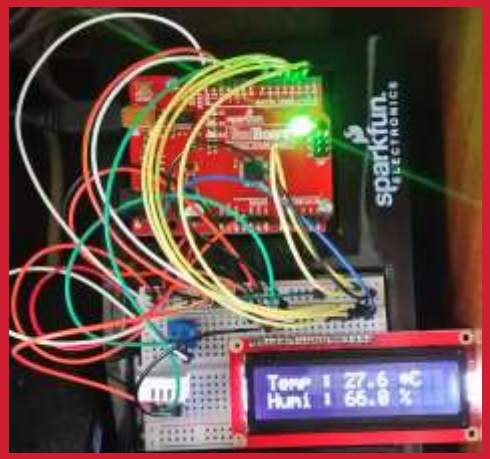
Arduino-IOT

[wk13]



Arduino + Node
Data storaging II

Visualization of Signals using Arduino, Node.js & Storing Signals in MongoDB & Mining Data using Python

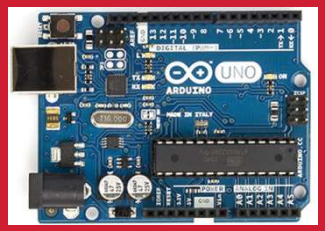
Comsi, INJE University

2nd semester, 2019

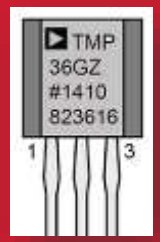
Email : chaos21c@gmail.com

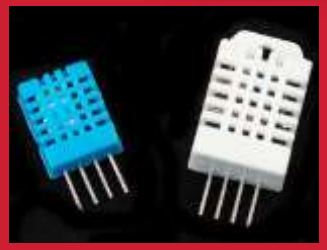
My ID

ID	성명
AA01	김관용
AA02	백동진
AA03	김도훈
AA04	김희찬
AA05	류재현
AA06	문민규
AA07	박진석
AA08	이승협
AA09	표혜성
AA10	김다영
AA11	성소진
AA12	김해인
AA13	신송주
AA14	윤지훈



[Review]





- [wk12]
  - RT Data storaging with MongoDB
  - Multi-sensor circuits (cds-dht22)
  - Complete your project
  - Upload folder: AAnn_Rpt10

wk12 : Practice : AAnn_Rpt10

- [Target of this week]
  - Complete your works
  - Save your outcomes and upload outputs in github

제출폴더명 : **AAnn_Rpt10**

- 압축할 파일들

① AAnn_mongo_schemas.png

② AAnn_mongo_update.png

③ AAnn_iot_mongodb.png

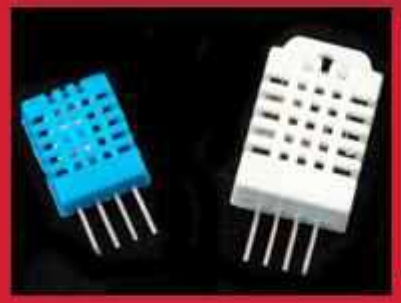
④ AAnn_iot_mongodb_web.png

⑤ All *.ino

⑥ All *.js

⑦ All *.html

Email : chaos21c@gmail.com



[Goal]

