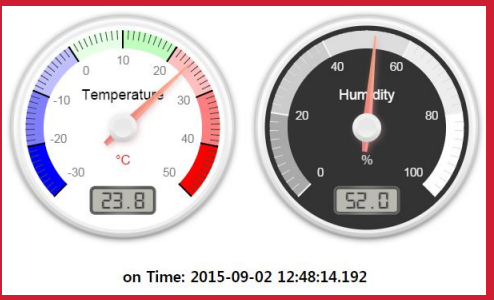
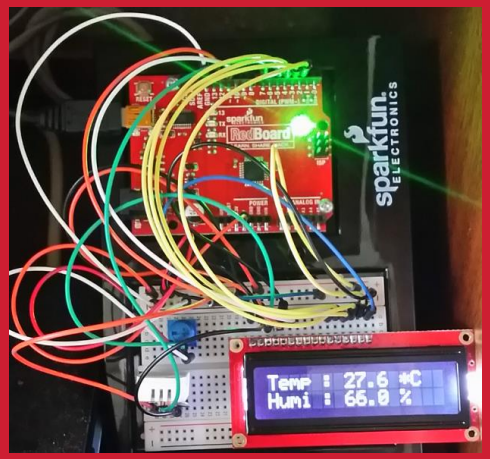




Arduino-IOT

[wk09]

cds_dht22 + node

MongoDB-I

Visualization of Signals using Arduino, Node.js & storing signals in MongoDB & mining data using Python

Drone-IoT-Comsi, INJE University

2nd semester, 2022

Email : chaos21c@gmail.com

My ID

ID를 확인하고 github에 repo 만들기

AA01	강대진	AA13	박제홍
		AA14	심준혁
AA03	김성우	AA15	이상혁
AA04	김정헌	AA16	이승무
		AA17	이승준
AA06	김창연	AA18	이준희
AA07	김창욱	AA19	이현준
AA08	김태화	AA20	임태형
AA09	남승현	AA21	정동현
AA10	류재환		
AA11	박세훈	AA23	정희서
AA12	박신영	AA24	최재형

위의 id를 이용해서 github에 repo를 만드시오.

Option: 아두이노응용 실습 과제 – AAnn

Public, README.md check

[Practice]

- [wk07-08]
  - RT Data Visualization with node.js
  - Usage of gauge.js
  - Complete your plotly-node project
  - Upload folder: aann-rpt08
  - Use repo “aann” in github

Wk07/08 : Practice : aann-rpt08

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

제출폴더명 : **aann-rpt08**

- 압축할 파일들

① AAnn_DS_30timestamps.png

② AAnn_DS_multiple_axis.png

③ AAnn_cds_gauge.png

④ AAnn_cds_change.png

⑤ AAnn_DS_cds_tmp36.png

⑥ All *.ino

⑦ All *.js

⑧ All *.html

Email : chaos21c@gmail.com

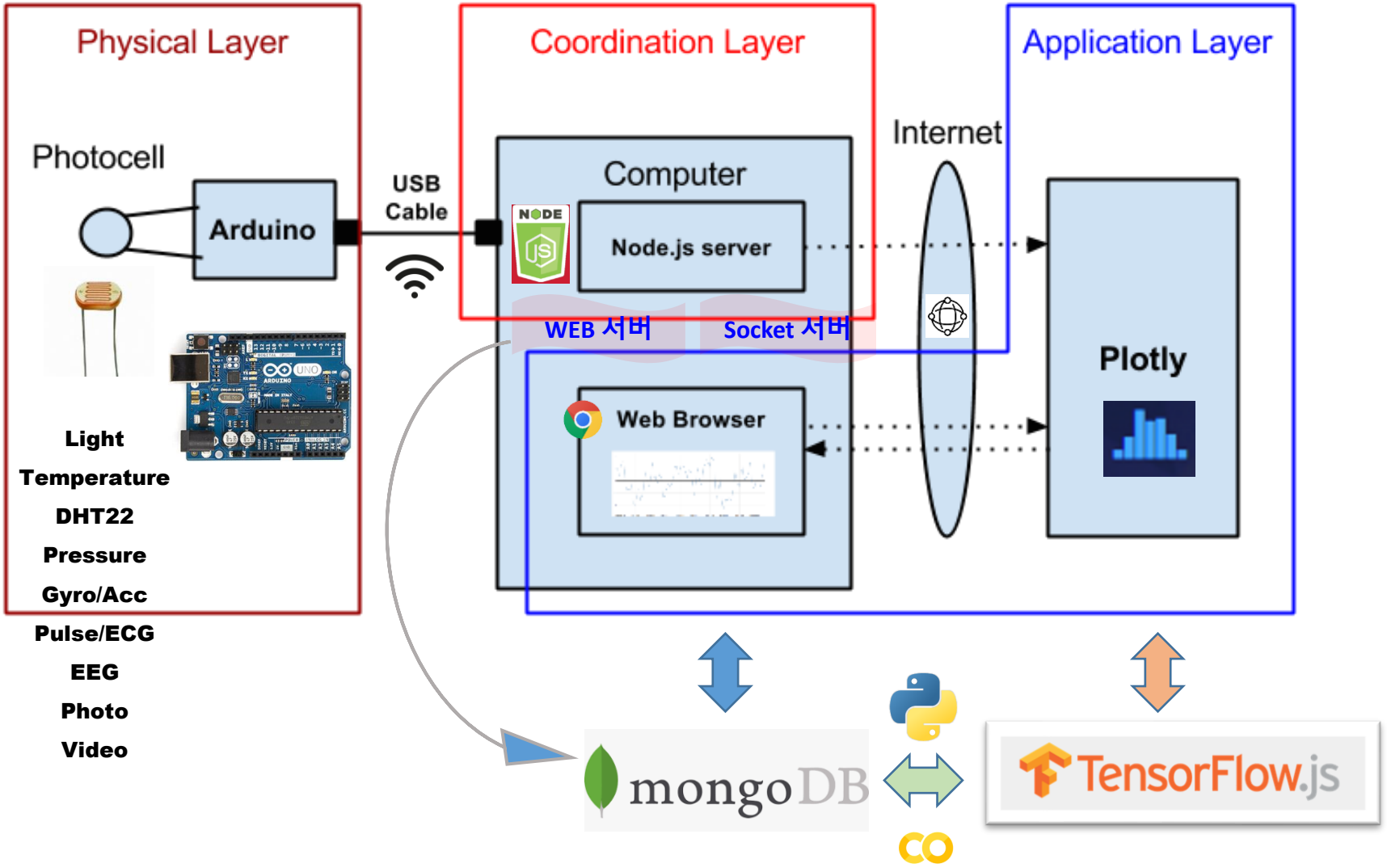
Purpose of AA

주요 수업 목표는 다음과 같다.

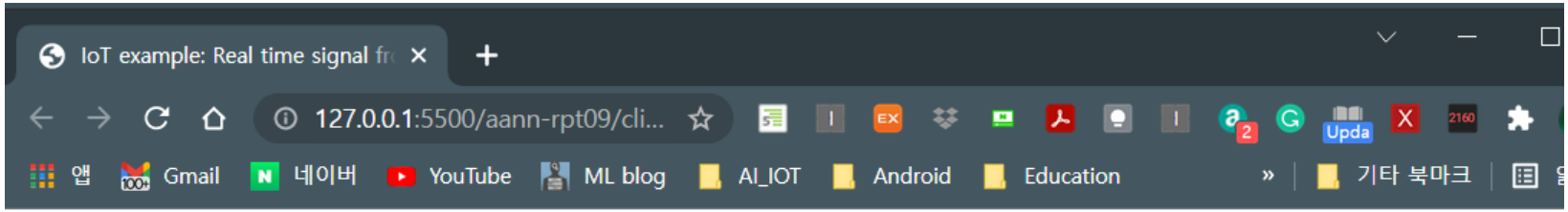
1. Node.js를 이용한 아두이노 센서 신호 처리
2. Plotly.js를 이용한 아두이노 센서 신호 시각화
3. MongoDB에 아두이노 센서 데이터 저장 및 처리

4. 저장된 IoT 데이터의 마이닝 (파이썬 코딩)

Layout [H S C]


Physical Layer
Photocell
Arduino
USB Cable
Light
Temperature
DHT22
Pressure
Gyro/Acc
Pulse/ECG
EEG
Photo
Video
Coordination Layer
Computer
Node.js server
WEB 서버
Socket 서버
Web Browser
Internet
Application Layer
Plotly
mongoDB
TensorFlow.js
CO

