); // port = 3000
socket.on('connect', function () {
    socket.on('message', function (msg) {
        // initial plot
        if(msg[0]!='' && initFlag){
            dtda[0]=msg[0];
            dtda[1]=parseFloat(msg[1]);  // temperature
            dtda[2]=parseFloat(msg[2]);  // Humidity
            dtda[3]=parseInt(msg[3]);    // Luminosity
            init();
            initFlag=false;
        }

        dtda[0]=msg[0];
        dtda[1] = parseFloat(msg[1]);
        dtda[2] = parseFloat(msg[2]);
        dtda[3] = parseInt(msg[3]);
```

Update

to include three signals:

temp, humi, lux

A5.8.4 DHT22 + CdS + Node.js

[4.4] WEB client: client_cds_dht22.html

```
// Only when any of data 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_temp.setValue(dtda[1])  // temp gauge
    gauge_humi.setValue(dtda[2]); // humi gauge
    gauge_lux.setValue(dtda[3]);  // lux gauge
    //nextPt();
    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);
}
```

Update

to include three signals:

temp, humi, lux

A5.8.5 DHT22 + CdS + Node.js

[4.5] WEB client: client_dht22_ldr.html → init()

```
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);
}
```

Update

to include three signals:

temp, humi, lux

A5.8.6 DHT22 + CdS + Node.js

[4.6] WEB client: client_cds_dht22.html - data

```
// data
var data = [{
    x : tArray,
    y : y1Track,
    name : 'temperature',
    mode: "markers+lines",  // "
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(255, 0, 0)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
},
```

```
{
    x : tArray,
    y : y2Track,
    name : 'humidity',
    xaxis: 'x2',
    yaxis : 'y2',
    mode: "markers+lines",  // "
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(0, 0, 255)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
},
```

```
{
    x : tArray,
    y : y3Track,
    name : 'luminosity',
    xaxis: 'x3',
    yaxis : 'y3',