Arduino + Node.js

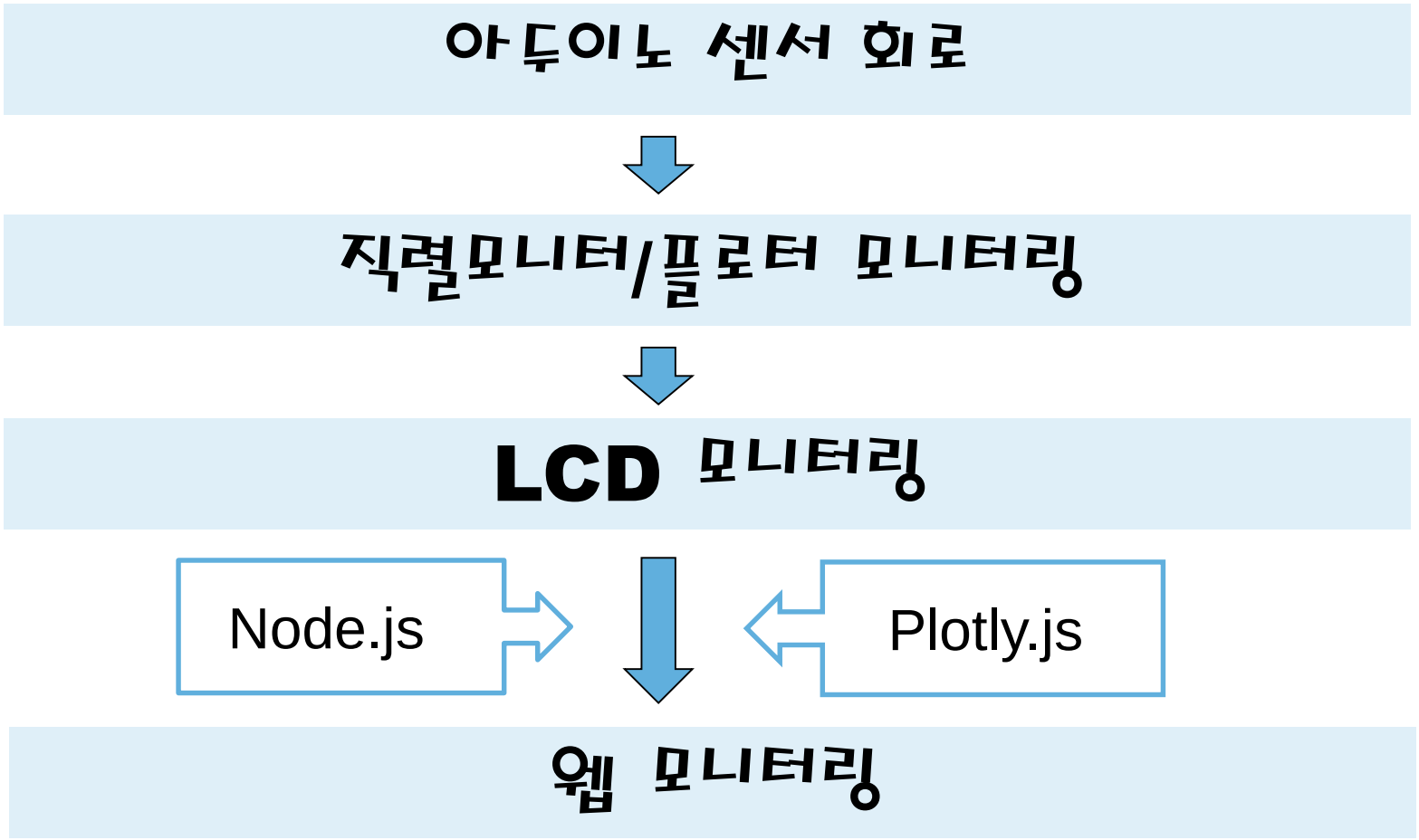
+ plotly.js

+ MongoDB

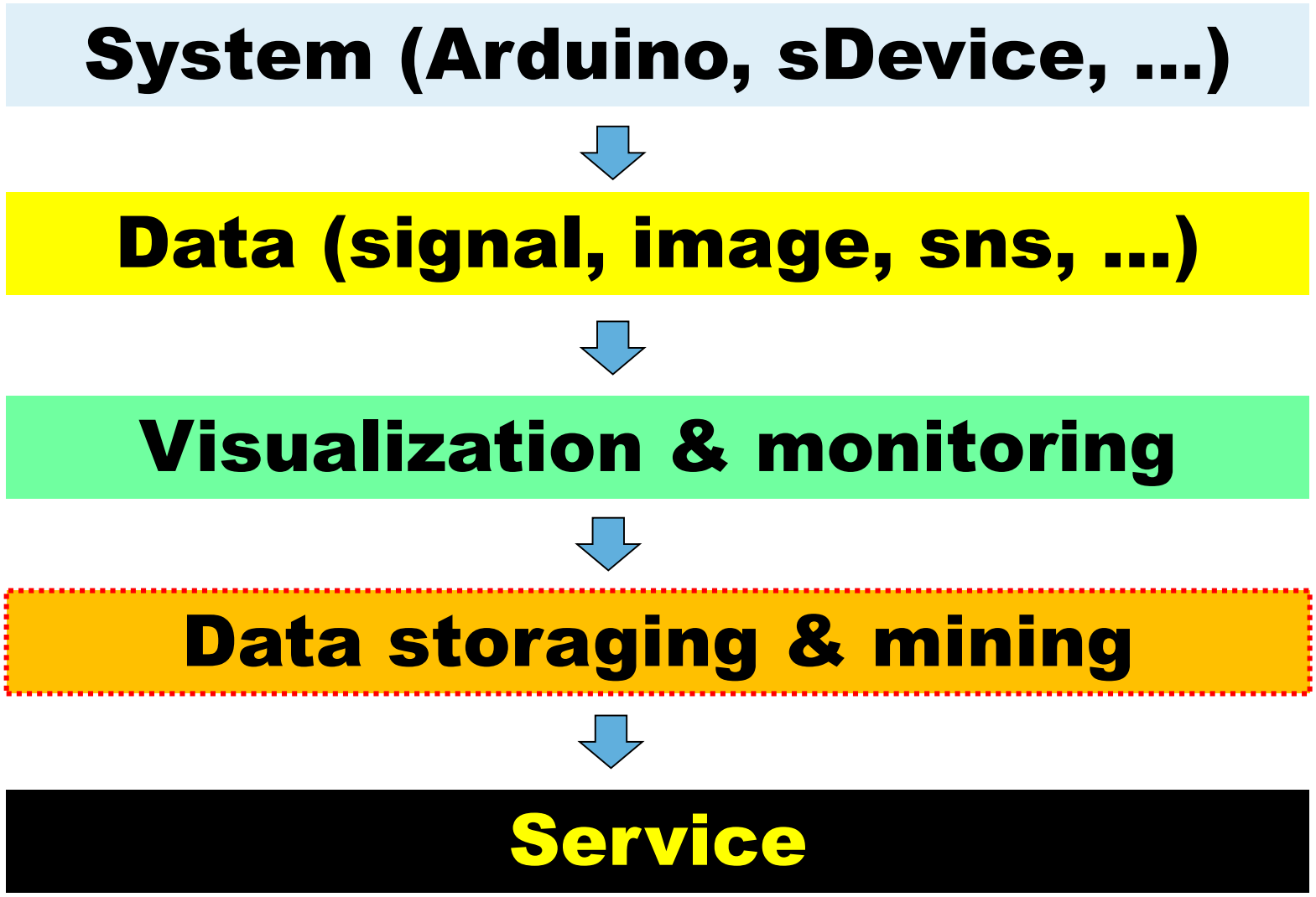
→ Data storaging

& visualization

A5.1 Introduction to data visualization

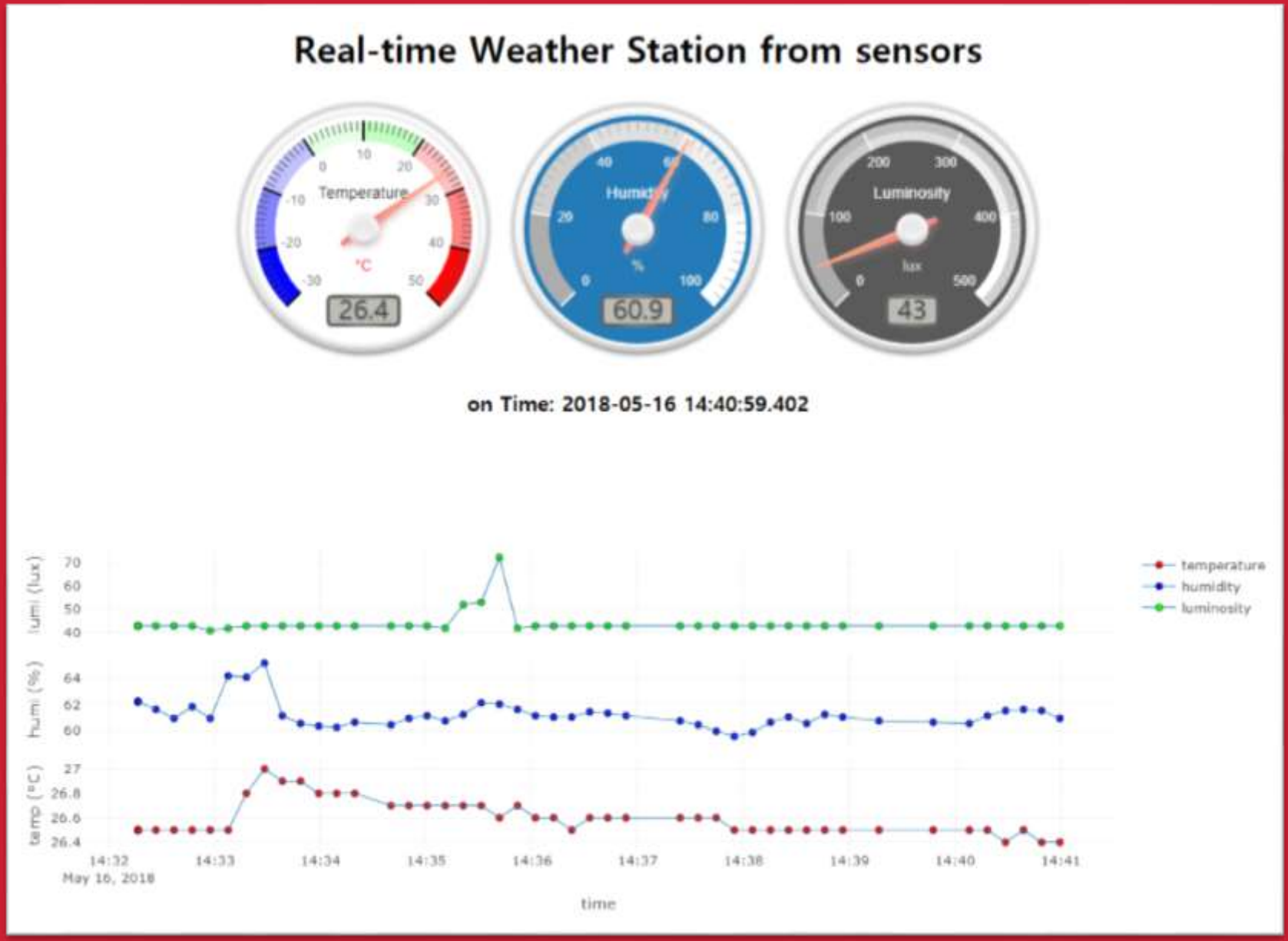


A5. Introduction to IoT service

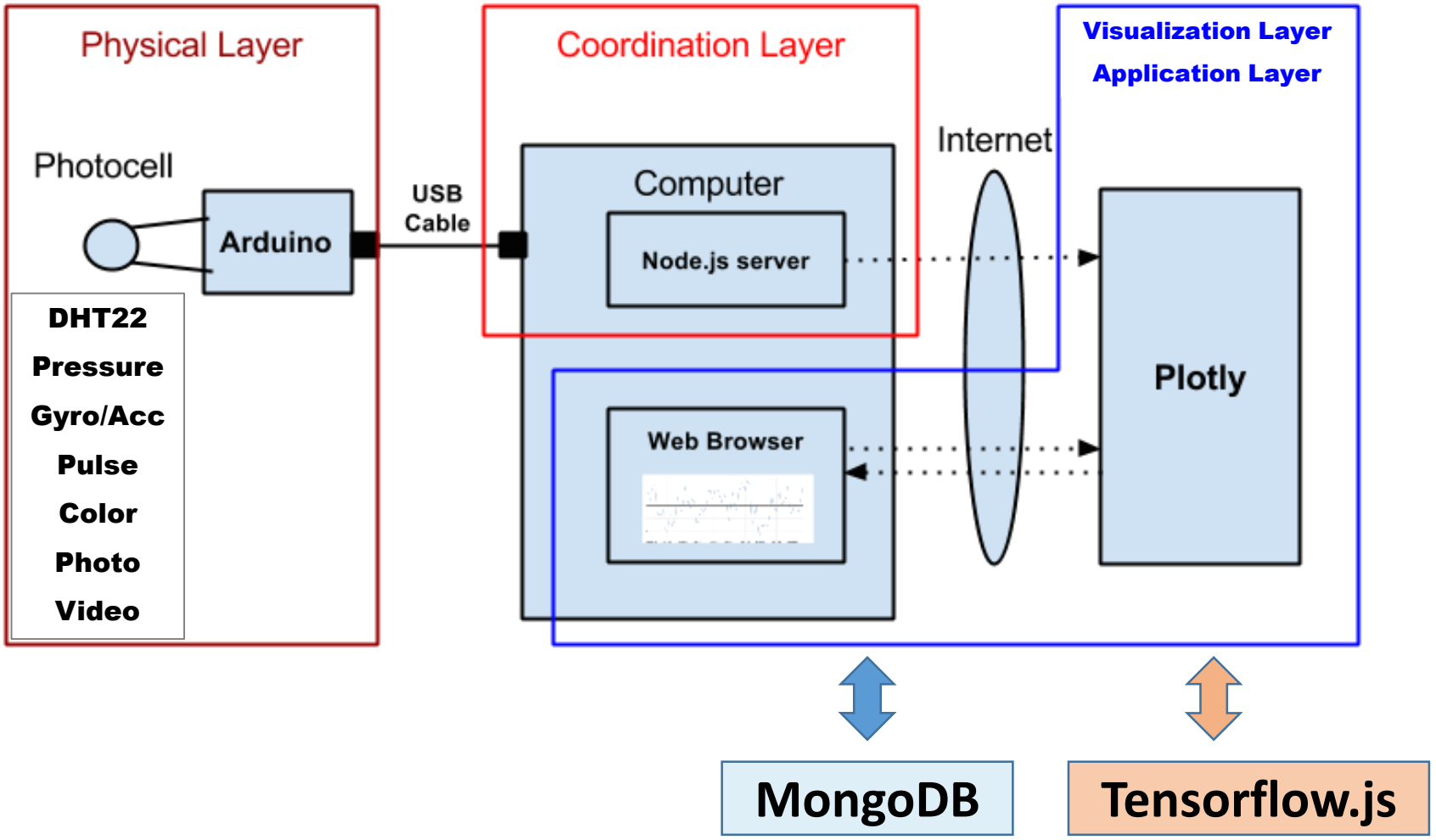


Arduino data on network socket

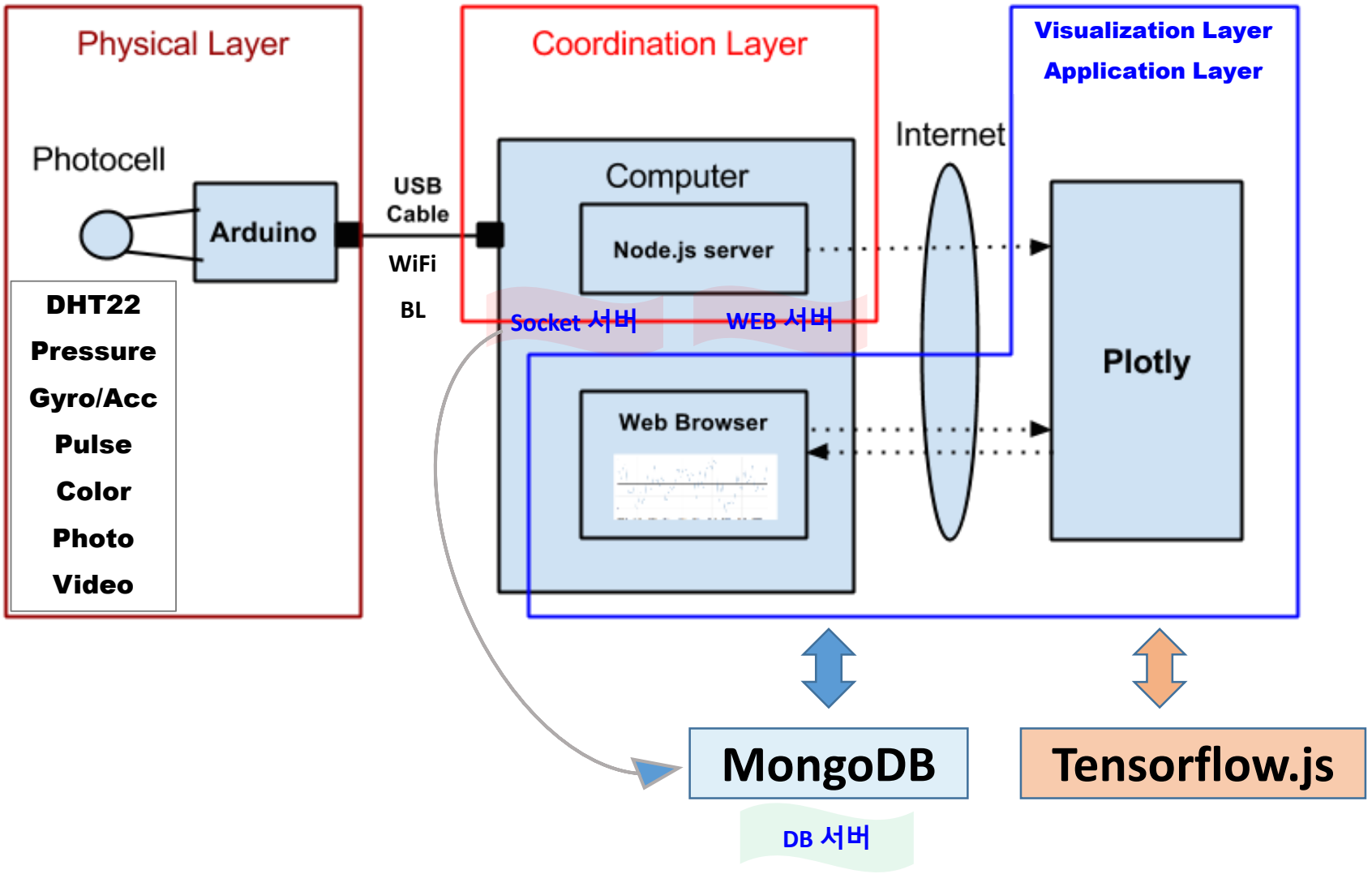
Arduino data + plotly



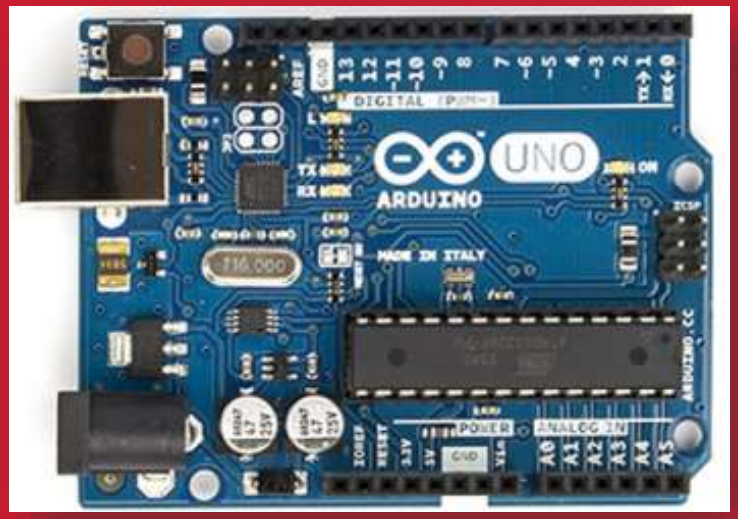
Layout [H S C]


Physical Layer
Photocell
Arduino
DHT22
Pressure
Gyro/Acc
Pulse
Color
Photo
Video
USB
Cable
Coordination Layer
Computer
Node.js server
Web Browser
Internet
Visualization Layer
Application Layer
Plotly
MongoDB
Tensorflow.js

Layout [H S C-IoT]