on WEB monitoring Arduino data



IoT Signal from Arduino Weather Station

Real-time Signals

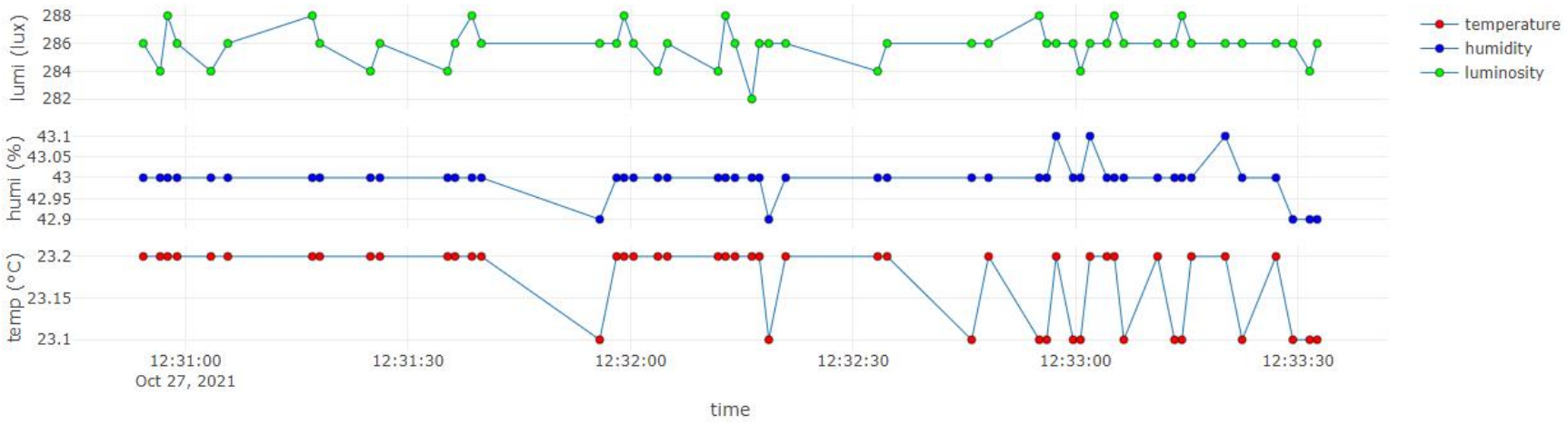
---

on Time: 2021-10-27 11:54:48.997

Signals (온도,습도,조도) : 23.4,42.6,286

Real-time Weather Station from sensors

on Time: 2021-10-27 12:33:32.600



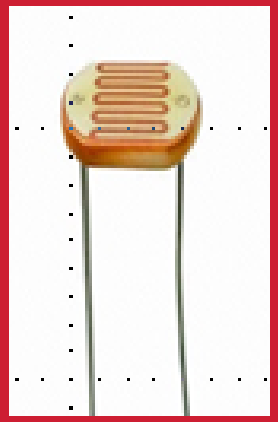
CdS + DHT22

+ plotly.js

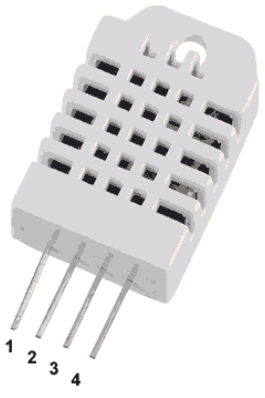
Node project

Multi-sensors

CdS + DHT22



DHT22 pins	
1	VCC
2	DATA
3	NC
4	GND



DHT22 pins	
1	VCC
2	DATA
3	NC
4	GND

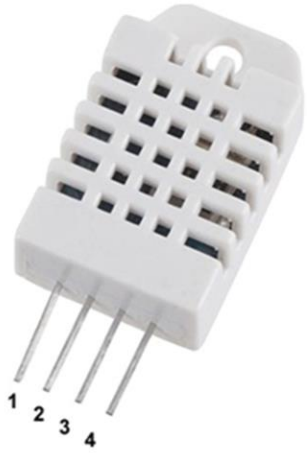
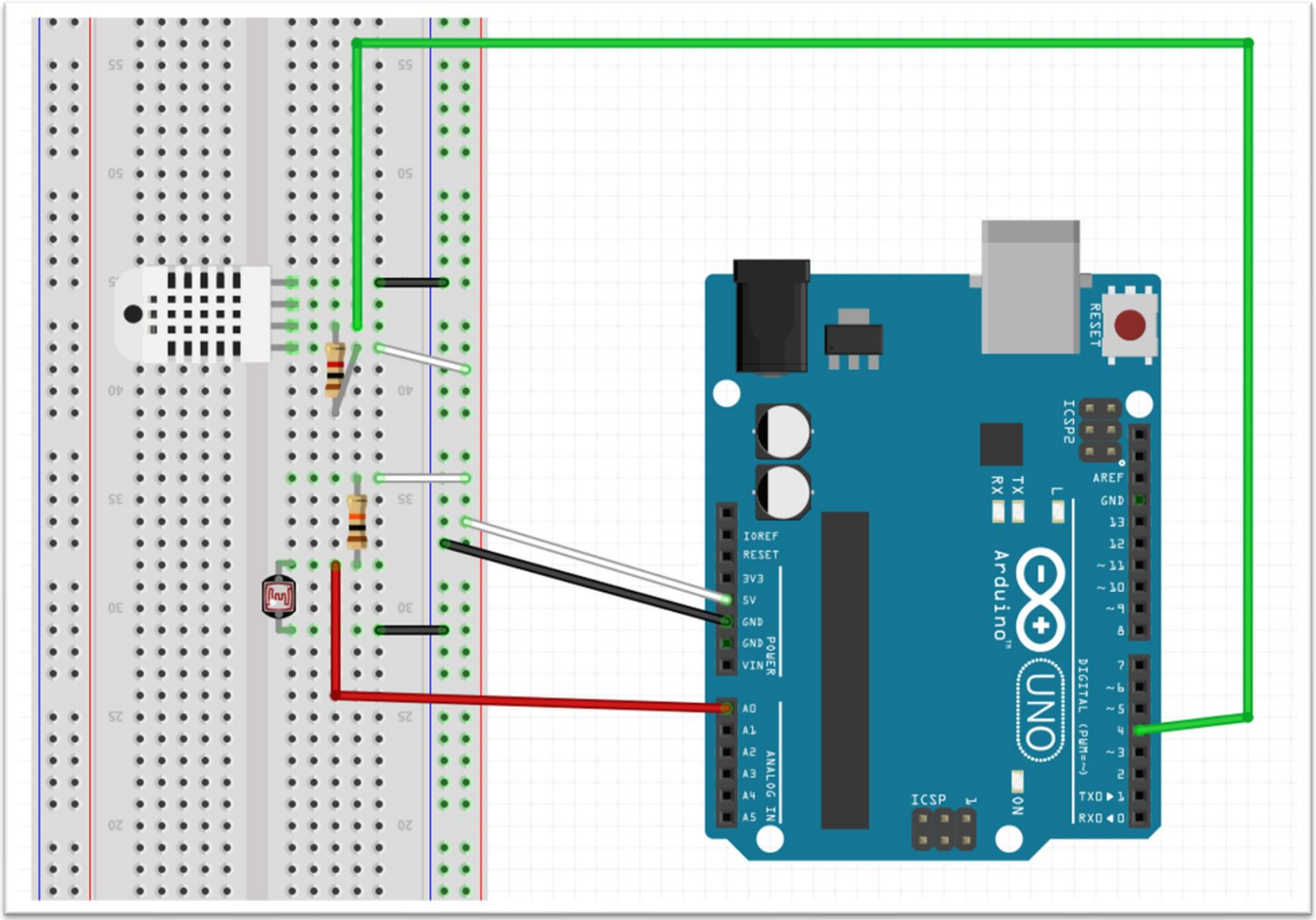


그림 8-7 DHT22 pin 구조

- 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

A5.7.1 DHT22 + CdS circuit



DHT22[D4] + 1 kΩ, CdS[A0] + 10 k Ω

A5.7.2 DHT22 + CdS : DHT library

Features Business Explore Marketplace Pricing This repository

adafruit / DHT-sensor-library

Code Issues 21 Pull requests 15 Projects 0 Wiki Insights

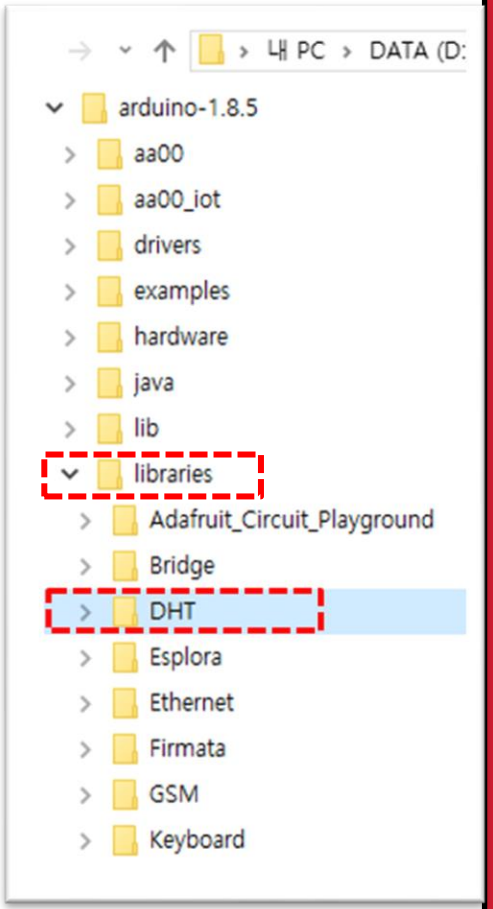
Arduino library for DHT11DHT22, etc Temp & Humidity Sensors http://www.ladyada.net/lea

54 commits 1 branch 8 releases

Branch: master New pull request

microbuilder Merged unified and raw libraries

.github	Add GitHub issue template
examples	Merged unified and raw libraries
DHT.cpp	Fix #44 by conditionally excluding unused port and bitmask state on n...
DHT.h	Fix #44 by conditionally excluding unused port and bitmask state on n...
DHT_U.cpp	Merged unified and raw libraries
DHT_U.h	Merged unified and raw libraries



A5.7.4 DHT22 + CdS : circuit

[1] Arduino code: AAnn_CdS_DHT22.ino

AAnn_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("AA00,")   // 주석 처리
    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
}
```

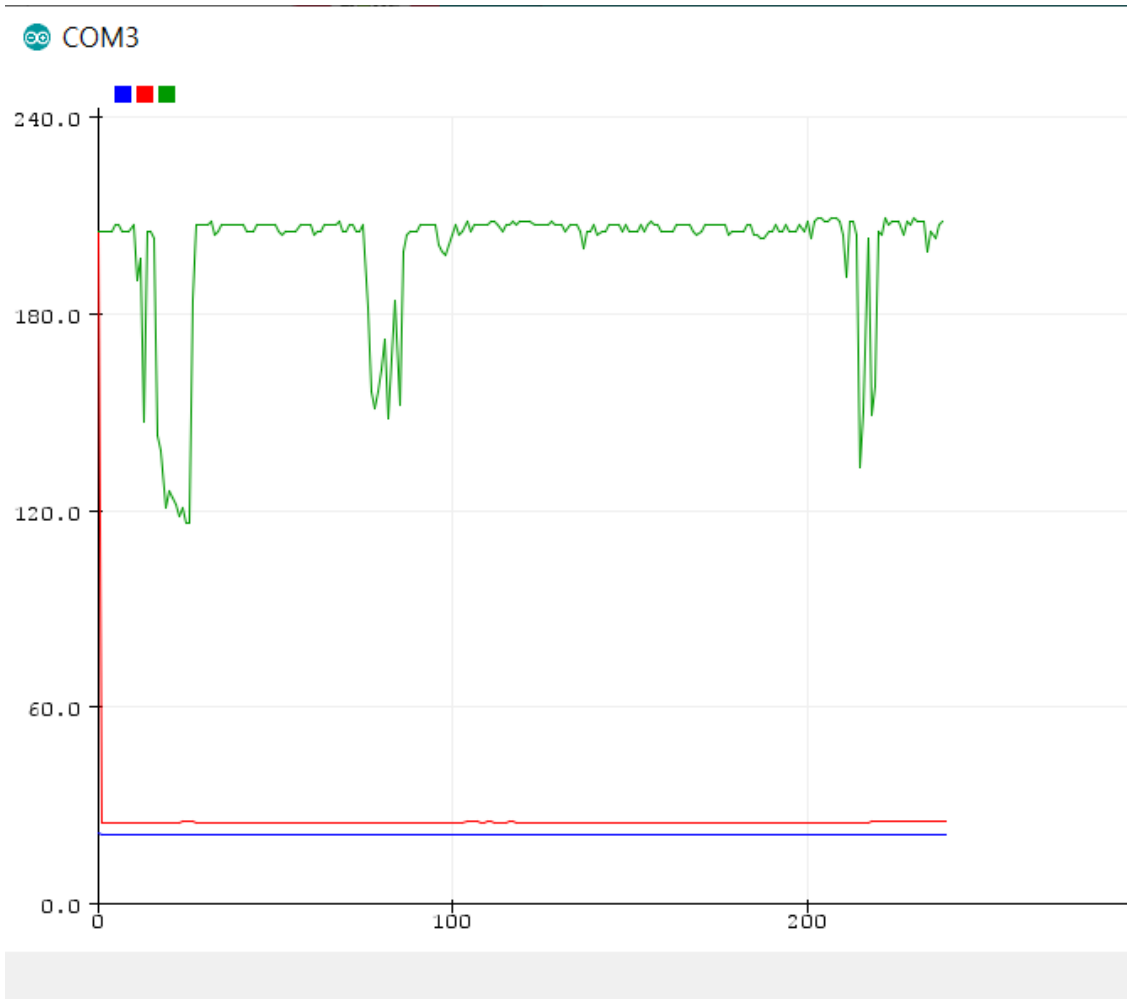
A5.7.5 DHT22 + CdS : Serial monitor

[1] Arduino code: AAnn_CdS_DHT22.ino

COM3

```
21.0,24.7,205
21.0,24.7,207
21.0,24.7,205
21.0,24.7,152
21.0,24.7,167
20.9,24.6,166
20.9,24.6,204
21.0,24.8,204
21.0,24.8,152
21.0,24.8,173
21.0,24.8,191
21.0,24.8,203
21.0,24.8,207
21.0,24.9,204
21.0,24.9,204
```

온도,습도,조도



A5.7.6 DHT22 + CdS + Node.js

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

aann > aann-rpt09 > Node > cds_dht22 > package.json > ...