    mode: "markers+lines",  // "
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(0, 255, 0)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
}];
```

Update data

to include three signals:

temp, humi, lux

A5.8.7 DHT22 + CdS + Node.js

[4.6] WEB client: client_cds_dht22.html - data

```
// data
var data = [{
    x : tArray,
    y : y1Track,
    name : 'temperature',
    mode: "markers+lines",  // "
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(255, 0, 0)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
},
```

```
{
    x : tArray,
    y : y2Track,
    name : 'humidity',
    xaxis: 'x2',
    yaxis : 'y2',
    mode: "markers+lines",  // "
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(0, 0, 255)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
},
```

```
{
    x : tArray,
    y : y3Track,
    name : 'luminosity',
    xaxis: 'x3',
    yaxis : 'y3',
    mode: "markers+lines",  // "
    line: {
        color: "#1f77b4",
        width: 1
    },
    marker: {
        color: "rgb(0, 255, 0)",
        size: 6,
        line: {
          color: "black",
          width: 0.5
        }
    }
}];
```

Update data

to include three signals:

temp, humi, lux

A5.8.7 DHT22 + CdS + Node.js

[4.7] WEB client: client_cds_dht22.html - layout

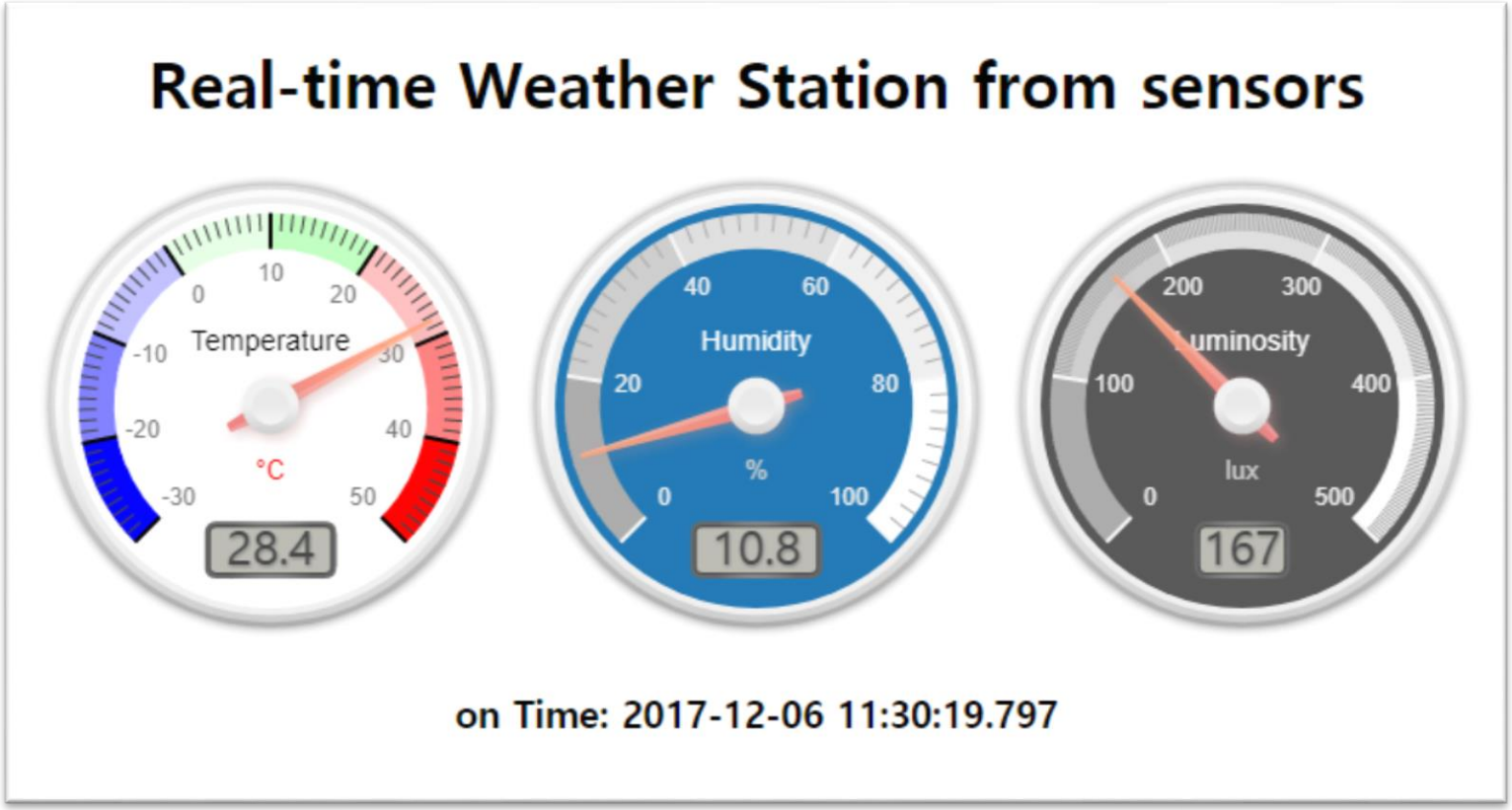
```
var layout = {
    xaxis : {
        title : 'time',
        domain : [0, 1]
    },
    yaxis : {
        title : 'temp (°C)',
        domain : [0, 0.3],
        range : [-30, 50]
    },
    xaxis2 : {
        title : '',
        domain : [0, 1],
        position : 0.35
    },
    yaxis2 : {
        title : 'humi (%)',
        domain : [0.35, 0.65],
        range : [0, 100]
    },
    xaxis3 : {
        title : '',
        domain : [0, 1],
        position : 0.7
    },
    yaxis3 : {
        title : 'lumi (lux)',
        domain : [0.7, 1],
        range : [0, 500]
    }
```