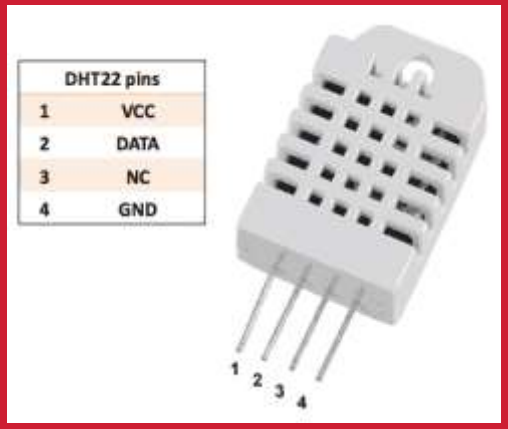


Arduino & Node.js & MongoDB

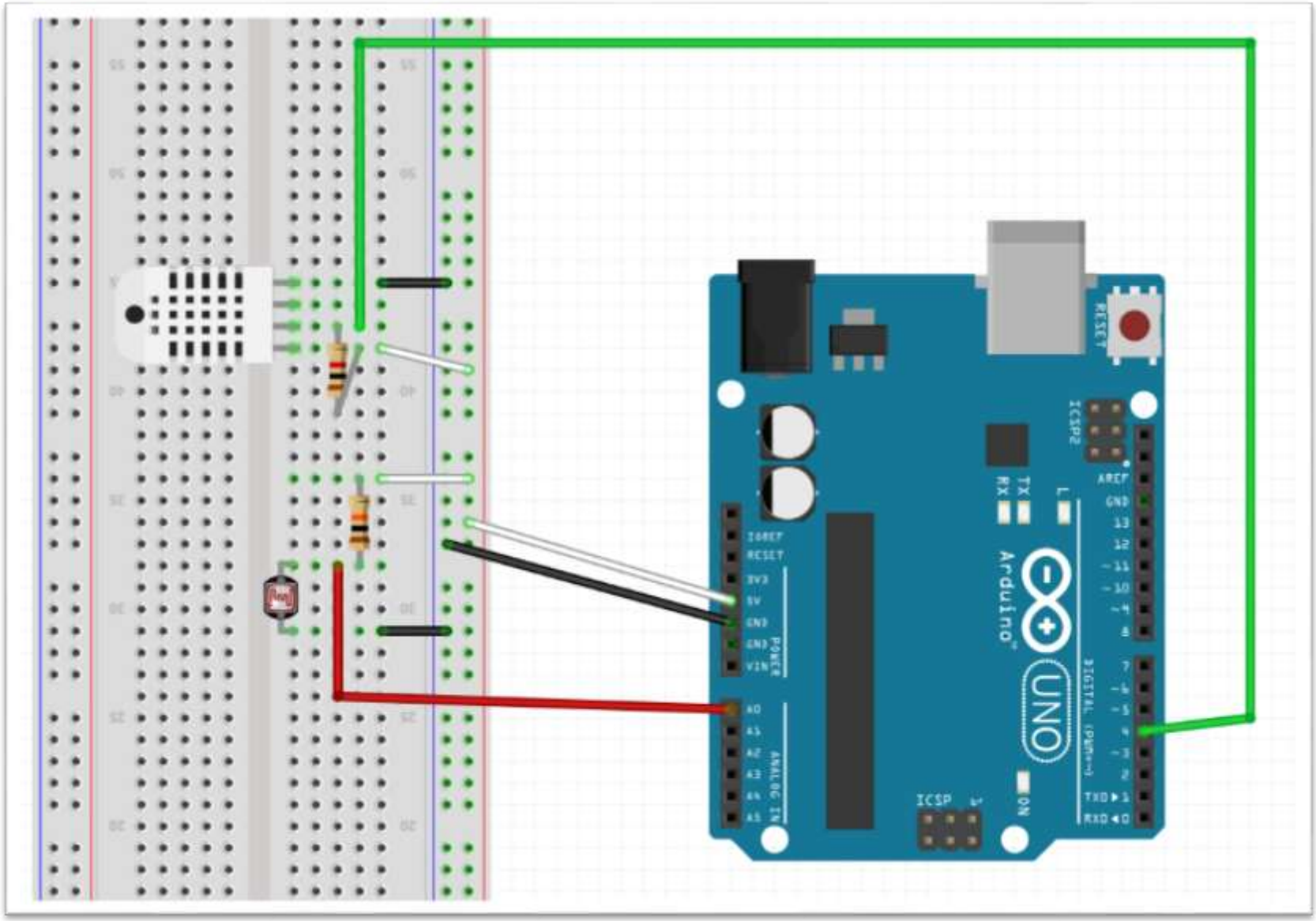


Multi-sensors

DHT22 + CdS

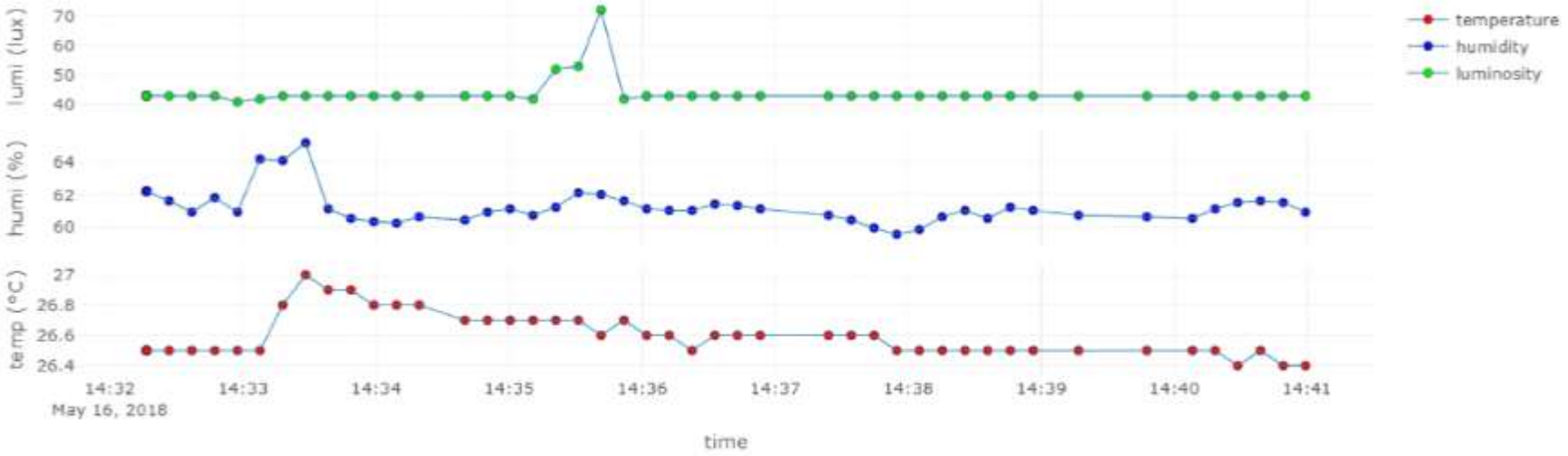


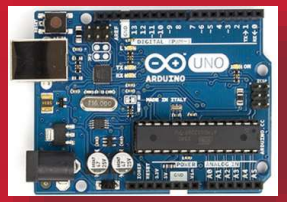
DHT22 + CdS : circuit



Real-time Weather Station from sensors

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





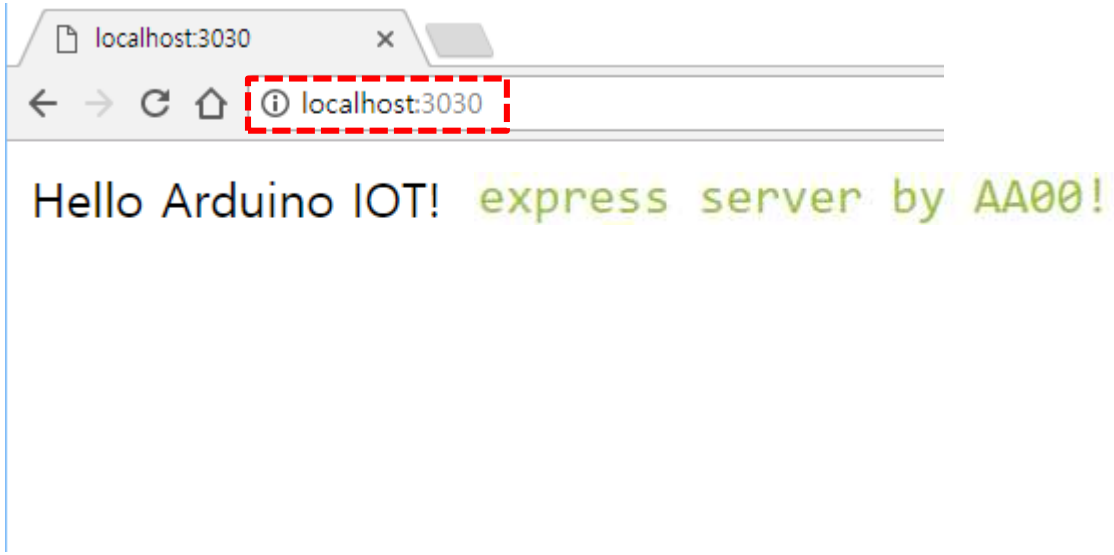
Arduino & Node.js & MongoDB & Express server

mongoDB

node JS express

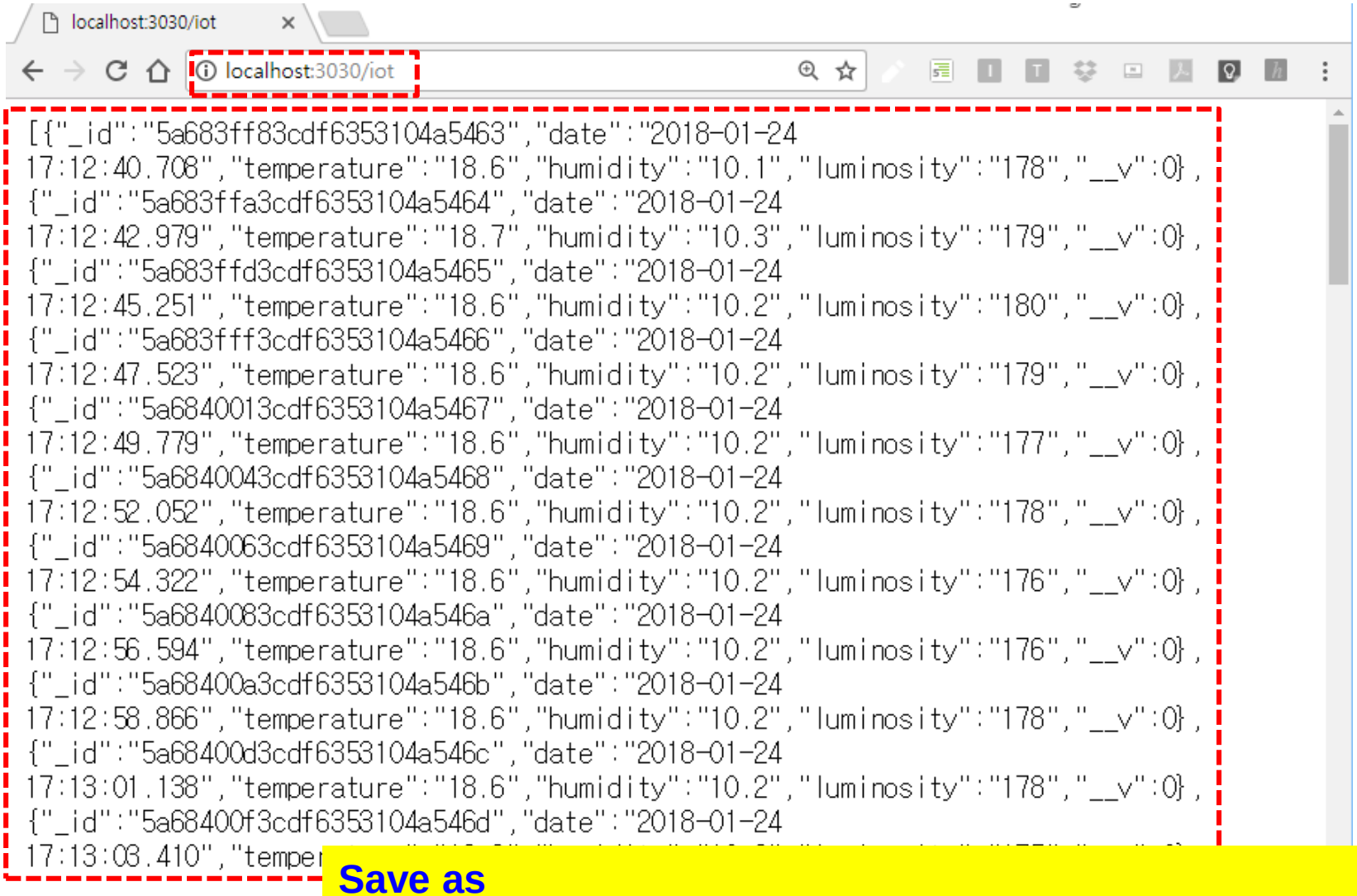
A5.9.6 DHT22 + CdS + Node.js + MongoDB

2.4 cds_dht22_express.js → routing1, http://localhost:3030/



A5.9.6 DHT22 + CdS + Node.js + MongoDB

2.5 cds_dht22_express.js → routing2 http://localhost:3030/iot



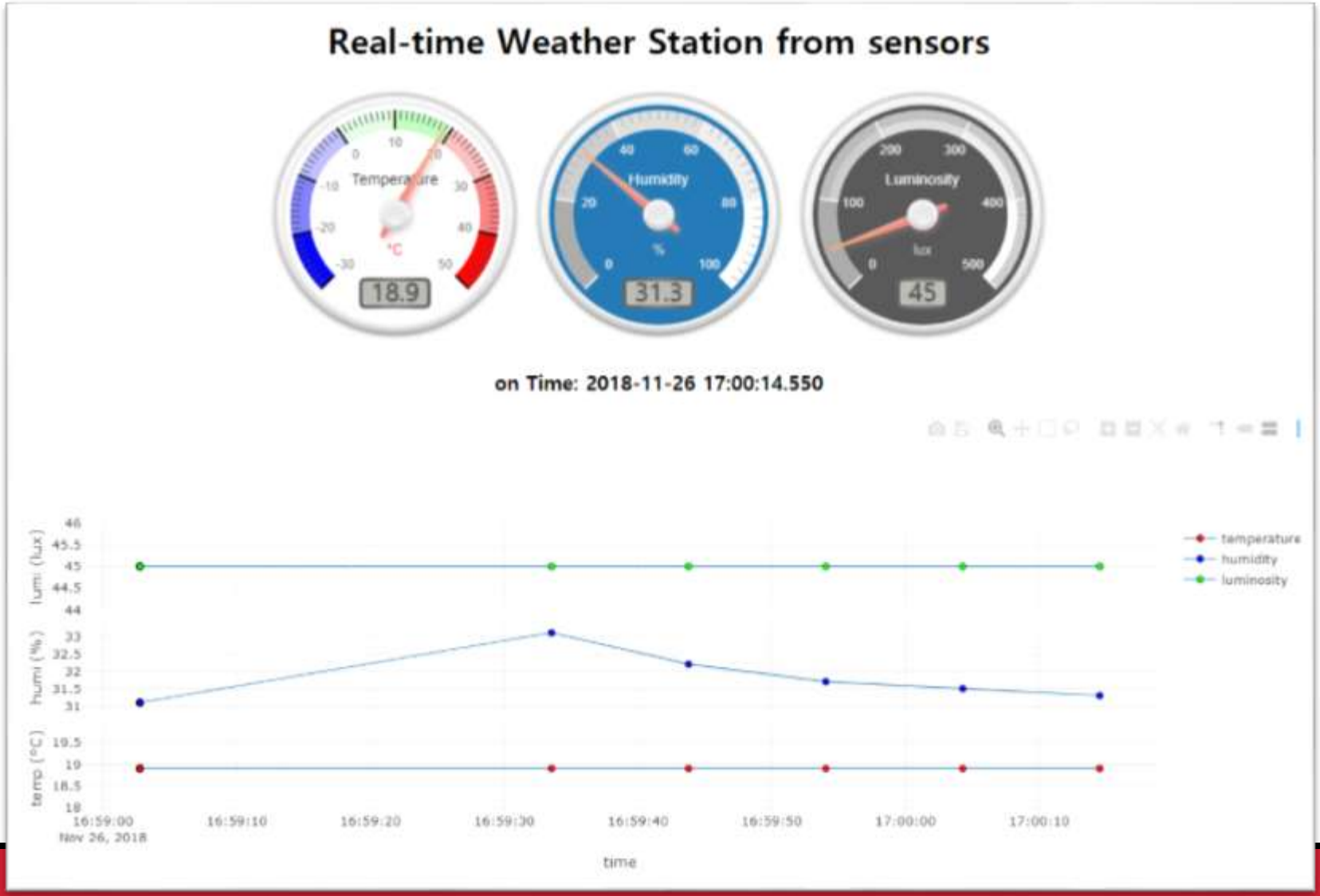
Save as

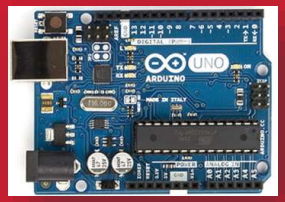
AAnn_iot_mongodb_web.png

A5.9.6 DHT22 + CdS + Node.js + MongoDB

2.7 copy cds_dht22_client.html & gauge.min.js → ./public/ subfolder

http://localhost:3030/client_cds_dht22.html (web root folder)





3-servers

mongoDB

socket.io

3000

Cloud (DB)

Network-Socket

node

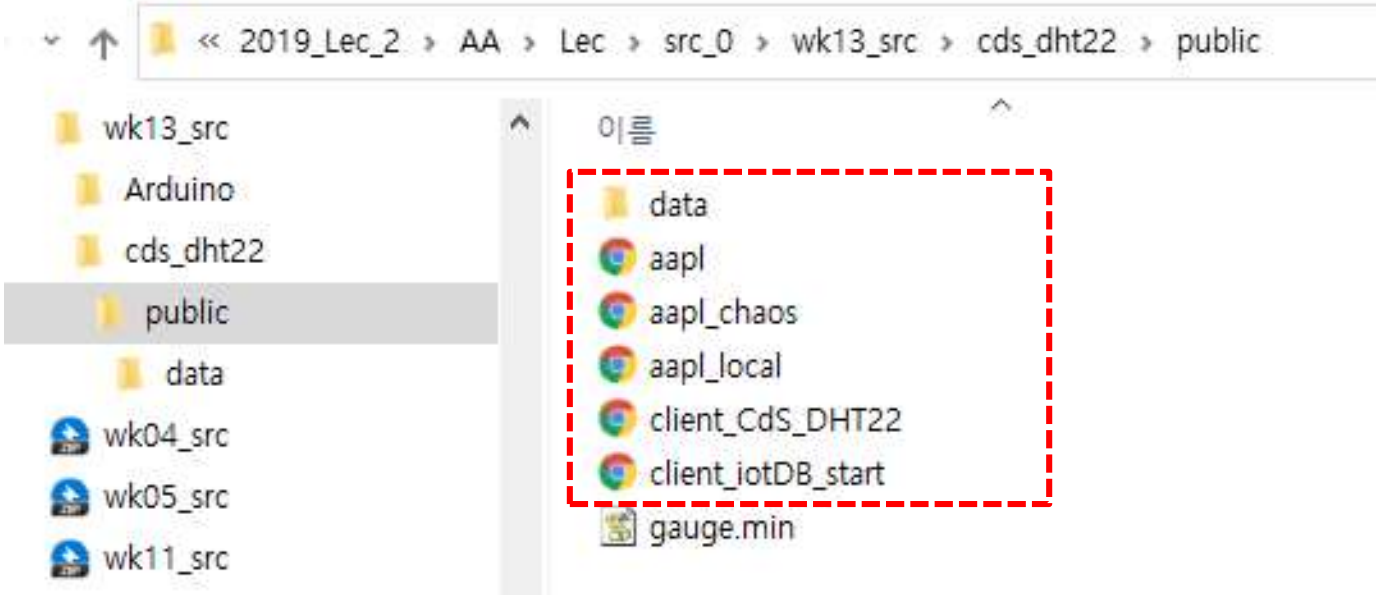
express

3030

Services (Client)

A5.9.6 DHT22 + CdS + Node.js + MongoDB

2.8 CORS bug (Cross Origin Resource Sharing)



Apple 사의 주가그래프를 그리는 **html client 3**개를 실행하고 결과를 비교.

→ **Local file**에 접근 불허

→ **CORS problem**

→ **public** 폴더로 **html,data**를 복사한 후에 비교.