```
{
  "name": "cds_tmp36",
  "version": "1.0.0",
  "description": "cds-dht22-node project",
  "main": "cds_dht22_node.js",
  ▷ 디버그
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "keywords": [
    "cds",
    "dht22",
    "node",
    "arduino"
  ],
  "author": "aa00",
  "license": "MIT",
  "dependencies": {
    "serialport": "^9.2.4",
    "socket.io": "^2.4.1"
  }
}
```

A5.7.7 DHT22 + CdS + Node.js

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

```
// cds_dht22_node.js

var serialport = require("serialport");
var portName = "COM3"; // check your COM port!!
var port = process.env.PORT || 3000;

var io = require("socket.io").listen(port);

const Readline = require("@serialport/parser-readline");
// serial port object
var sp = new serialport(portName, {
  baudRate: 9600, // 9600  38400
  dataBits: 8,
  parity: "none",
  stopBits: 1,
  flowControl: false,
  parser: new Readline("\r\n"),
});

const parser = sp.pipe(new Readline({ delimiter: "\r\n" }));

// Read the port data
sp.on("open", () => {
  console.log("serial port open");
});
```

A5.7.8 DHT22 + CdS + Node.js

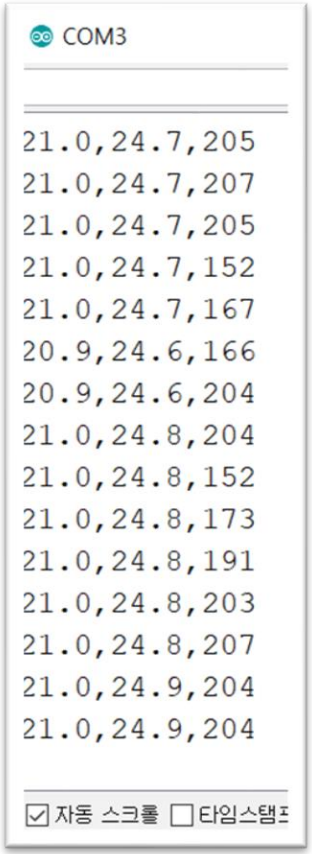
[2.3] NodeJS code: cds_dht22_node.js (Complete your parser code)

```
var dStr = "";
var readData = ""; //
var temp = "";
var humi = "";
var lux = "";
var mdata = []; // thi
var firstcommaidx = 0;
```

```
parser.on("data", (data) => {
  Complete your parser code!!
                                                    > 0) {
    readData = "";
    dStr = getDateString();
    mdata[0] = dStr; // Date
    mdata[1] = temp; // temperature data
    mdata[2] = humi; // humidity data
    mdata[3] = lux; // luminosity data
    console.log("AAnn," + mdata);
    io.sockets.emit("message", mdata); // send data to all clients
  } else {
    // error
    console.log(readData);
  }
});
```

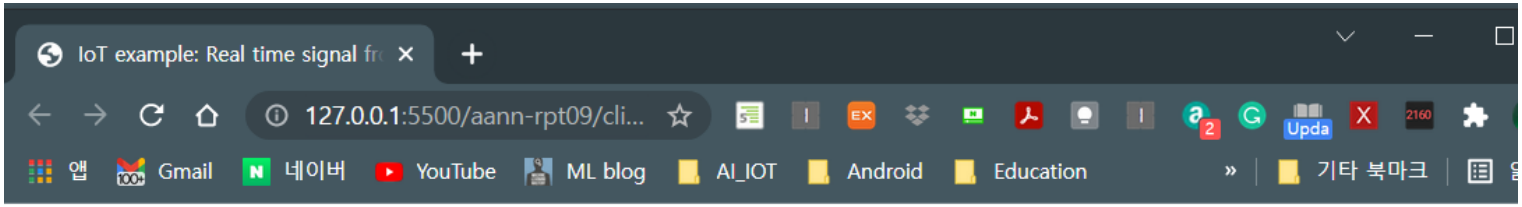
A5.7.10 DHT22 + CdS + Node.js

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



Save as
AAnn_cds_dht22_data.png

Arduino data on network socket



IoT Signal from Arduino Weather Station

Real-time Signals

---

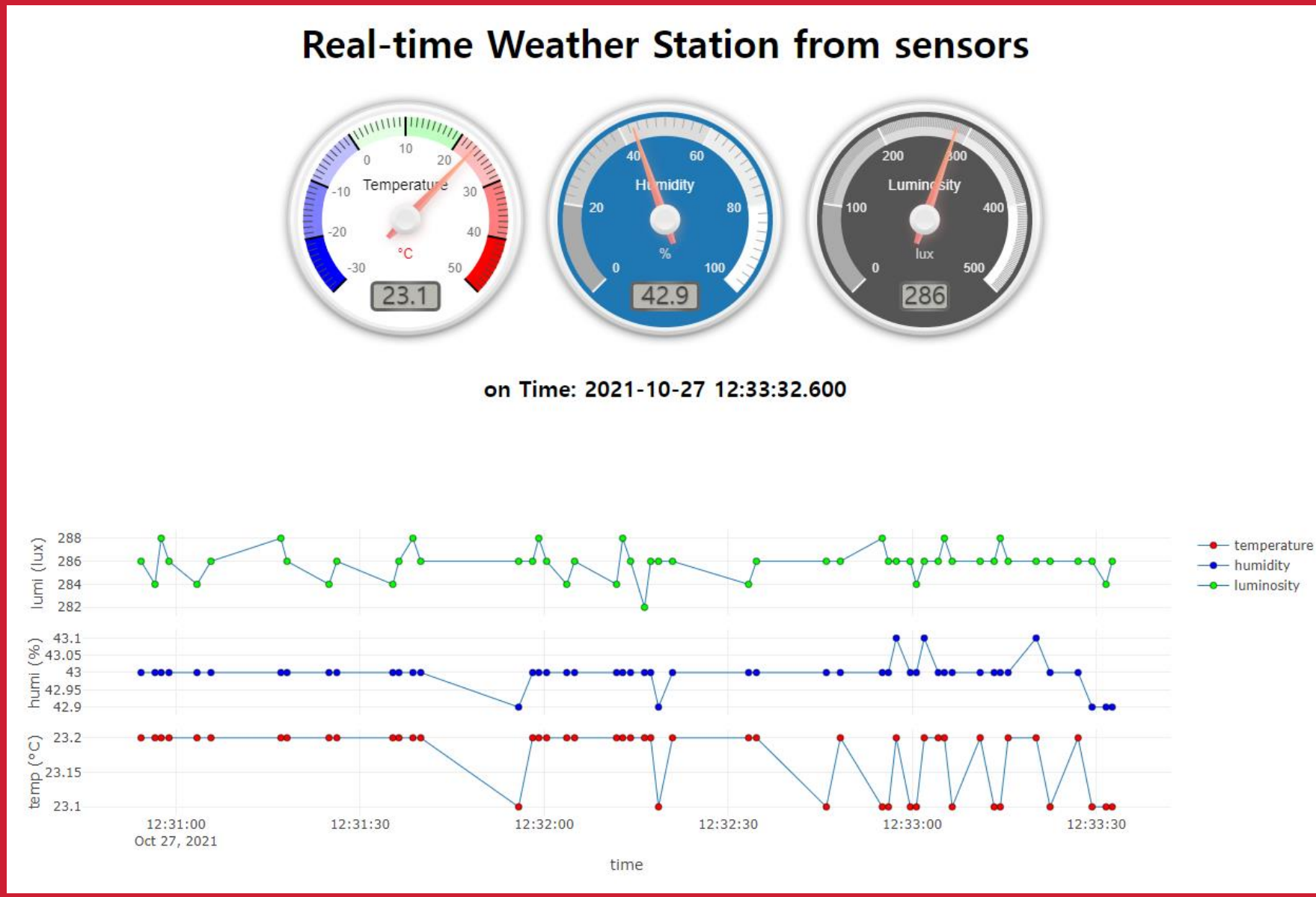
on Time: 2021-10-27 11:54:48.997

Signals (온도,습도,조도) : 23.4,42.6,286

Save as AAnn_signals_cds_dht22.html

Real-time monitoring of signals from Arduino CdS + DHT22 circuit

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

[4.7] WEB client: client_cds_dht22.html - layout

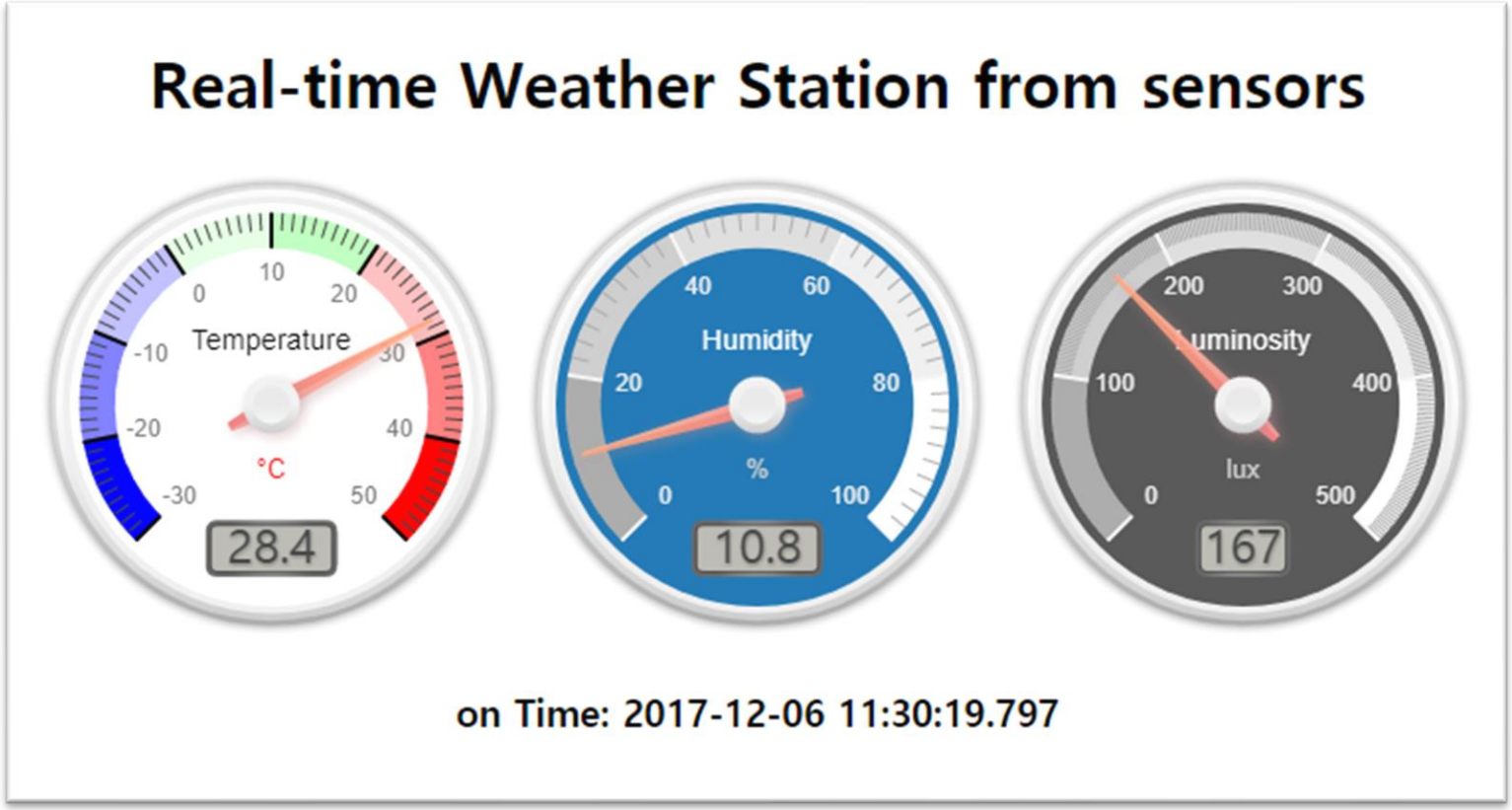
```
var layout = {
    xaxis : {
        title : 'time',
        domain : [0, 1]
    },
    yaxis : {
        title : 'temp (°C)',
        domain : [0, 0.3],
        range : [-30, 50]
    },
    xaxis2 : {
        title : '',
        domain : [0, 1],
        position : 0.35
    },
    yaxis2 : {
        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 AAnn_cds_dht22.html