1. Update layout to include three signals: temp, humi, lux.
2. Check the domain & position.

Save the complete code as HSnn_cds_dht22.html

A5.8.8 DHT22 + CdS + Node.js

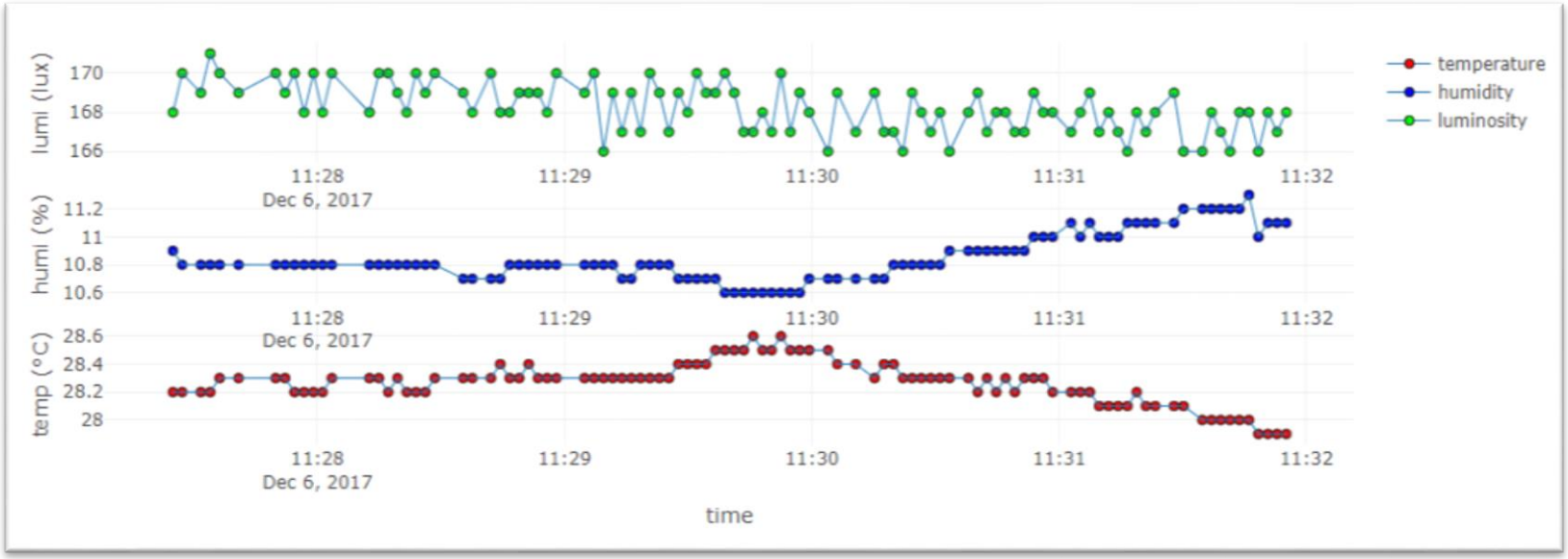
[4.8] WEB client: client_dht22_ldr.html – Design your gauges

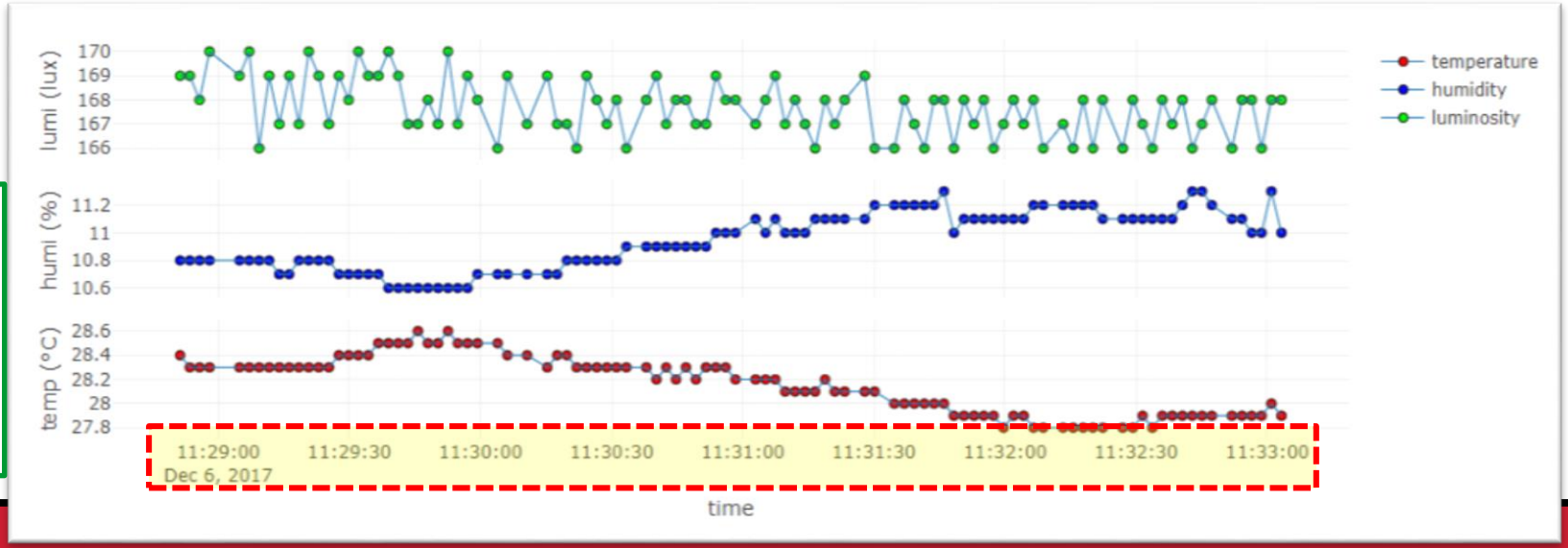


Save the complete code as HSnn_cds_dht22.html

A5.8.9 DHT22 + CdS + Node.js

[4.9] WEB client: Design layout (show date at lower axis)





[Hint]

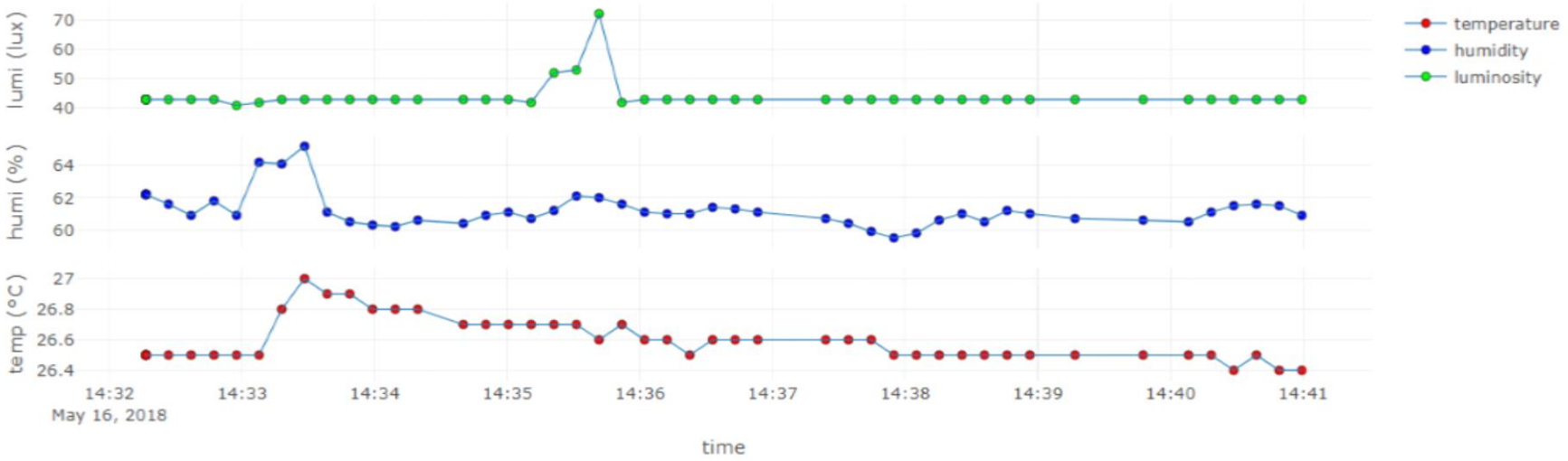
[Plot.ly]

Real-time Weather Station from sensors

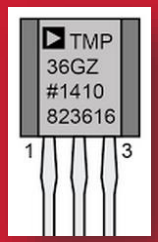
on Time: 2018-05-16 14:40:59.402

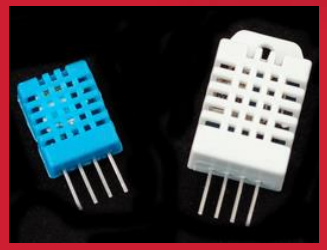
Save as

HSnn_cds_dht22.png



[Practice]





- [wk11]
  - RT Data Visualization with node.js
  - Multi-sensor circuits
  - Complete your real-time WEB clients
  - Upload file name : HSnn_Rpt09.zip

[wk11] Practice-09 HSnn_Rpt09.zip

- [Target of this week]
  - Complete your charts
  - Save your outcomes and compress them.