A5.9.6 DHT22 + CdS + Node.js + MongoDB

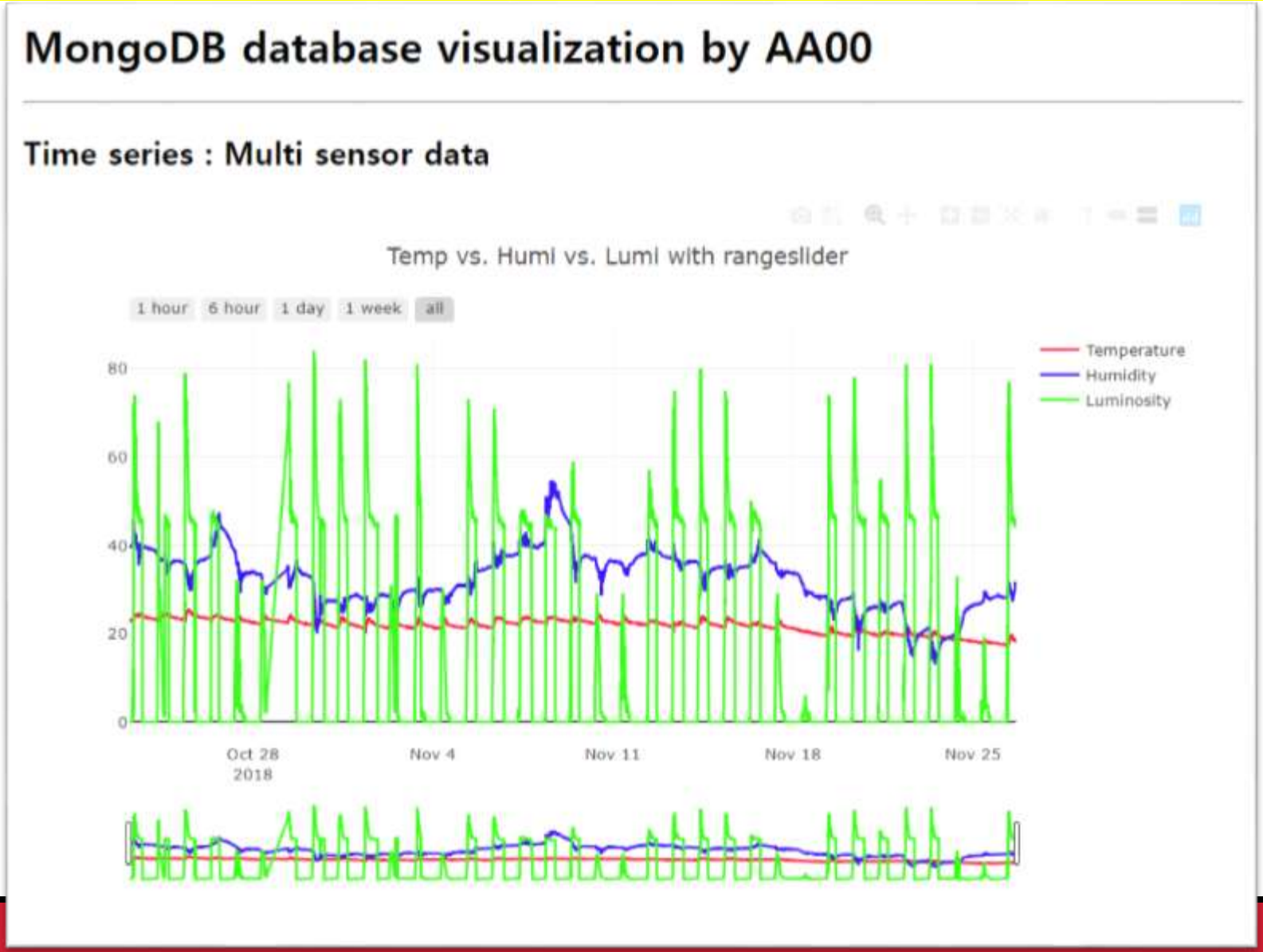
2.9 CORS patch on the express server → cds_dht22_express.js
Node cmd에서 'cors' module 설치 (version 2.8.4 이상)
npm install –save cors

```
1  // cds_dht22_express.js
2  // Express with CORS
3  var express = require('express');
4  var cors = require('cors');  // CORS: Cross Origin Resource Sharing
5  var app = express();
6  // CORS
7  app.use(cors());
8
9  var web_port = 3030;  // express port
10 // MongoDB
11 var mongoose = require('mongoose');
12 var Schema = mongoose.Schema;  // Schema object
13 // MongoDB connection
14 mongoose.connect('mongodb://localhost:27017/iot11'); // DB name
15 var db = mongoose.connection;
16 db.on('error', console.error.bind(console, 'connection error:'));
17 db.once('open', function callback () {
18         console.log("mongo db connection OK.");
19 });
```

Web monitoring

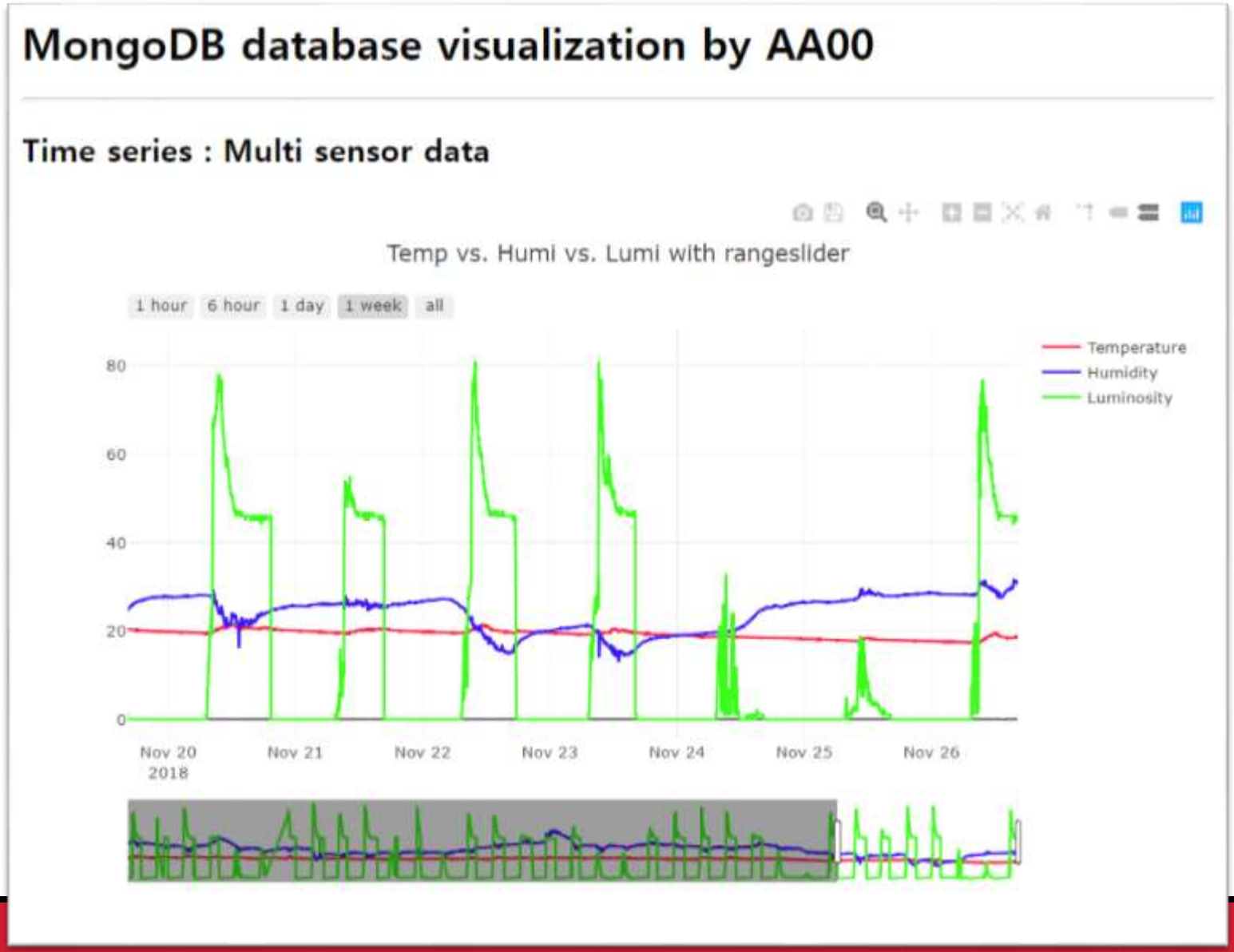
A5.9.7 DHT22 + CdS + Node.js + MongoDB

Web monitoring-1: month



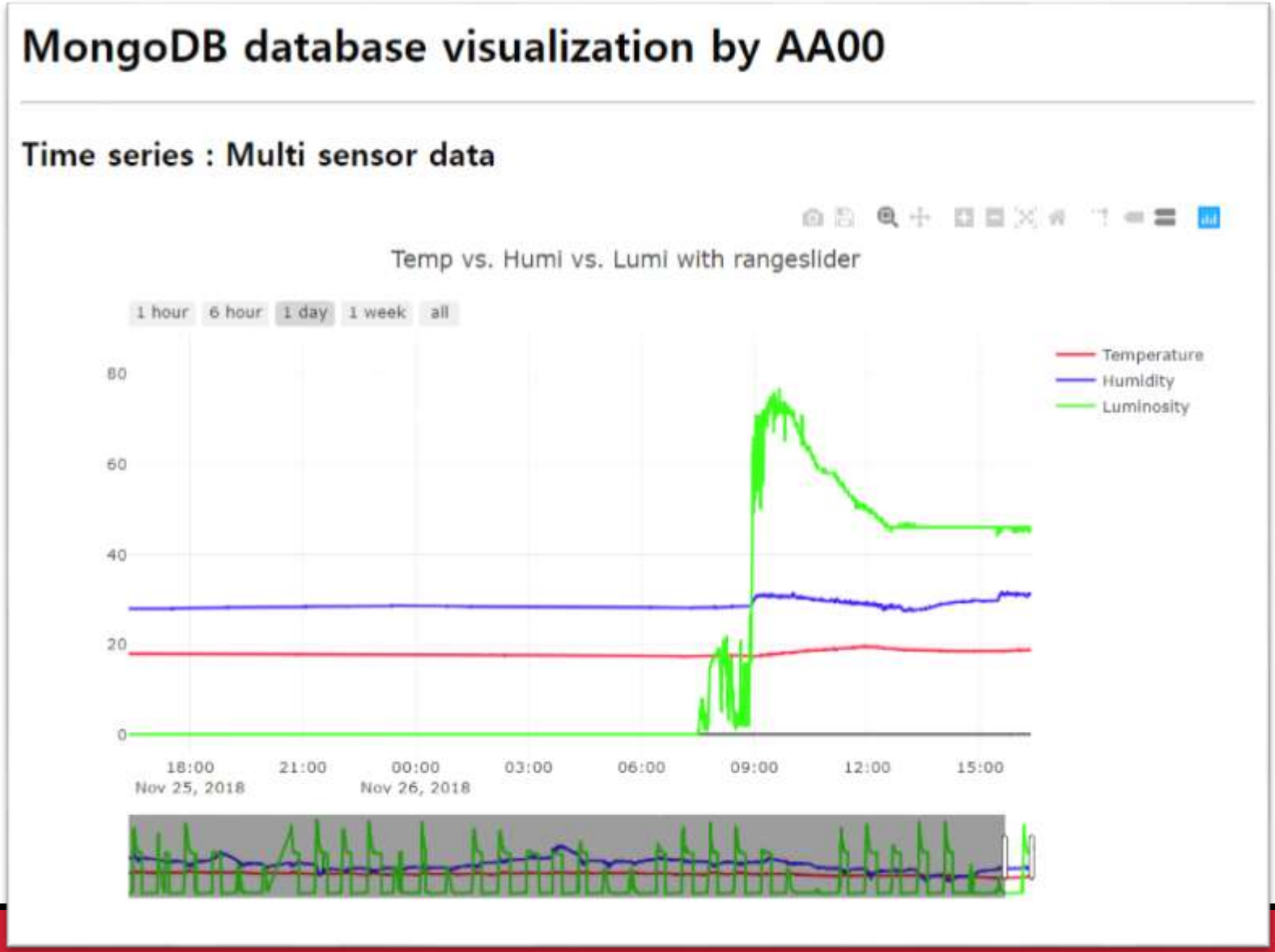
A5.9.7 DHT22 + CdS + Node.js + MongoDB

Web monitoring-2: week



A5.9.7 DHT22 + CdS + Node.js + MongoDB

Web monitoring-3: day



3.1 Web client: client_iotDB.html

client_iotDB.html

```
<!DOCTYPE html>
<head>
    <meta charset="utf-8">
    <!-- Plotly.js -->
    <script src="https://cdn.plot.ly/plotly-latest.min.js"></script>
</head>
<body>
    <h1>MongoDB database visualization by AA00</h1>
    <hr>
    <h2>Time series : Multi sensor data</h2>

    <!-- Plotly chart will be drawn inside this DIV -->
    <div id="myDiv" style="width: 900px;height: 600px"></div>

```

A5.9.7 DHT22 + CdS + Node.js + MongoDB

3.2 Web client: client_iotDB.html

```
<script>
    <!-- JAVASCRIPT CODE GOES HERE -->

    Plotly.d3.json(" http://localhost:3030/iot ", function(err, json){
        //alert(json);
         alert(JSON.stringify(json));  // It works!!!
        //alert(JSON.parse(eval(json));
        if(err) throw err;

        var date = [];
        var temp = [];
        var humi = [];
        var lumi = [];
        var jsonData = eval(JSON.stringify(json));
        //alert(jsonData.length);
        //alert(jsonData[2].luminosity);

        for (var i = 0; i < jsonData.length; i++) {
            date[i] = jsonData[i].date;
            temp[i] = jsonData[i].temperature ;
            humi[i] = jsonData[i].humidity;
            lumi[i] = jsonData[i].luminosity;

        }
```

JSON file

{"_id":"5a683ffd3cdf6353104a5465","date":"2018-01-24 17:12:45.251","temperature":"18.6","humidity":"10.2","luminosity":"180","__v":0},
{"_id":"5a683fff3cdf6353104a5466","date":"2018-01-24 17:12:47.523","temperature":"18.6","humidity":"10.2","luminosity":"179","__v":0},