A5.8.8 DHT22 + CdS + Node.js

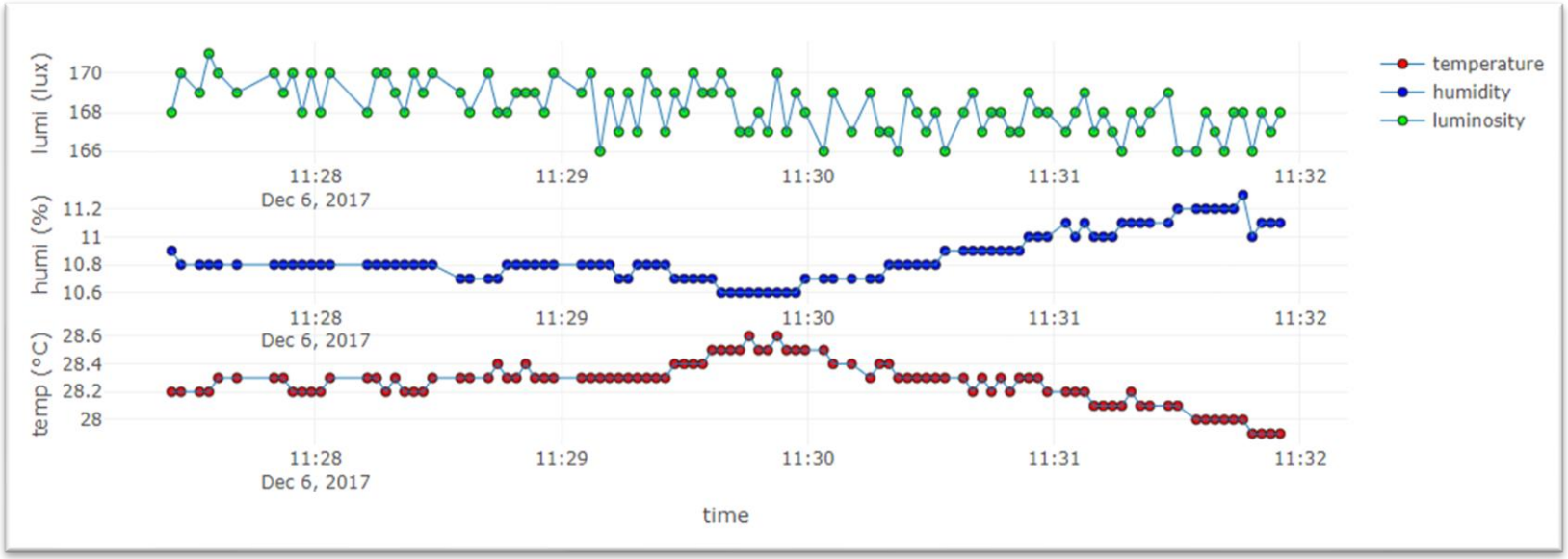
[4.8] WEB client: client_dht22_ldr.html – Design your gauges

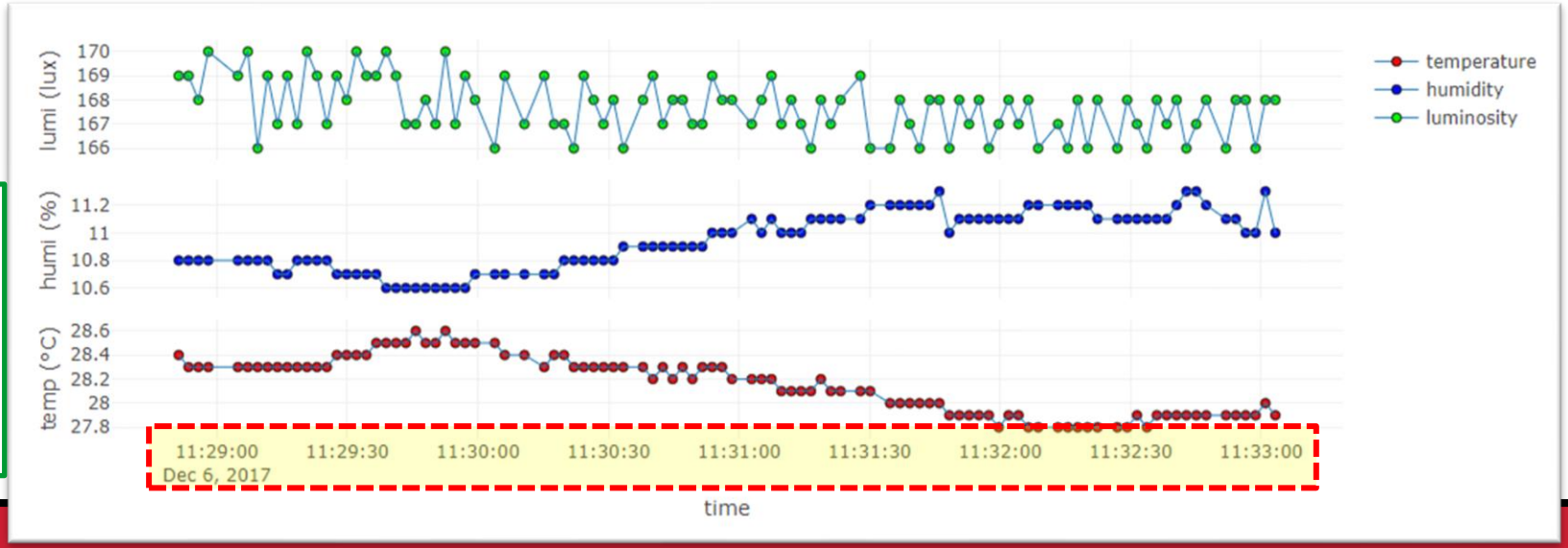


Save the complete code as AAnn_cds_dht22.html

A5.8.9 DHT22 + CdS + Node.js

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





[Hint]

[Plot.ly]

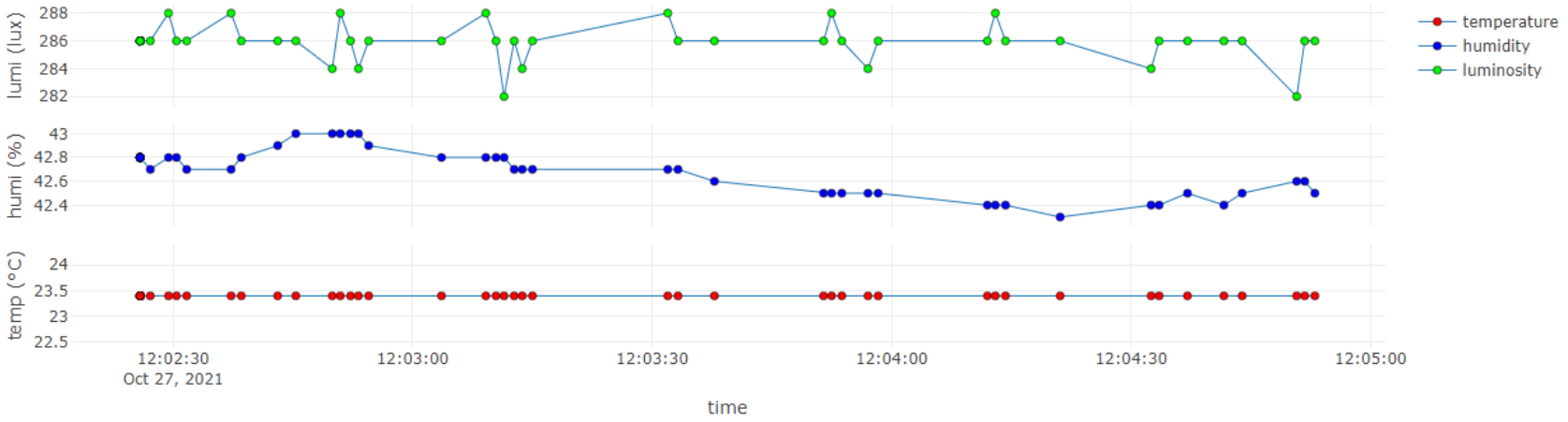
WEB client： client_cds_dht22.html

Real-time Weather Station from sensors

on Time: 2021-10-27 12:04:53.016

Save as

AAnn_cds_dht22.png



[Practice]

- [wk09: cds_dht22]
  - RT Data Visualization with node.js
  - Multiple data and Usage of gauge.js
  - Complete your real-time WEB charts
  - Upload folder: aann-rpt09
  - Use repo “aann” in github

wk09 : Practice : aann-rpt09

- [Target of this week]
  - Complete your works : **cds_dht22 project.**
  - **Save your outcomes and upload outputs in github**

제출폴더명 : **aann-rpt09**

- 제출할 파일들

① **AAnn_cds_dht22_data.png**

② **AAnn_signals_cds_dht22.html**

③ **AAnn_cds_dht22.html**

④ **AAnn_cds_dht22.png**

⑤ **All *.ino**

⑥ **All *.js**

⑦ **All *.html**

A5. Introduction to IoT service

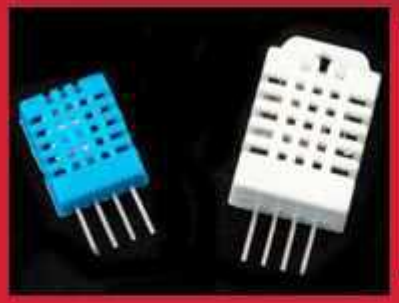
System (Arduino, sDevice, ...)

Data (signal, image, sns, ...)