제출파일명 : **HSnn_Rpt09.zip**

- 압축할 파일들

① **HSnn_DS_cds_tmp36.png**

② **HSnn_cds_dht22_data.png**

③ **HSnn_cds_dht22.html**

④ **HSnn_cds_dht22.png**

Email : chaos21c@gmail.com

[제목 : **id,** 이름 (수정) **]**

Lecture materials

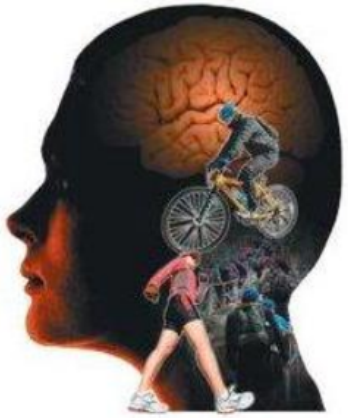
References & good sites

- ✓ http://www.nodejs.org/ko Node.js
- ✓ http://www.arduino.cc Arduino Homepage
- ✓ http://www.w3schools.com By w3schools
- ✓ http://www.github.com GitHub
- ✓ http://www.google.com Googling

Github.com/Redwoods

GitHub, Inc. [US] | https://github.com Redwoods (Redwoods Yi) · GitHub

Features Business Explore Marketplace Pricing Search GitHub Sign in or Sign up