A5.9.7 DHT22 + CdS + Node.js + MongoDB

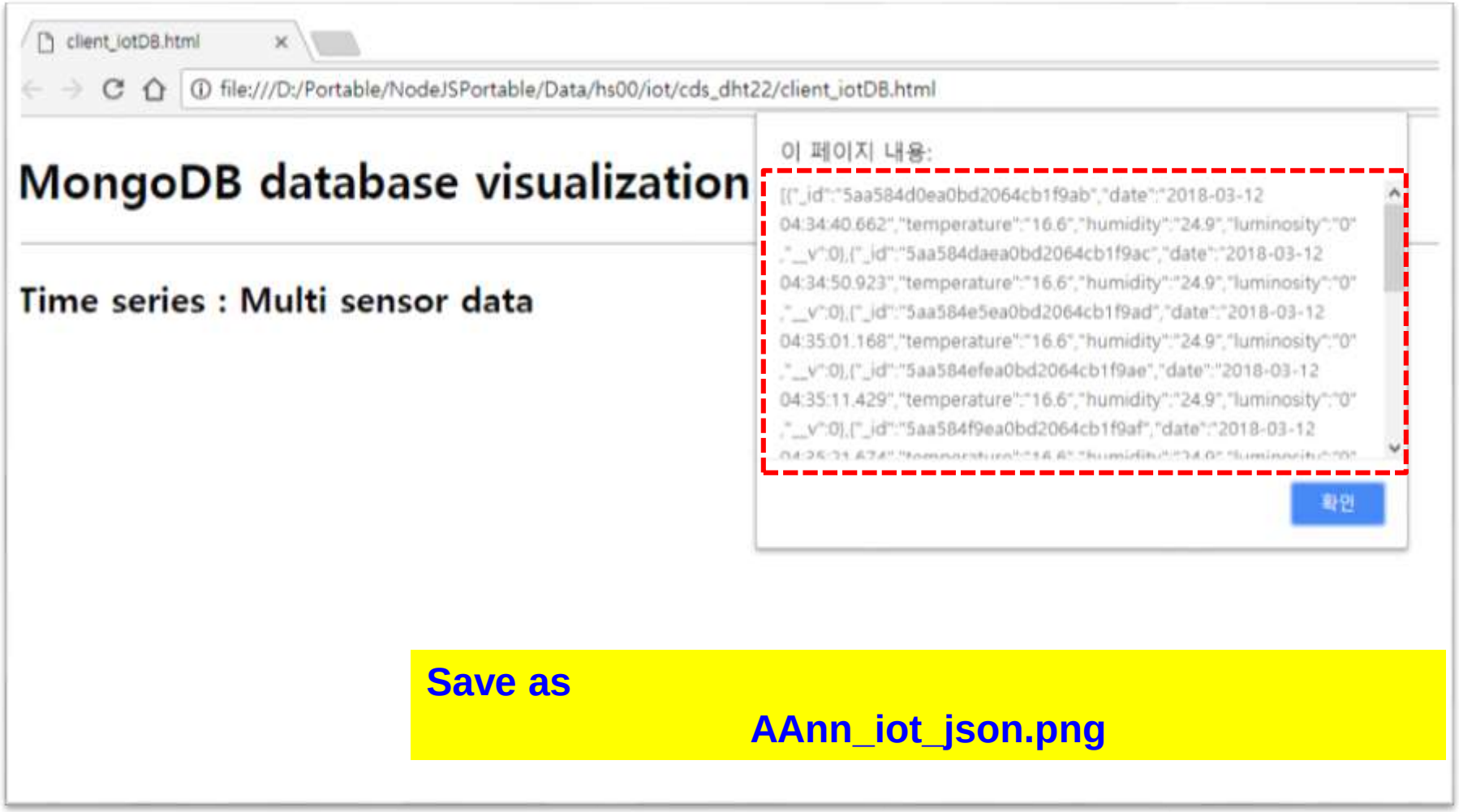
3.3 Web client: client_iotDB.html – data & layout

```
// time series of sensor data
var trace1 = {
    type: "scatter",
    mode: "lines",
    name: 'Temperature',
    x: date,
    y: temp,
    line: {color: '#fc1234'}
}

var trace2 = {
    type: "scatter",
    mode: "lines",
    name: 'Humidity',
    x: date,
    y: humi,
    line: {color: '#3412fc'}
}
var trace3 = {
    type: "scatter",
    mode: "lines",
    name: 'Luminosity',
    x: date,
    y: lumi,
    line: {color: '#34fc12'}
}
var data = [trace1, trace2, trace3];
```

```
// Layout with builtin rangeslider
var layout = {
    title: 'Temp vs. Humi vs. Lumi with rangeslider',
    xaxis: {
        autorange: true,
        range: [date[0], date[date.length-1]],
        rangeselector: {buttons: [
            {
                count: 1,
                label: '1 hour',
                step: 'hour',
                stepmode: 'backward'
            },
            {
                count: 6,
                label: '6 hour',
                step: 'hour',
                stepmode: 'backward'
            },
            {
                count: 24,
                label: '1 day',
                step: 'hour',
                stepmode: 'backward'
            },
            {
                count: 7,
                label: '1 week',
                step: 'day',
                stepmode: 'backward'
            },
            {step: 'all'}
            ]},
        rangeslider: {range: [date[0], date[date.length-1]]},
        type: 'date'
    },
    yaxis: {
        autorange: true,
        range: [0, 300],
        type: 'linear'
    }
};

Plotly.newPlot('myDiv', data, layout);
})
```

A5.9.7 DHT22 + CdS + Node.js + MongoDB

3.4 Web client: client_iotDB.html – load iot data in json file

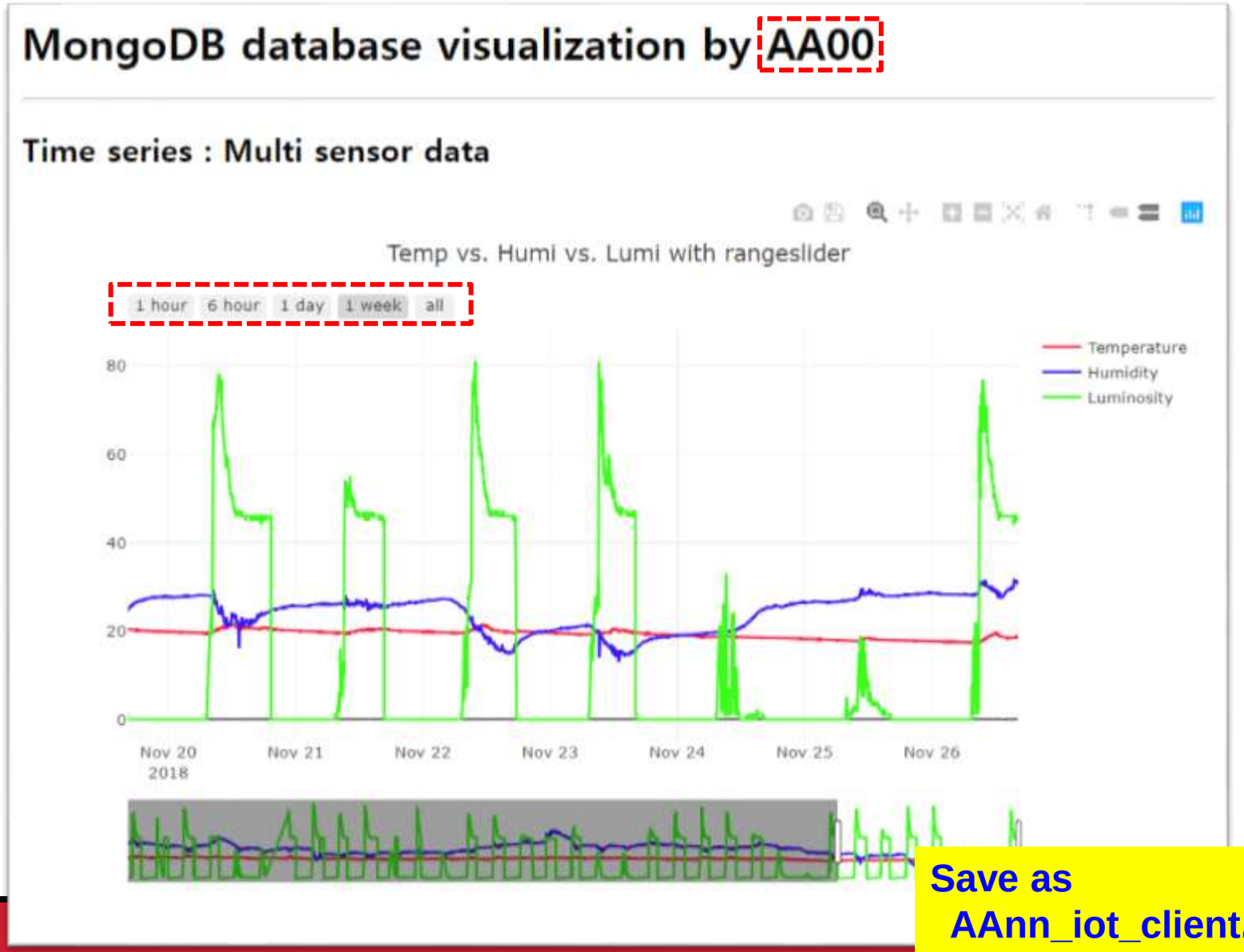


Save as

AAnn_iot_json.png

A5.9.7 DHT22 + CdS + Node.js + MongoDB

3.5 Web client: client_iotDB.html – iot DB monitoring (public 폴더에서 제공)



Save as
AAnn_iot_client.png

MongoDB data management

- Query in mongo shell
- Export & import MongoDB
- Using and understanding iot data with Python (or R)

A5.9.8 MongoDB management

1. Query in Mongo shell

db.sensors.count() → sensors collection에 있는 도큐먼트 (문서)의 수

db.sensors.find().sort({_id: 1}).limit(10) → 오래된 document 10개 추출

db.sensors.find().sort({_id: -1}).limit(10) → 최근 document 10개 추출

db.sensors.find({date: {$gt: "2019-11-26 22:26:05"}}) → 특정 시간 이후 document 추출

db.sensors.find({temperature: {$gt: 29}}) → 온도가 29도를 넘는 document 추출

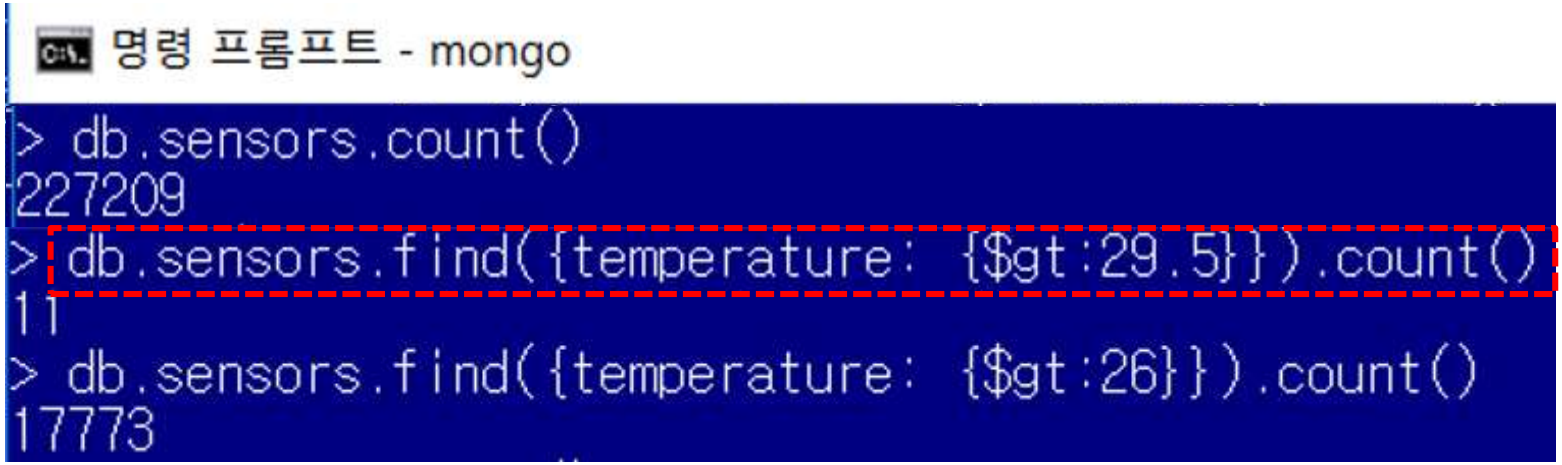
https://docs.mongodb.com/manual/tutorial/query-documents/

A5.9.8 MongoDB management

1.1 Query in Mongo shell

db.sensors.count() → sensors collection 에 있는 문서의 총수

db.sensors.find({temperature: {$gt: 29.5}}).count()
→ sensors collection 에 있는 온도가 **29.5**를 초과하는 문서의 수



A5.9.8 MongoDB management

1.2 Query in Mongo shell

db.sensors.find().sort({_id: -1}).limit(10) → 최근 데이터 10개 추출

명령 프롬프트 - mongo

```
> show dbs
Warning  0.000GB
iot11    0.013GB
local    0.000GB
> use iot11
switched to db iot11
> show collections
sensors
> db.sensors.find().sort({_id:-1}).limit(10)
{ "_id" : ObjectId("5b0d5ff82d151211a8b9e2ef"), "date" : "2018-05-29 22:13:28.218", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51ed2d151211a8b9e2ee"), "date" : "2018-05-29 22:13:17.958", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51e32d151211a8b9e2ed"), "date" : "2018-05-29 22:13:07.713", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51d92d151211a8b9e2ec"), "date" : "2018-05-29 22:12:57.453", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51cf2d151211a8b9e2eb"), "date" : "2018-05-29 22:12:47.208", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51c42d151211a8b9e2ea"), "date" : "2018-05-29 22:12:36.947", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51ba2d151211a8b9e2e9"), "date" : "2018-05-29 22:12:26.687", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51b02d151211a8b9e2e8"), "date" : "2018-05-29 22:12:16.442", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d51a62d151211a8b9e2e7"), "date" : "2018-05-29 22:12:06.182", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
{ "_id" : ObjectId("5b0d519b2d151211a8b9e2e6"), "date" : "2018-05-29 22:11:55.937", "temperature" : "26.3", "humidity" :
 "49.8", "luminosity" : "0", "__v" : 0 }
>
```

사용 중인 **db** 이름으로 변경이 필요! **--- use iotxx**

시간의 역순!