Visualization & monitoring

Data storaging & mining

Service



[Goal]

Arduino + Node.js

+ plotly.js

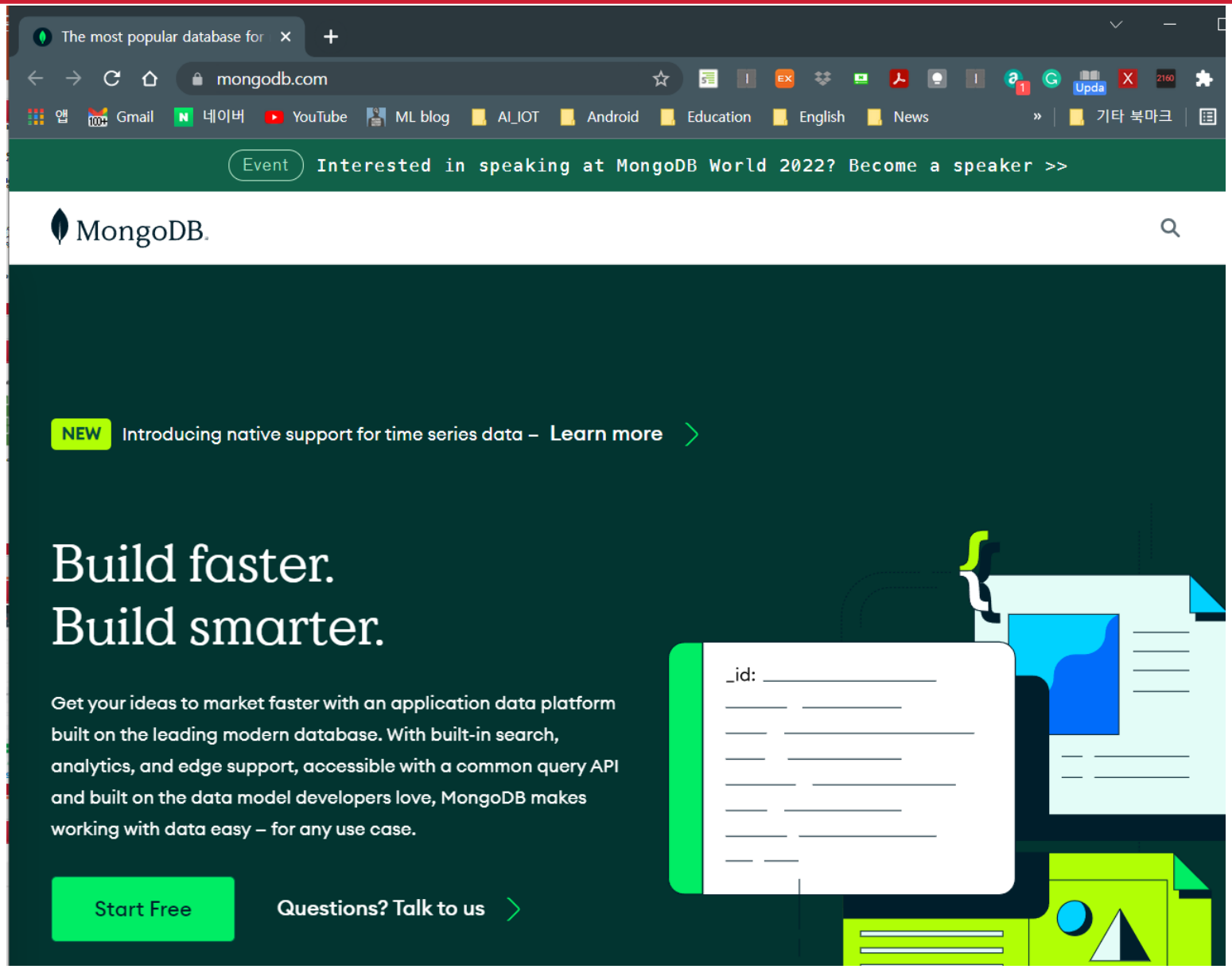
+ MongoDB

→ Data storaging

& visualization

A5.9 MongoDB

A5.9 MongoDB


The most popular database for
mongodb.com
앱 Gmail 네이버 YouTube ML blog AI_IOT Android Education English News 기타 북마크
Event Interested in speaking at MongoDB World 2022? Become a speaker >>
MongoDB.
NEW Introducing native support for time series data – Learn more
Build faster.
Build smarter.
Get your ideas to market faster with an application data platform built on the leading modern database. With built-in search, analytics, and edge support, accessible with a common query API and built on the data model developers love, MongoDB makes working with data easy – for any use case.
Start Free
Questions? Talk to us
_id:

A5.9 MongoDB

MongoDB는 C++로 작성된 오픈소스 문서지향(Document-Oriented) 적 Cross-platform 데이터베이스이며, 뛰어난 확장성과 성능을 자랑합니다. 또한, 현존하는 NoSQL 데이터베이스 중 인지도 1위를 유지하고있습니다.

NoSQL?

흔히 NoSQL이라고 해서 아, SQL이 없는 데이터베이스구나! 라고 생각 할 수도 있겠지만, 진짜 의미는 Not Only SQL 입니다. 기존의 RDBMS의 한계를 극복하기 위해 만들어진 새로운 형태의 데이터저장소 입니다. 관계형 DB가 아니므로, RDMS처럼 고정된 스키마 및 JOIN 이 존재하지 않습니다.

Document?

Document Oriented 데이터베이스라는데.. 여기서 말하는 Document가 뭘까요? 문서? 이게 그냥 '문서' 로 번역해버리면 조금은 애매합니다. 문서라고 하면 보통 워드/엑셀에 사용되는 그런 문서가 떠오르는데요, 그것과는 다릅니다. Document는 RDMS의 record 와 비슷한 개념인데요, 이의 데이터 구조는 한개이상의 key-value pair 으로 이뤄져있습니다. MongoDB 샘플 Document를 확인 해 볼까요?

```
{ "_id": ObjectId("5099803df3f4948bd2f98391"),
"username": "velopert",
"name": { first: "M.J.", last: "Kim" } }
```

여기서 _id, username, name 은 key 이고 그 오른쪽에 있는 값들은 value 입니다.

_id 는 12bytes의 hexadecimal 값으로서, 각 document의 유일함(uniqueness)을 제공합니다.
이 값의 첫 4bytes 는현재 timestamp, 다음 3bytes는 machine id, 다음 2bytes는 MongoDB 서버의 프로세스id, 마지막 3bytes는 순차번호입니다 추가될때마다 값이 높아진다는거지요.

Document는 동적(dynamic)의 schema 를 갖고있습니다. 같은 Collection 안에 있는 Document 끼리 다른 schema 를 갖고 있을 수 있는데요, 쉽게 말하면 서로 다른 데이터 (즉 다른 key) 들을 가지고 있을 수 있습니다.

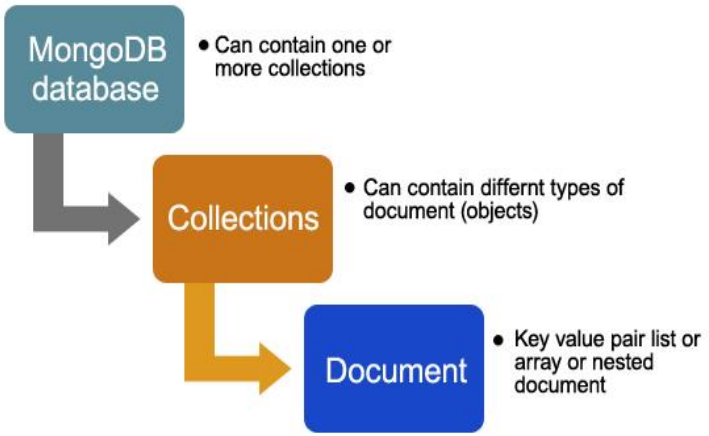
Collection?

Collection은 MongoDB Document의 그룹입니다. Document들이 Collection내부에 위치하고 있습니다. RDMS의 table과 비슷한 개념입니다만 RDMS와 달리 schema를 따로 가지고 있지않습니다. Document 부분설명에 나와있듯이 각 Document들이 동적인 schema를 가지고 있으니까요

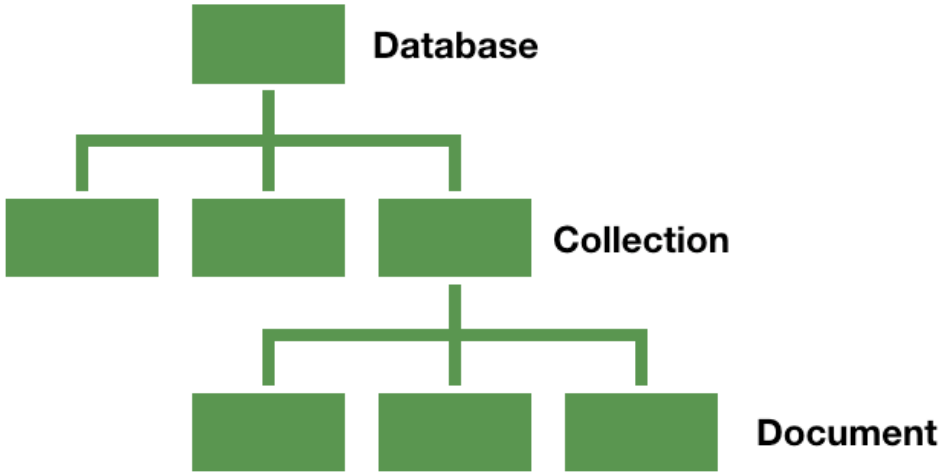
Database?

Database는 Collection들의 물리적인 컨테이너입니다. 각 Database는 파일시스템에 여러파일들로 저장됩니다.