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GimHae, Republic of Korea

Overview Repositories 5 Stars 2 Followers 0 Following 0

Pinned repositories

dht22-iot-project

Iot project to monitor data streaming from DHT22 wired at Arduino.

HTML

Lec

All lectures by Redwoods in Inje University

arduino-nodejs-plotly-streaming

This repo introduces a simple and efficient way to plot the streaming data from Arduino with Easy Pulse ppg sensor or DHT11 sensor.

HTML

hw-coding

Resource for lecture of Hardware Programming (2017, Inje university)

Arduino

Github.com/Redwoods/healthcare-signal-iot

Redwoods / Lec

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Add topics

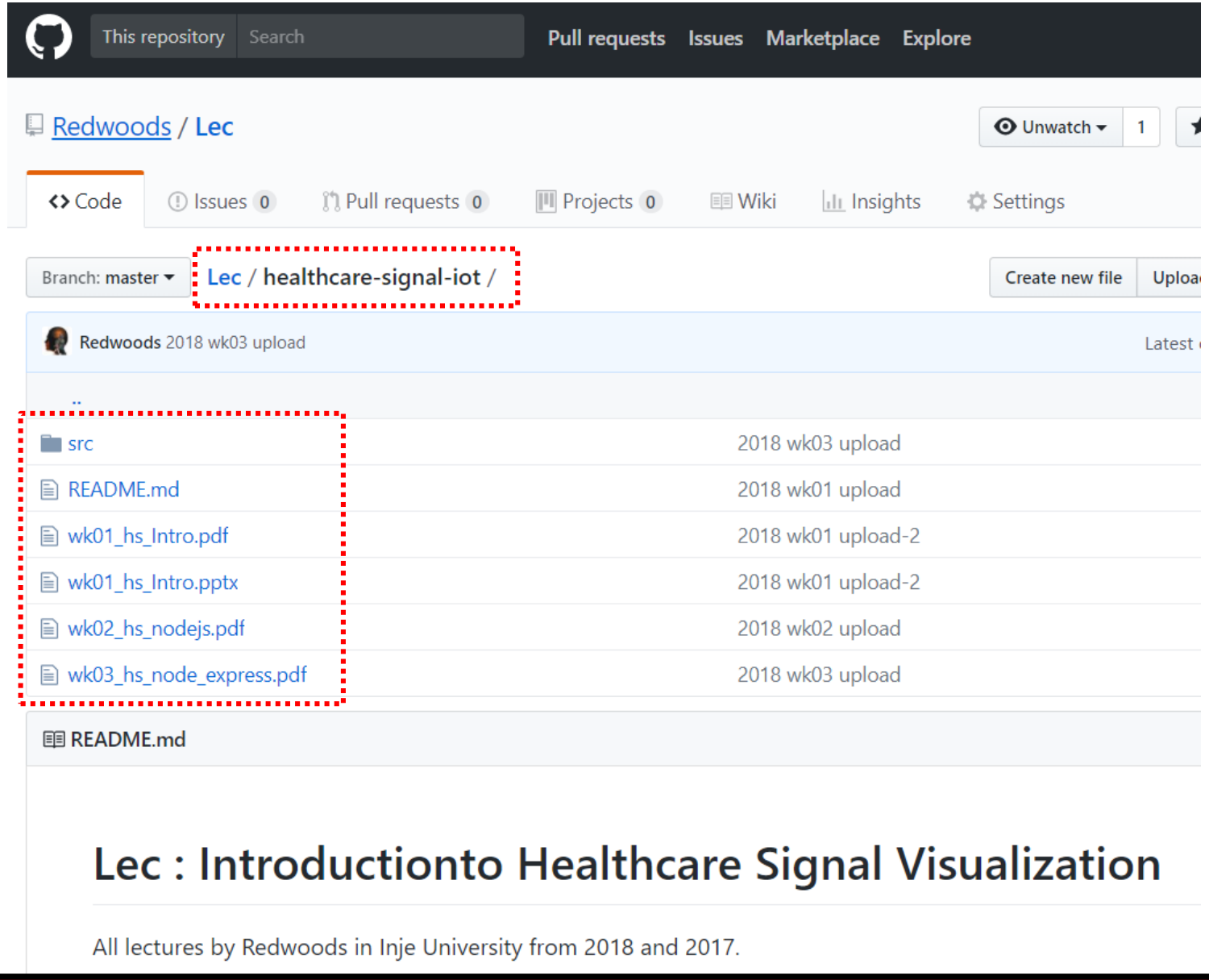
81 commits | 1 branch | 0 releases

Branch: master | New pull request | Create new file | Upload files

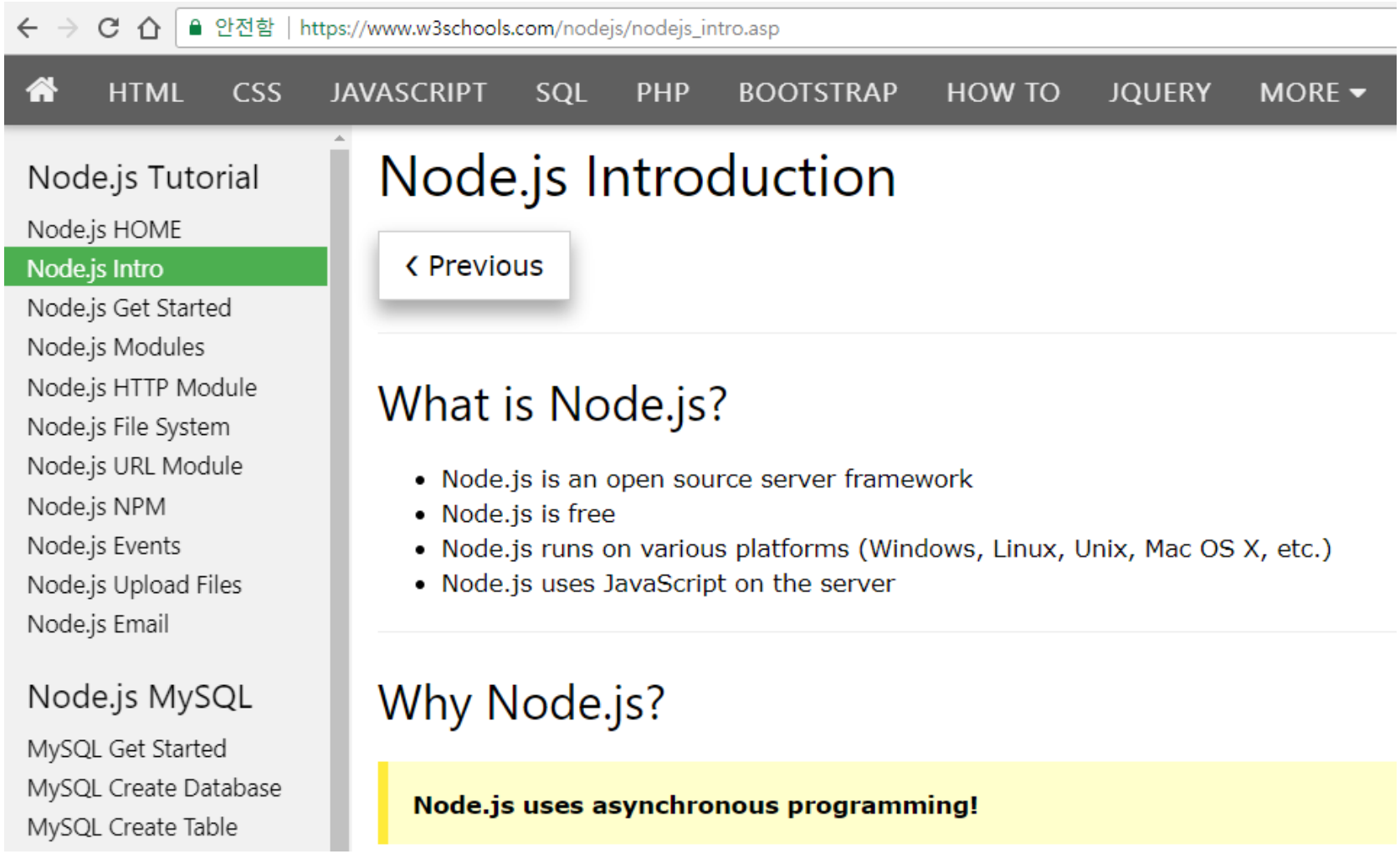
Redwoods 2018 wk01 upload

advanced-Arduino-iot	wk16 exam upload
ev3	wk16 final exam. answers
healthcare-signal-iot	2018 wk01 upload
html5-basic	2018 wk01 upload
html5-mobile-simulation	wk15 lec upload
Lec.Rproj	2018 wk01 upload
README.md	wk03 upload and fix links

Github.com/Redwoods/healthcare-signal-iot

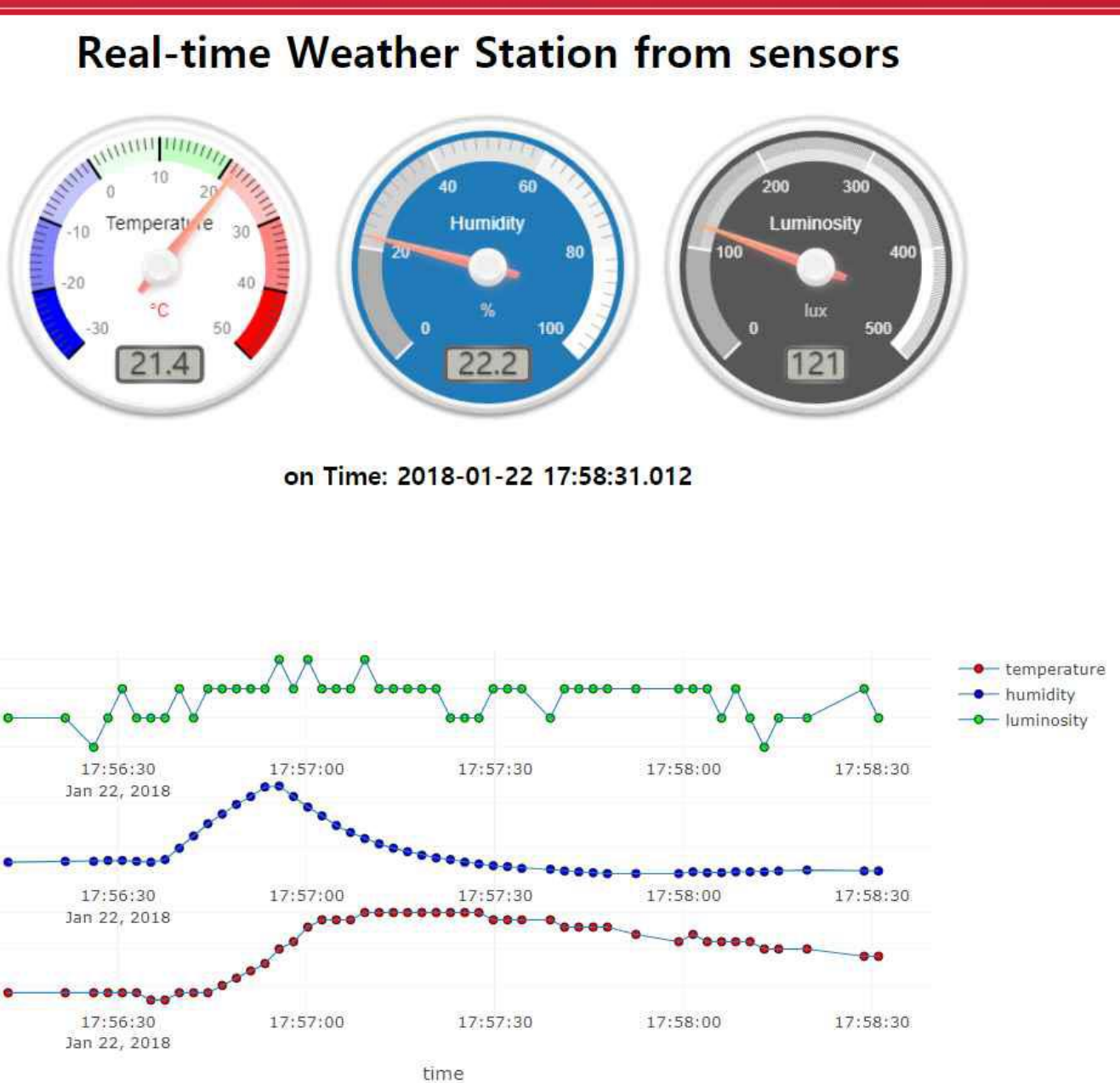