A5.9.8 MongoDB management

1.3 Query in Mongo shell

db.sensors.find({temperature: {$gt: 29}}) → 29도 초과하는 문서추출

명령 프롬프트 - mongo

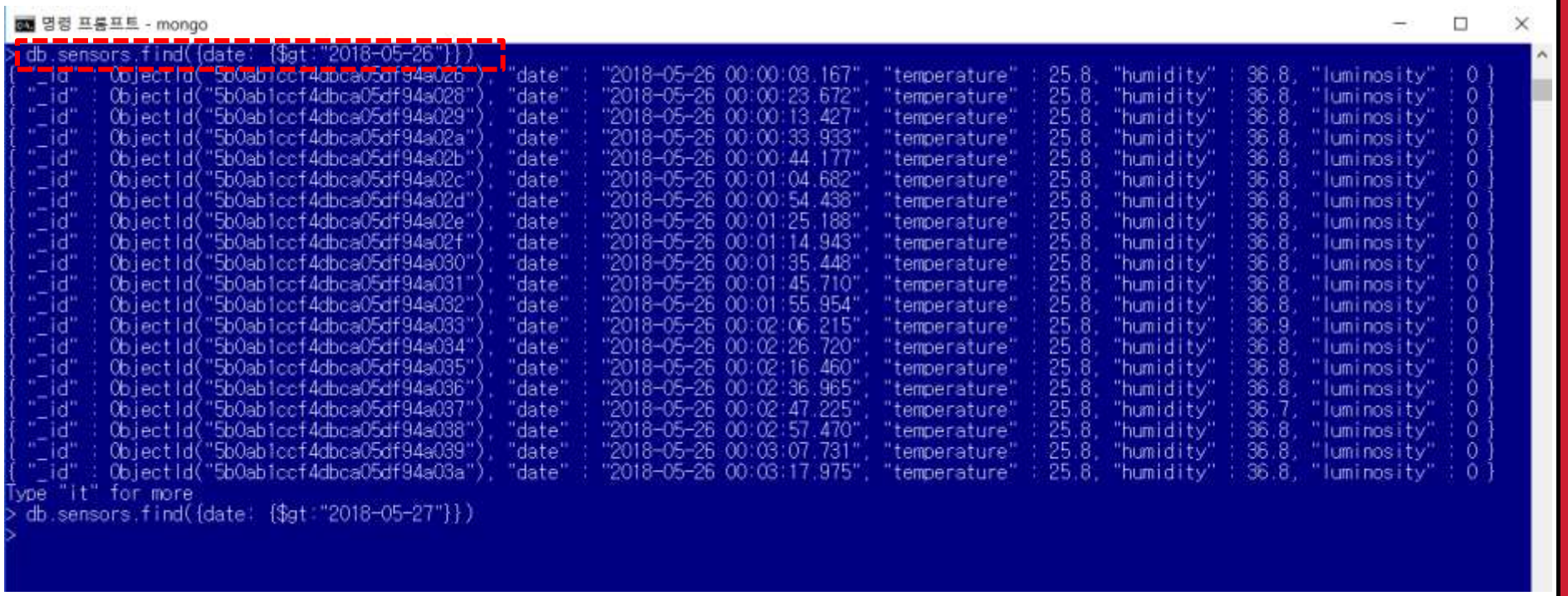
```
{ "_id" : ObjectId("5b0ab1c7f4dbca05df913fec"), "date" : "2018-03-12 09:17:59.512", "temperature" : 28.6, "humidity" : 13.7, "luminosity" : 60 }
Type "it" for more
> db.sensors.find({temperature: {$gt:29}})
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91426a"), "date" : "2018-03-12 11:06:51.069", "temperature" : 29.1, "humidity" : 14.4, "luminosity" : 60 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91426b"), "date" : "2018-03-12 11:07:01.330", "temperature" : 29.2, "humidity" : 14.3, "luminosity" : 60 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91426c"), "date" : "2018-03-12 11:07:11.575", "temperature" : 29.1, "humidity" : 14.2, "luminosity" : 60 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914377"), "date" : "2018-03-12 11:52:49.318", "temperature" : 29.1, "humidity" : 14.4, "luminosity" : 57 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914378"), "date" : "2018-03-12 11:52:59.563", "temperature" : 29.2, "humidity" : 14.4, "luminosity" : 58 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914379"), "date" : "2018-03-12 11:53:09.826", "temperature" : 29.2, "humidity" : 14.3, "luminosity" : 58 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91437b"), "date" : "2018-03-12 11:53:20.069", "temperature" : 29.1, "humidity" : 14.3, "luminosity" : 57 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143a9"), "date" : "2018-03-12 12:01:21.996", "temperature" : 29.2, "humidity" : 14.7, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143aa"), "date" : "2018-03-12 12:01:32.258", "temperature" : 29.1, "humidity" : 14.6, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143ad"), "date" : "2018-03-12 12:02:03.008", "temperature" : 29.1, "humidity" : 14.5, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143ae"), "date" : "2018-03-12 12:02:13.268", "temperature" : 29.2, "humidity" : 14.4, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143af"), "date" : "2018-03-12 12:02:23.529", "temperature" : 29.3, "humidity" : 14.3, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b0"), "date" : "2018-03-12 12:02:33.774", "temperature" : 29.4, "humidity" : 14.2, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b1"), "date" : "2018-03-12 12:02:54.280", "temperature" : 29.4, "humidity" : 14.1, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b2"), "date" : "2018-03-12 12:02:44.035", "temperature" : 29.4, "humidity" : 14.2, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b3"), "date" : "2018-03-12 12:03:04.541", "temperature" : 29.4, "humidity" : 14, "luminosity" : 55 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b4"), "date" : "2018-03-12 12:03:14.785", "temperature" : 29.3, "humidity" : 13.9, "luminosity" : 54 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b5"), "date" : "2018-03-12 12:03:25.046", "temperature" : 29.2, "humidity" : 13.9, "luminosity" : 54 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143b6"), "date" : "2018-03-12 12:03:35.291", "temperature" : 29.1, "humidity" : 14, "luminosity" : 54 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9143eb"), "date" : "2018-03-12 12:12:38.735", "temperature" : 29.2, "humidity" : 14.7, "luminosity" : 53 }
Type "it" for more
> db.sensors.find({temperature: {$gt:31}})
> db.sensors.find({temperature: {$gt:30}})
> db.sensors.find({temperature: {$gt:29.5}})
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914427"), "date" : "2018-03-12 12:22:53.957", "temperature" : 29.6, "humidity" : 13.7, "luminosity" : 50 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914428"), "date" : "2018-03-12 12:23:04.218", "temperature" : 29.7, "humidity" : 13.6, "luminosity" : 50 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914429"), "date" : "2018-03-12 12:23:14.479", "temperature" : 29.7, "humidity" : 13.4, "luminosity" : 50 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91442a"), "date" : "2018-03-12 12:23:24.724", "temperature" : 29.7, "humidity" : 13.4, "luminosity" : 51 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91442b"), "date" : "2018-03-12 12:23:34.985", "temperature" : 29.7, "humidity" : 13.4, "luminosity" : 51 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91442d"), "date" : "2018-03-12 12:23:45.229", "temperature" : 29.6, "humidity" : 13.4, "luminosity" : 51 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df9149d6"), "date" : "2018-03-12 16:32:03.827", "temperature" : 29.6, "humidity" : 14.8, "luminosity" : 46 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914a0e"), "date" : "2018-03-12 16:40:46.764", "temperature" : 29.6, "humidity" : 14.8, "luminosity" : 46 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df914a0f"), "date" : "2018-03-12 16:40:57.025", "temperature" : 29.6, "humidity" : 14.8, "luminosity" : 46 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df916289"), "date" : "2018-03-13 10:30:48.354", "temperature" : 29.6, "humidity" : 19.2, "luminosity" : 63 }
{ "_id" : ObjectId("5b0ab1c7f4dbca05df91628a"), "date" : "2018-03-13 10:30:38.108", "temperature" : 29.6, "humidity" : 19.3, "luminosity" : 64 }
>
```

A5.9.8 MongoDB management

1.4 Query in Mongo shell

db.sensors.find({date: {$gt: “2018-05-26”}})

→ 5월 26일 이후 데이터 전부 추출 (시간 변경)



A5.9.8 MongoDB management

2. Import or export MongoDB (windows cmd 창에서 실행)

- **mongoimport -d dbName -c collectionName --type csv --headerline --file fileName.csv**

- **mongoexport -d dbName -c collectionName --fields <field1,field2,…> --limit=nn --type csv --out fileName.csv**

json 또는 csv 파일로 import/export

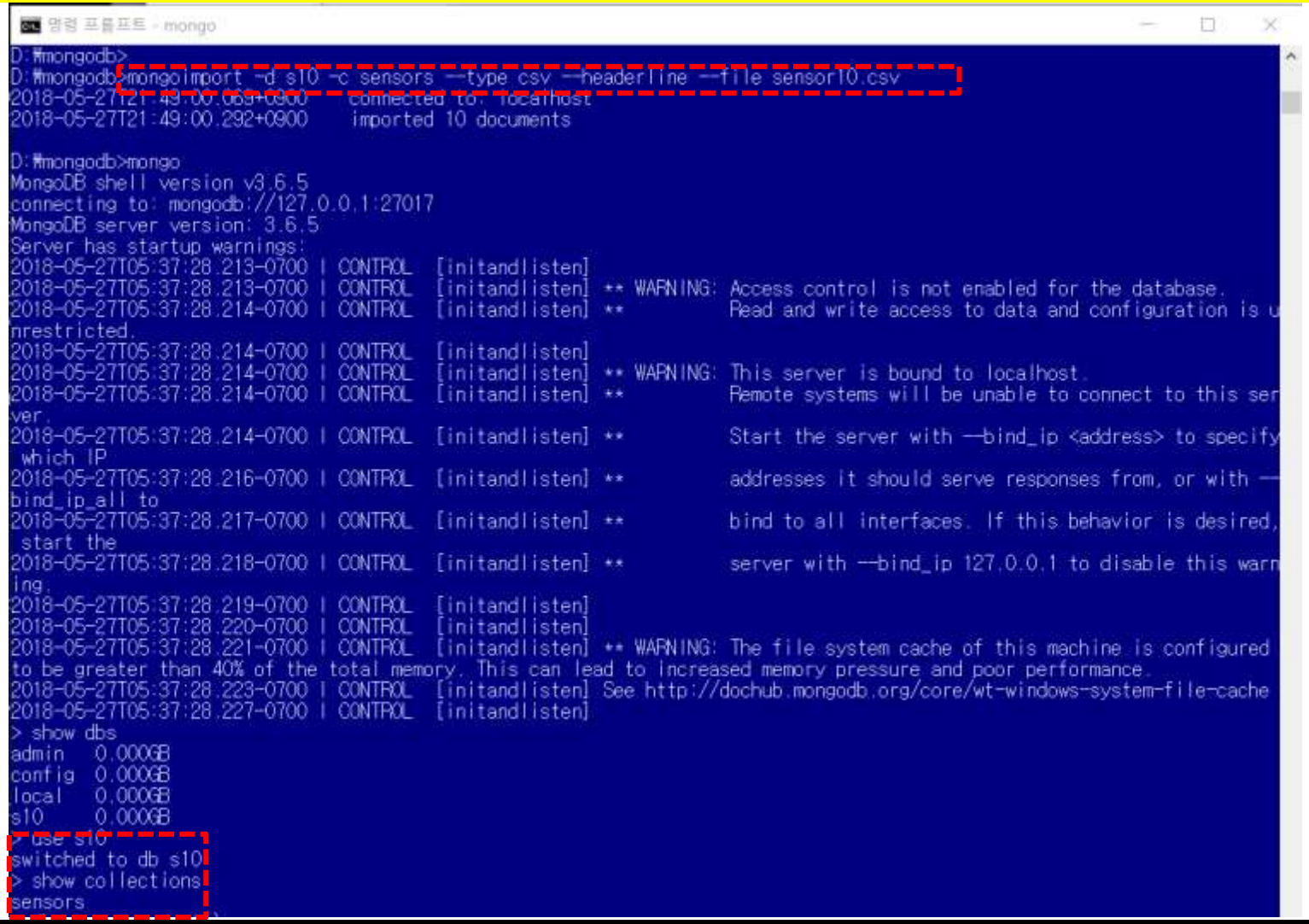
https://docs.mongodb.com/manual/reference/program/mongoimport/

https://docs.mongodb.com/manual/reference/program/mongoexport/

A5.9.8 MongoDB management

2.1.1 Import MongoDB (windows cmd 창에서 실행)

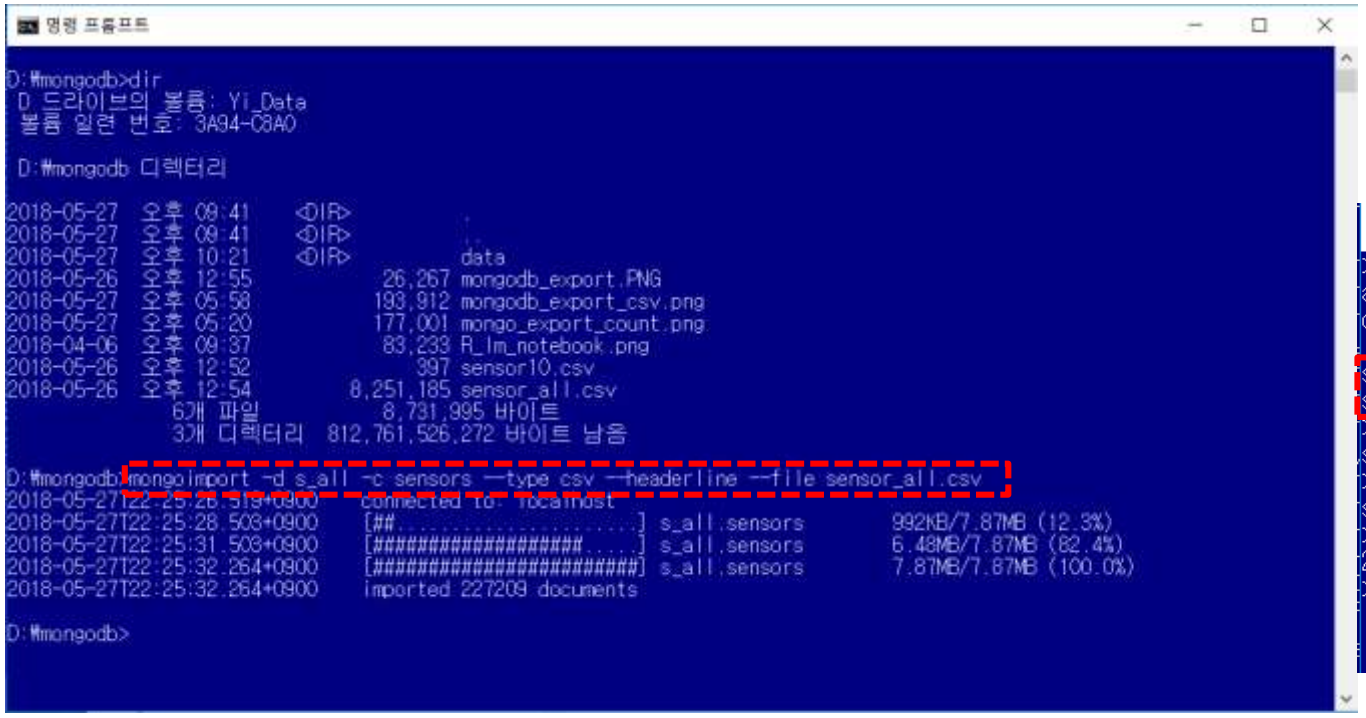
- mongoimport -d s10 -c sensors --type csv --headerline --file sensor10.csv

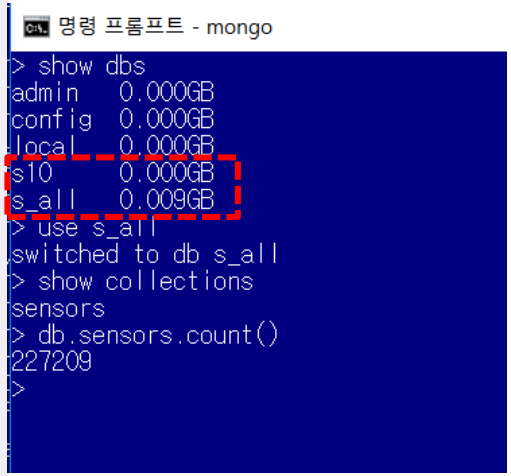


A5.9.8 MongoDB management

2.1.2 Import MongoDB (windows cmd 창에서 실행)

- **mongoimport -d s_all -c sensors --type csv –headerline --file sensor_all.csv**