A5.9 MongoDB

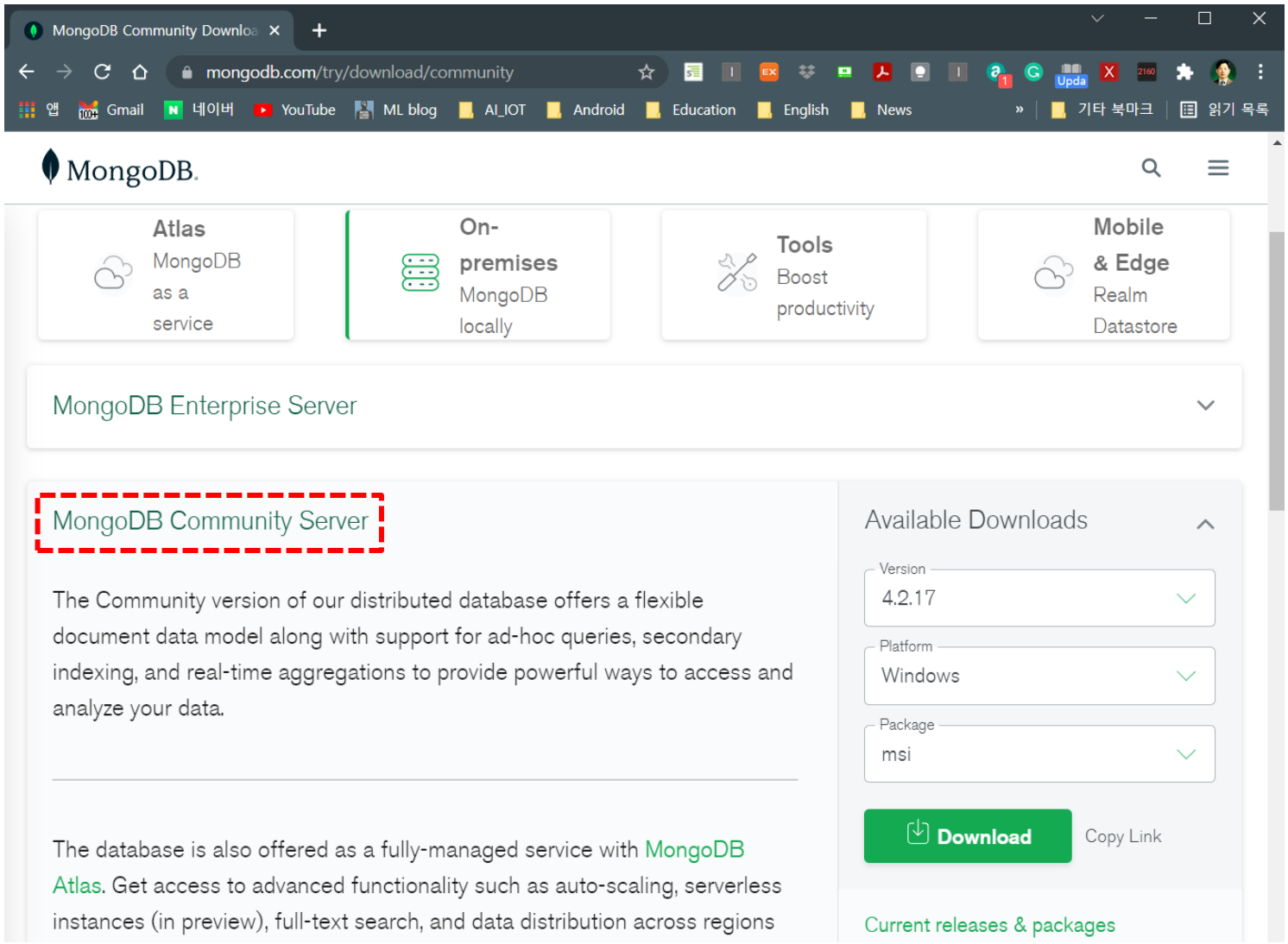


https://cdn.educba.com/academy/wp-content/uploads/2019/04/MongoDB-chart2.jpg



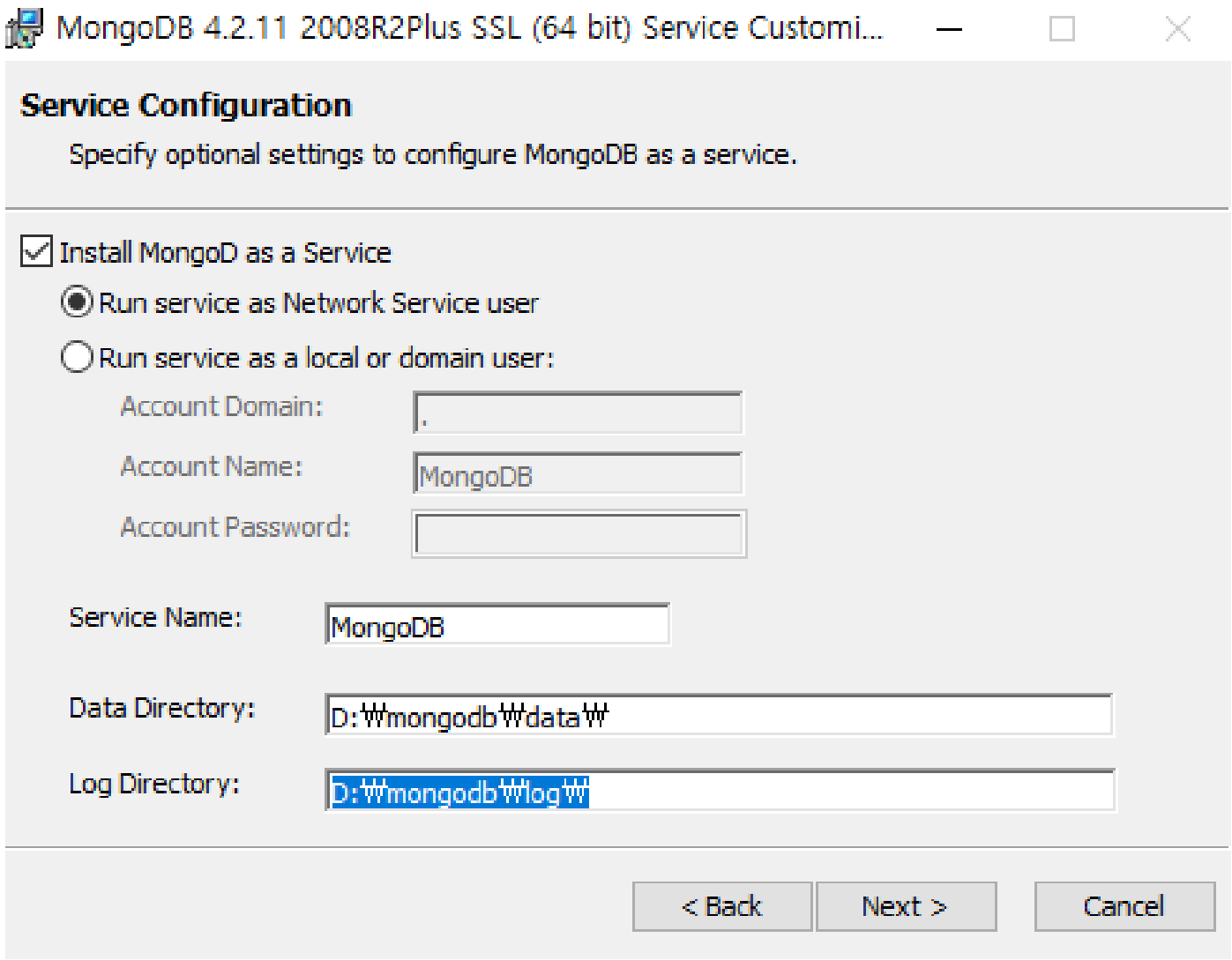
https://i.imgur.com/Att4uVC.png

A5.9 MongoDB: download



https://www.mongodb.com/try/download/community

A5.9 MongoDB: folder



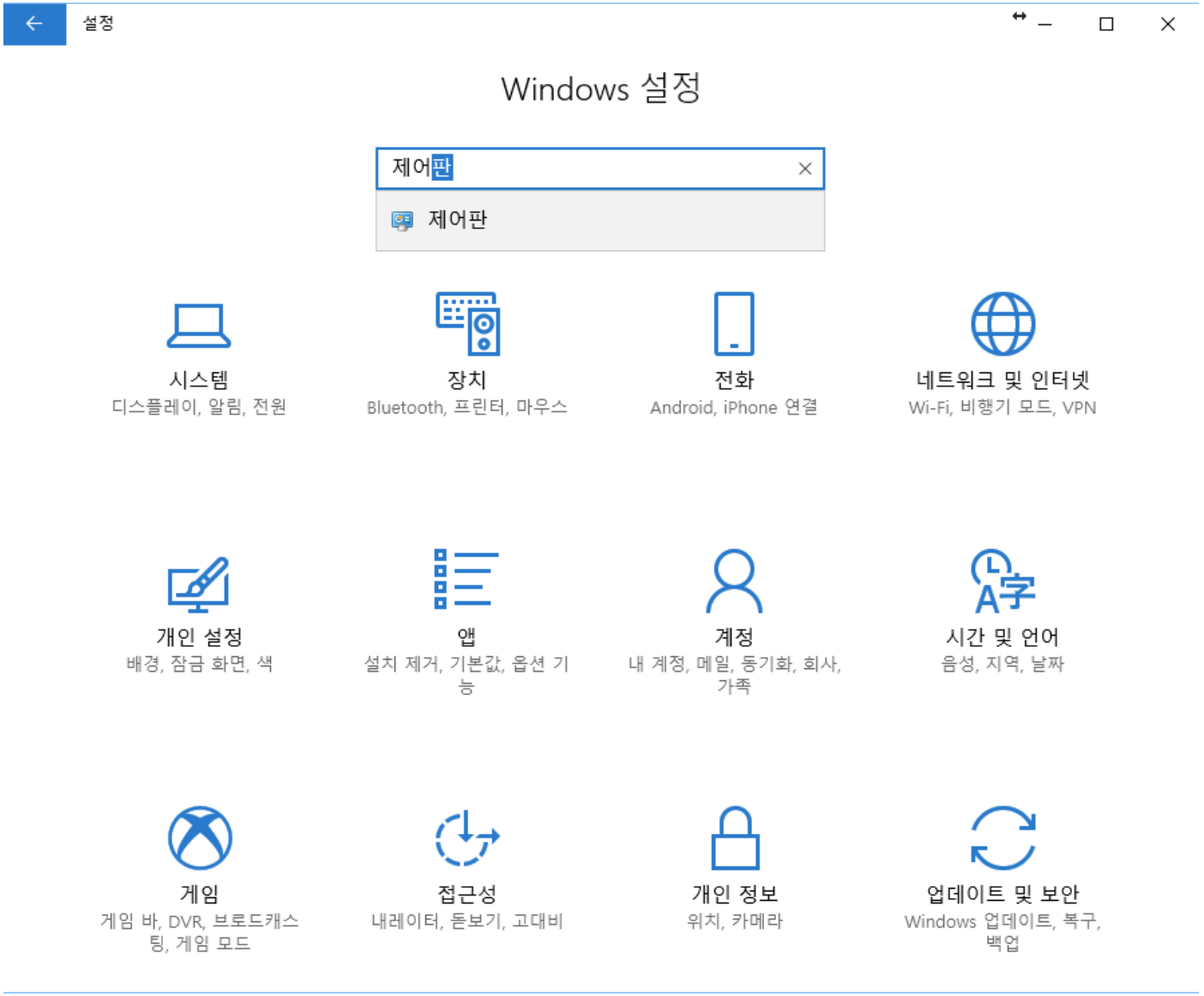