1.0 What is node.js?

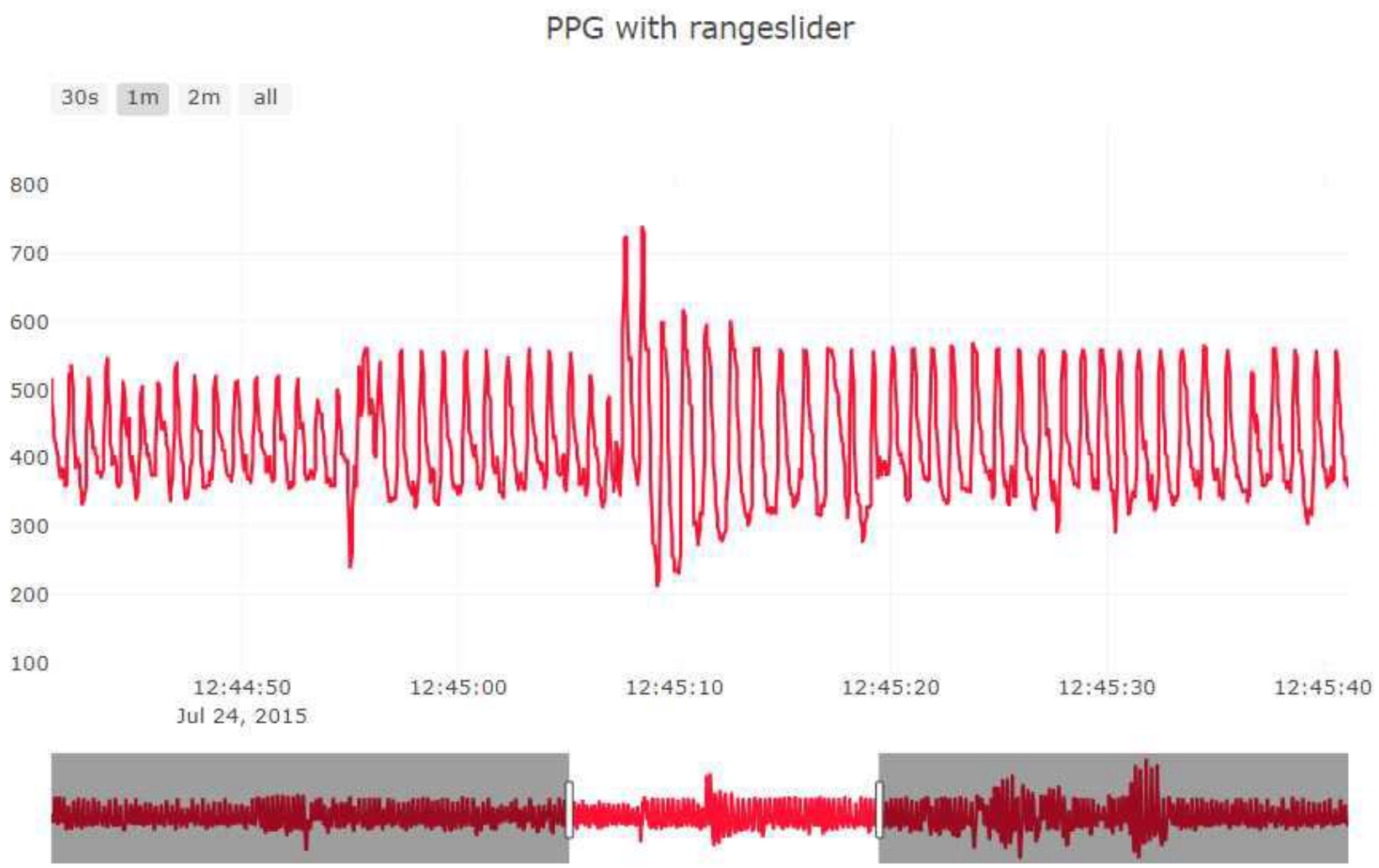


https://www.w3schools.com/nodejs/nodejs_intro.asp

Target of this class



Project of this class



주교재