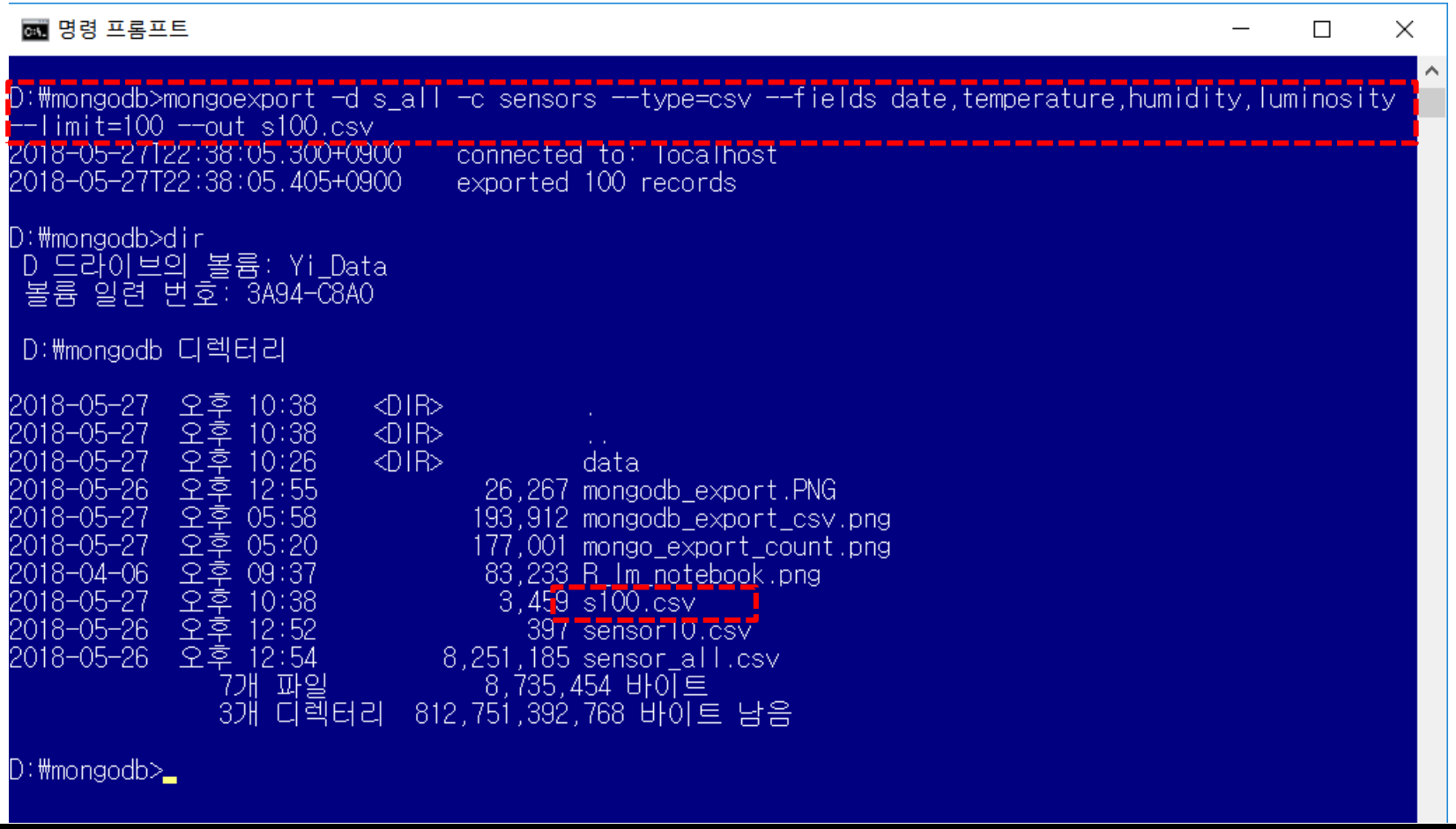


[DIY] Import된 ‘s_all’ db 에 대하여 앞에서 배운 query를 테스트해서 결과를 확인한다.

A5.9.8 MongoDB management

2.2 Export MongoDB (windows cmd 창에서 실행, dbName을 iotx로 변경!)

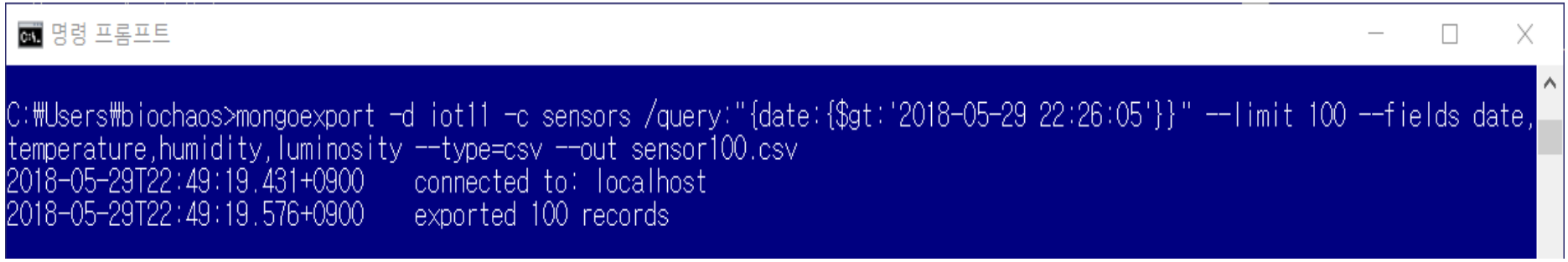
- **mongoexport -d s_all -c sensors --type=csv --fields date,temperature,humidity,luminosity --limit=100 --out s100.csv**



A5.9.8 MongoDB management

2.3 Advanced export with query (windows cmd 창에서 실행)
iotxx db의 특정 시간 이후의 데이터 100개를 csv 파일 (s100.csv)로 저장

- **Mongoexport –d iotxx -c sensors /query:"{date: {$gt: '2018-05-29 22:26:06'}}" --limit=100 --fields date,temperature,humidity,luminosity --type=csv --out s100.csv**



[Tip] iot db의 최근 데이터 500개를 csv 파일 (s500.csv)로 저장할 때,

- **mongoexport –d iot -c sensors --sort "{_id: -1}" --limit=500 --fields date,temperature,humidity,luminosity --type=csv --out s500.csv**

A5.9.8 MongoDB management

[Tip] iot db의 최근 데이터 500개를 csv 파일 (s500.csv)로 저장할 때,

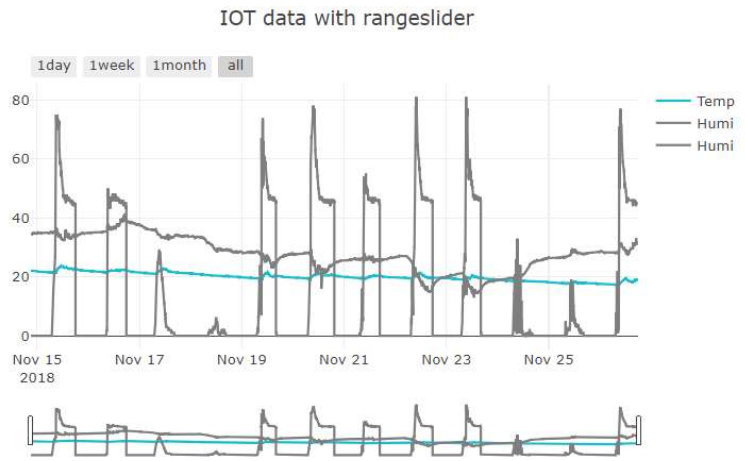
- **mongoexport –d iot -c sensors --sort “{_id: -1}” --limit=500 --fields date,temperature,humidity,luminosity --type=csv --out s500.csv**

```
C:₩Users₩biochaos>mongoexport -d iot11 -c sensors --sort "{_id:-1}" --limit=100000 --type=csv --fields date,temperature,
humidity,luminosity --out iot_chaos.csv
2018-11-26T17:50:23.577+0900    connected to: localhost
2018-11-26T17:50:24.576+0900    [###############.........]  iot11.sensors  64000/100000  (64.0%)
2018-11-26T17:50:24.797+0900    [########################]  iot11.sensors  100000/100000  (100.0%)
2018-11-26T17:50:24.798+0900    exported 100000 records
```

	A	B	C	D
1	date	temperatu	humidity	luminosity
2	50:18.6	18.9	31.6	45
3	50:08.4	18.9	31.6	45
4	49:58.1	18.9	31.6	45
5	49:47.8	19	31.7	45
6	49:37.6	19	31.7	45
7	49:27.3	18.9	31.7	45
8	49:17.1	18.9	31.6	45

Data visualization by AAnn

Time series by AAnn



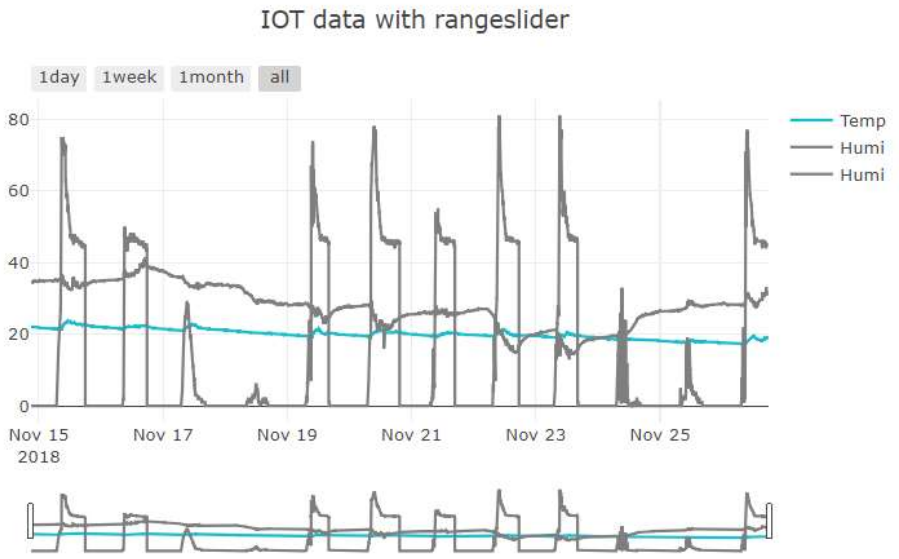
A5.9.8 MongoDB management

[DIY]

1. **iot db의 최근 데이터 1000개를 csv 파일 (AAnn_s1000.csv)로 저장하시오.**
2. **저장된 AAnn_s1000.csv 파일을 public/data 폴더에 복사.**
3. **csv 파일을 이용하는 Rangeslider가 포함된 웹 클라이언트 client_iot.html 파일을 만드시오.**

Data visualization by AAnn

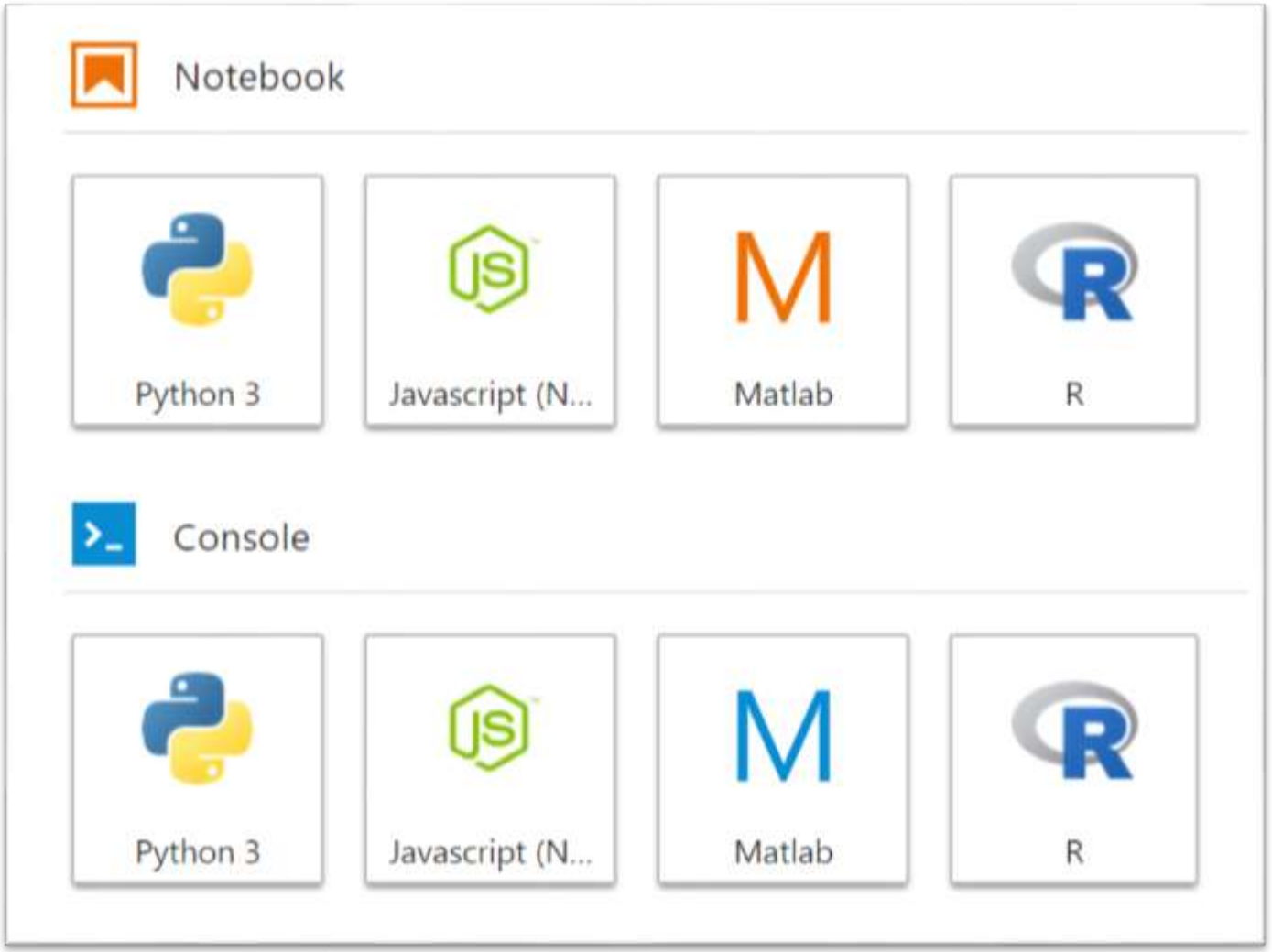
Time series by AAnn



Save as AAnn_s1000.png

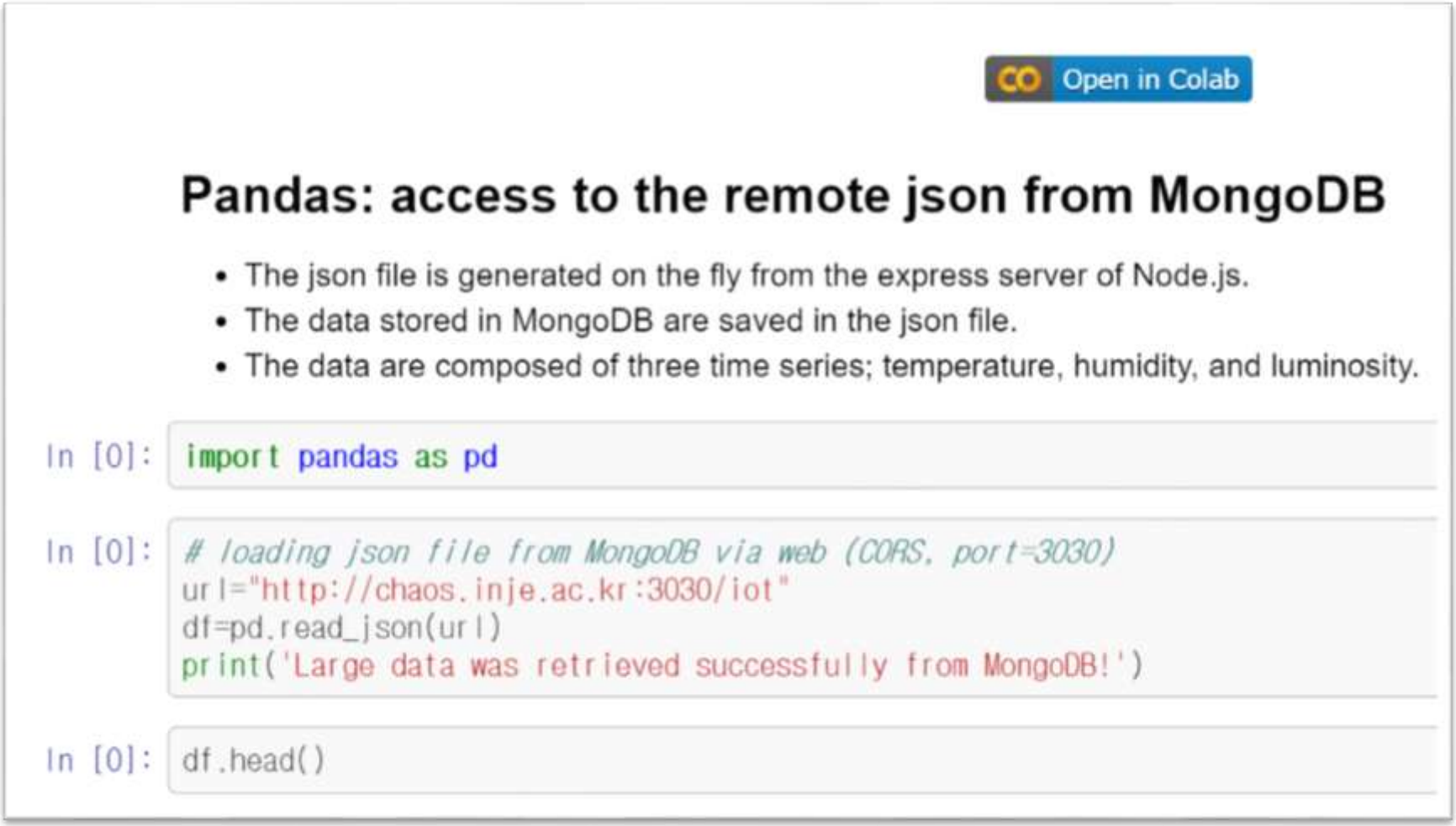
IoT data mining (next week)