A5.9.1 MongoDB install - 1

윈도우10: 설정 > 시스템 > 정보

[중요] 시스템 환경변수 : **PATH** 에 경로 추가

C:\Program Files\MongoDB\Server\4.2\bin

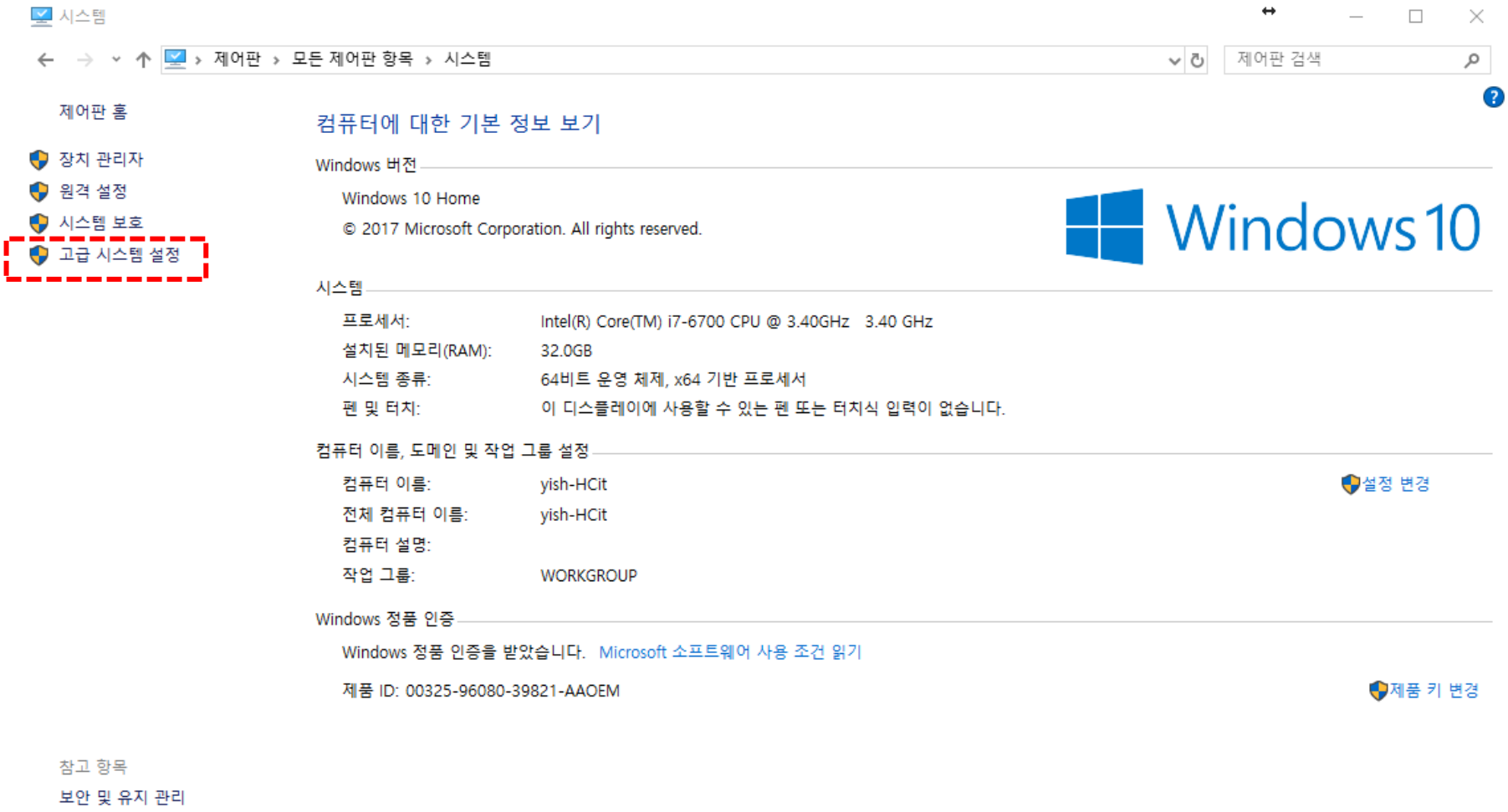
A5.9.1 MongoDB install – 2



A5.9.1 MongoDB install – 3

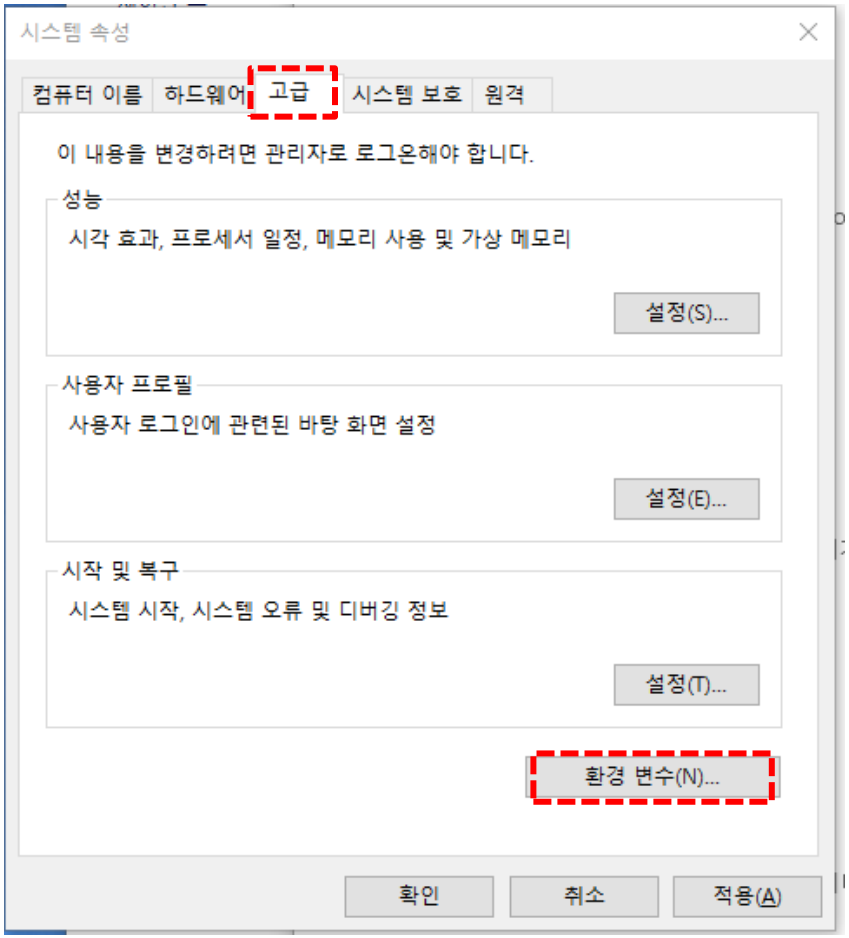
윈도우10: 설정 > '제어판' 검색 > 모든 제어판 항목에서 '시스템' 선택