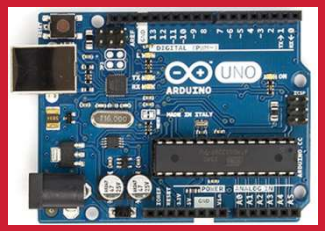
3. How to use and understand iot data? → Python(or R) in Colab/Jupyter lab



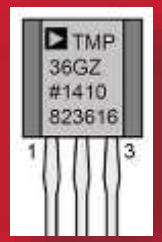
IoT data mining (next week)

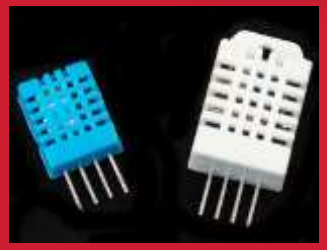
How to use and understand iot data? → Google Colab





[Practice]





- [wk13]
  - RT Data management with MongoDB
  - Multi-sensor circuits(cds-dht22)
  - Complete your project
  - Upload folder: AAnn_Rpt11

wk13 : Practice : AAnn_Rpt11

- [Target of this week]
  - Complete your works
  - Save your outcomes and upload outputs in github

제출폴더명 : **AAnn_Rpt11**

- 압축할 파일들

① AAnn_iot_json.png

② AAnn_iot_client.png

③ AAnn_s1000.csv (mongoexport file)

④ AAnn_s1000.png

⑤ client_IoT.html

⑥ All *.ino

⑦ All *.js

⑧ All *.html

[Upload to github]

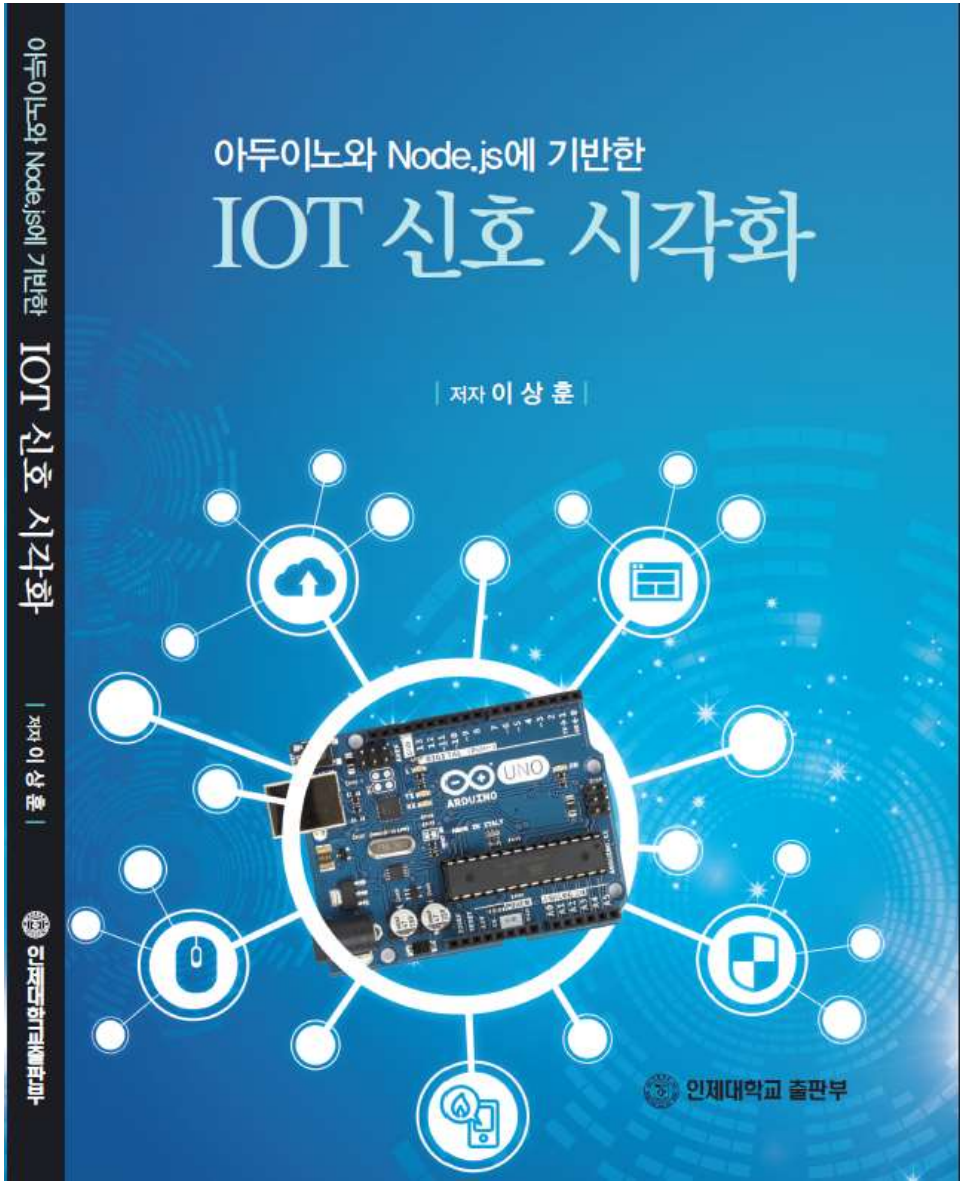
- [wk13]
  - upload all work of this week
  - Use your repo “aann” in github
  - upload folder “aann_rpt11” in your github.

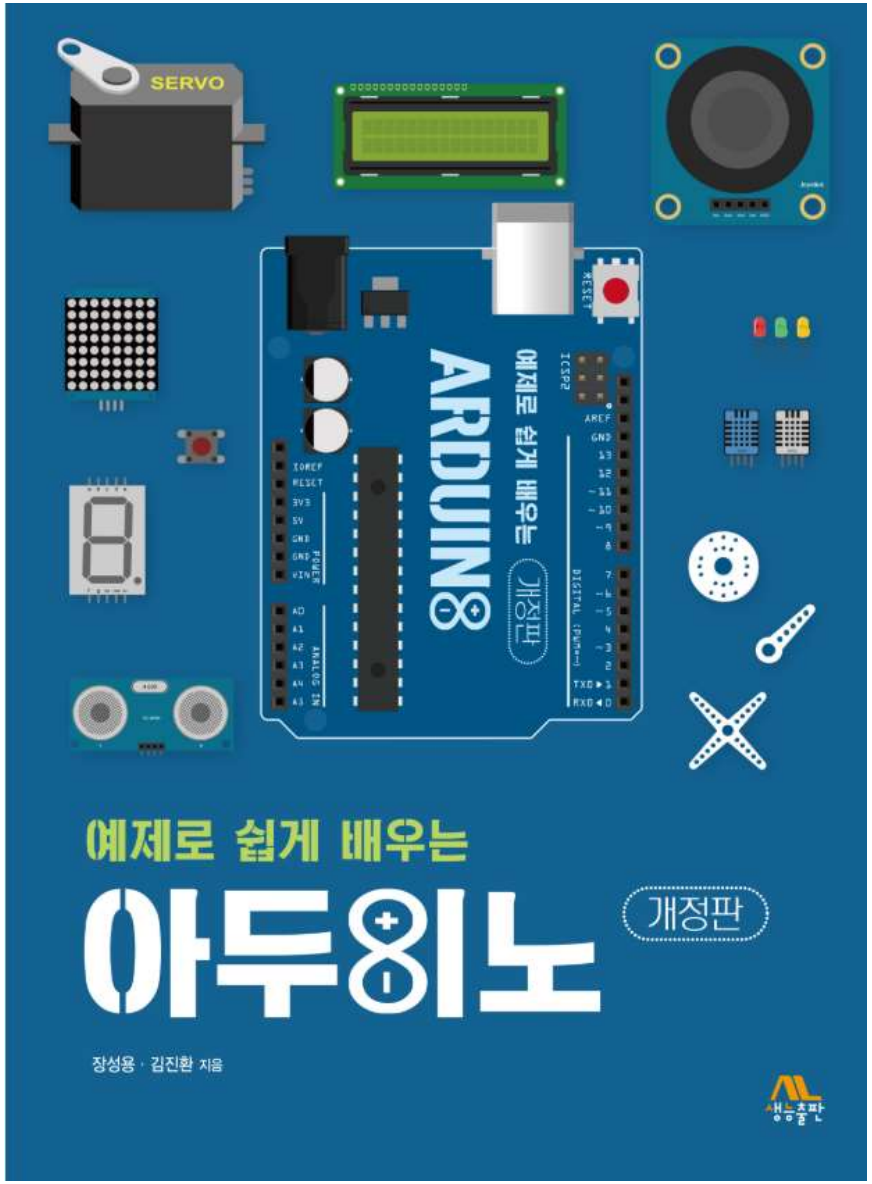
Lecture materials

References & good sites

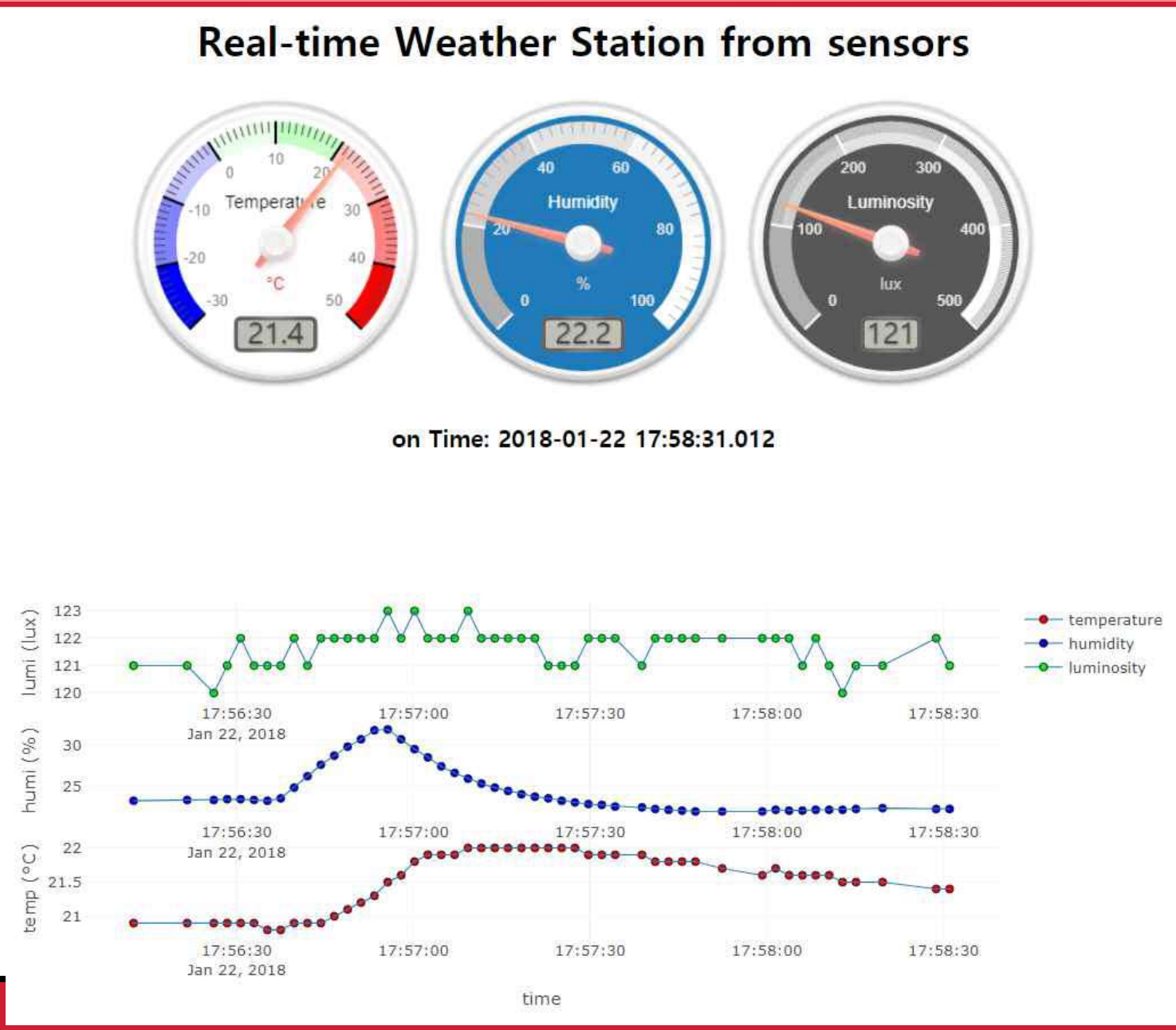
- ✓ http://www.arduino.cc Arduino Homepage
- ✓ http://www.nodejs.org/ko Node.js
- ✓ https://plot.ly/ plotly
- ✓ https://www.mongodb.com/ MongoDB
- ✓ http://www.w3schools.com By w3schools
- ✓ http://www.github.com GitHub

주교재 및 참고도서


아두이노와 Node.js에 기반한
IOT 신호 시각화
| 저자 이 상 훈 |
인제대학교 출판부
아두이노와 Node.js에 기반한 IOT 신호 시각화
| 저자 이 상 훈 |
인제대학교 출판부


SERVO
ARDUINO
예제로 쉽게 배우는
개정판
예제로 쉽게 배우는
아두이노
개정판
장성용 · 김진환 지음

Target of this class



Another target of this class