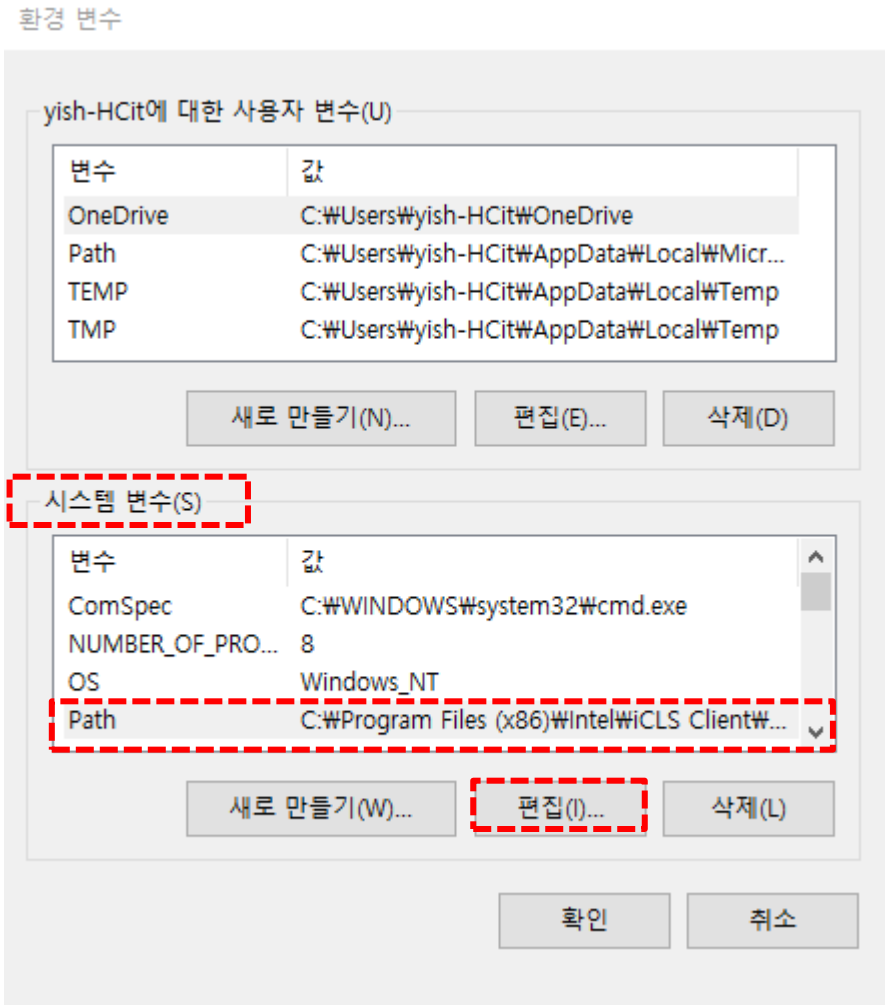
> 고급 시스템 설정



A5.9.1 MongoDB install – 4

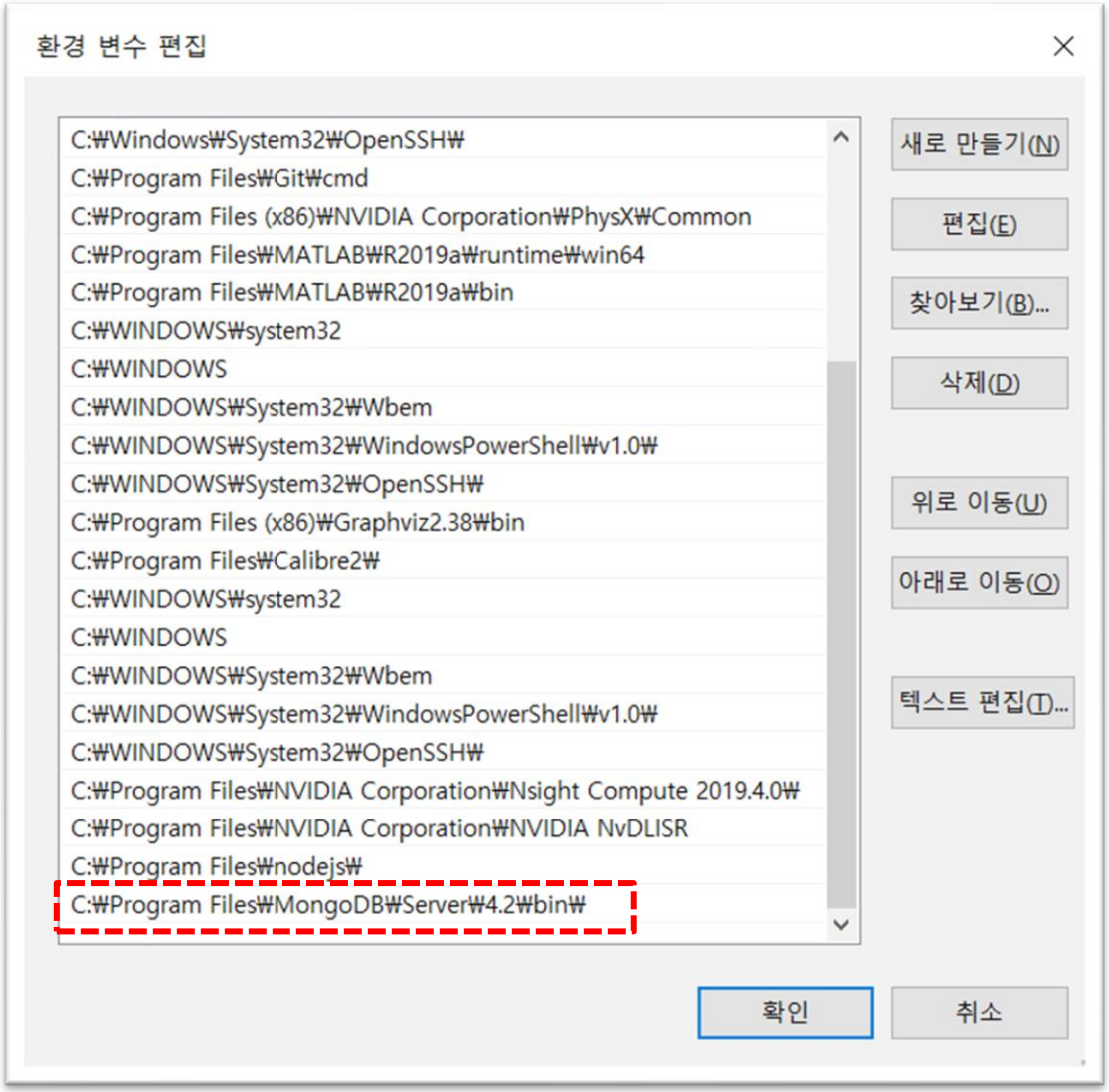
환경 변수 설정





A5.9.1 MongoDB install – 5

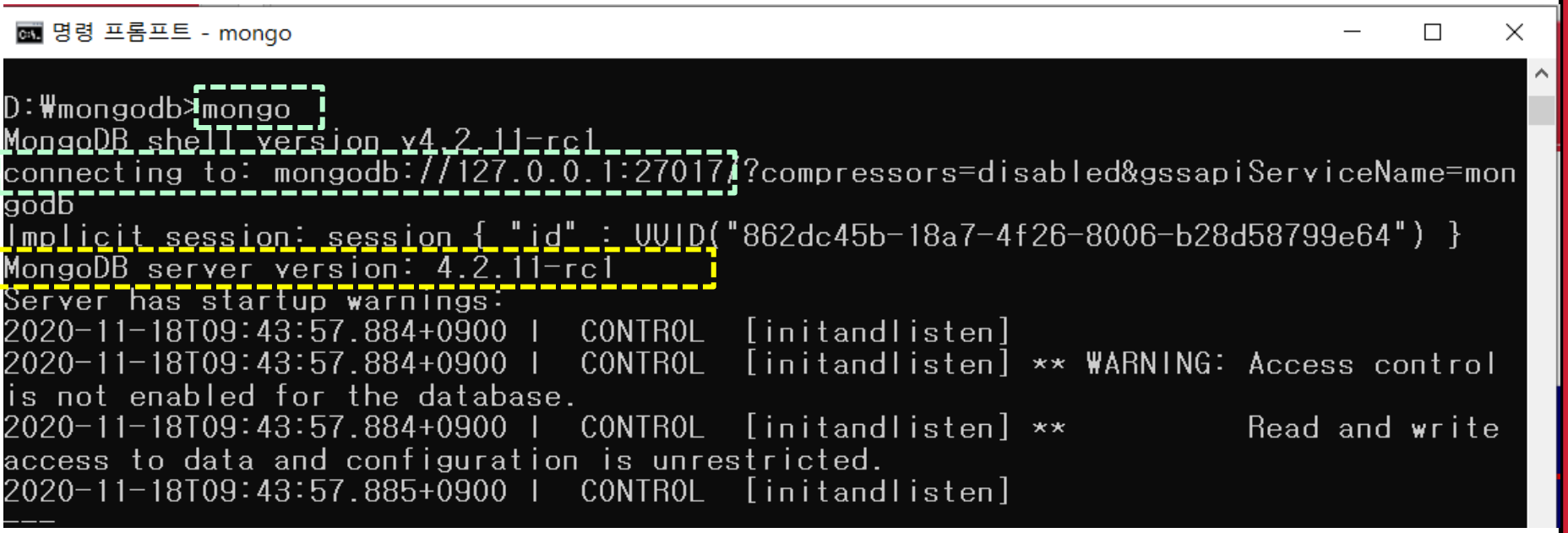
환경 변수 추가



A5.9.2 MongoDB shell - 1

1. Mongo shell 실행

> mongo (or mongosh)

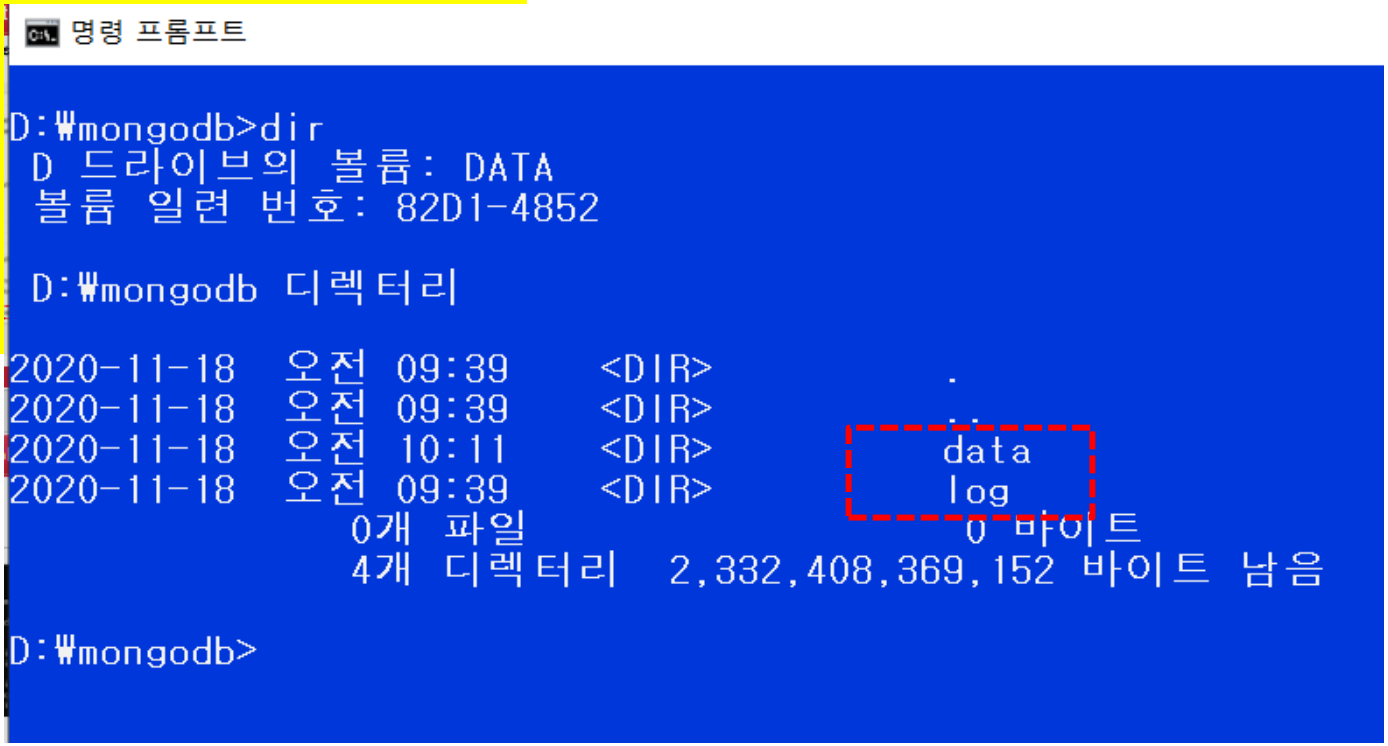


If, Connect failed... → DB 데몬 실행

A5.9.2 MongoDB shell - 2

2. MongoDB 저장소 만들기 → D drive

- md mongodb
- cd mongodb
- dir
- md data
- md log
- dir



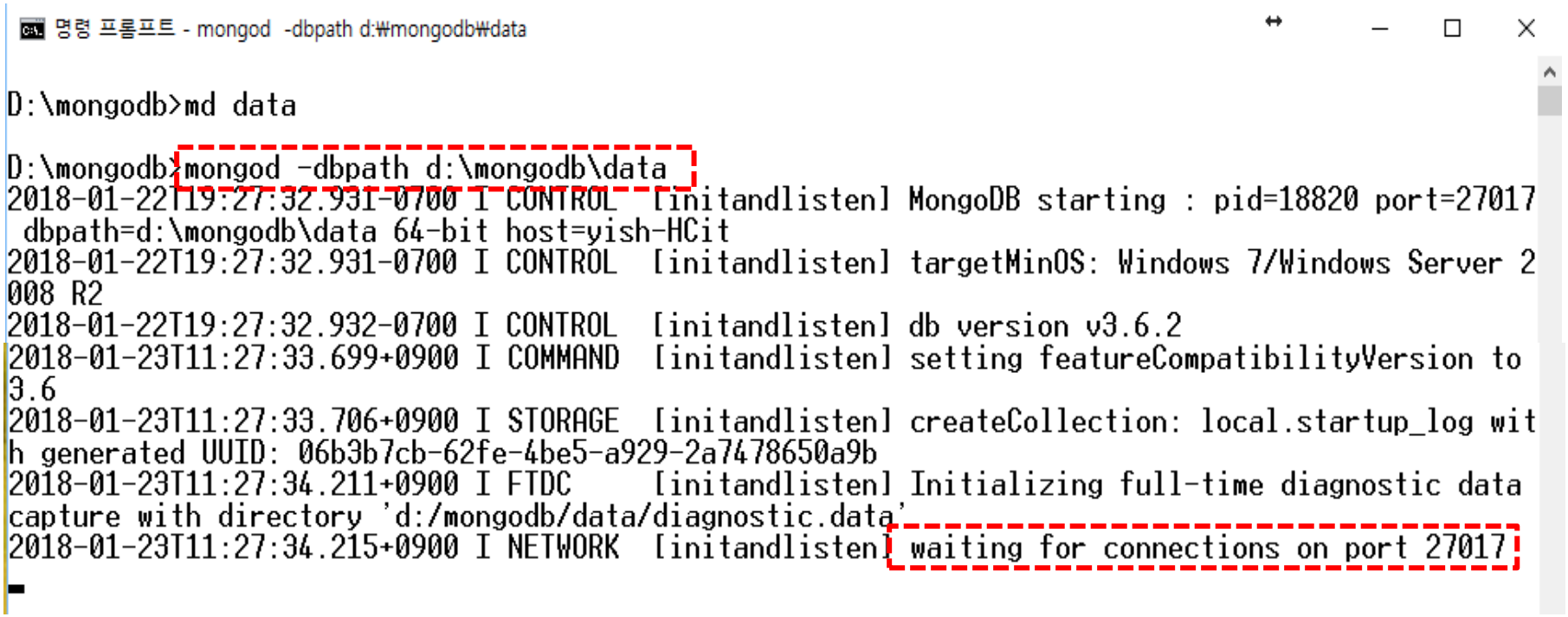
사용 PC 환경에 맞게 실행 (특히, 경로 지정)

실습실 환경에 맞춰서 D:에 mongoDB data 폴더 지정

A5.9.2 MongoDB shell - 3

3. Run MongoDB by using mongod.exe

- **mongod --dbpath d:\mongodb\data**



사용 PC 환경에 맞게 실행 (특히, 경로 지정)

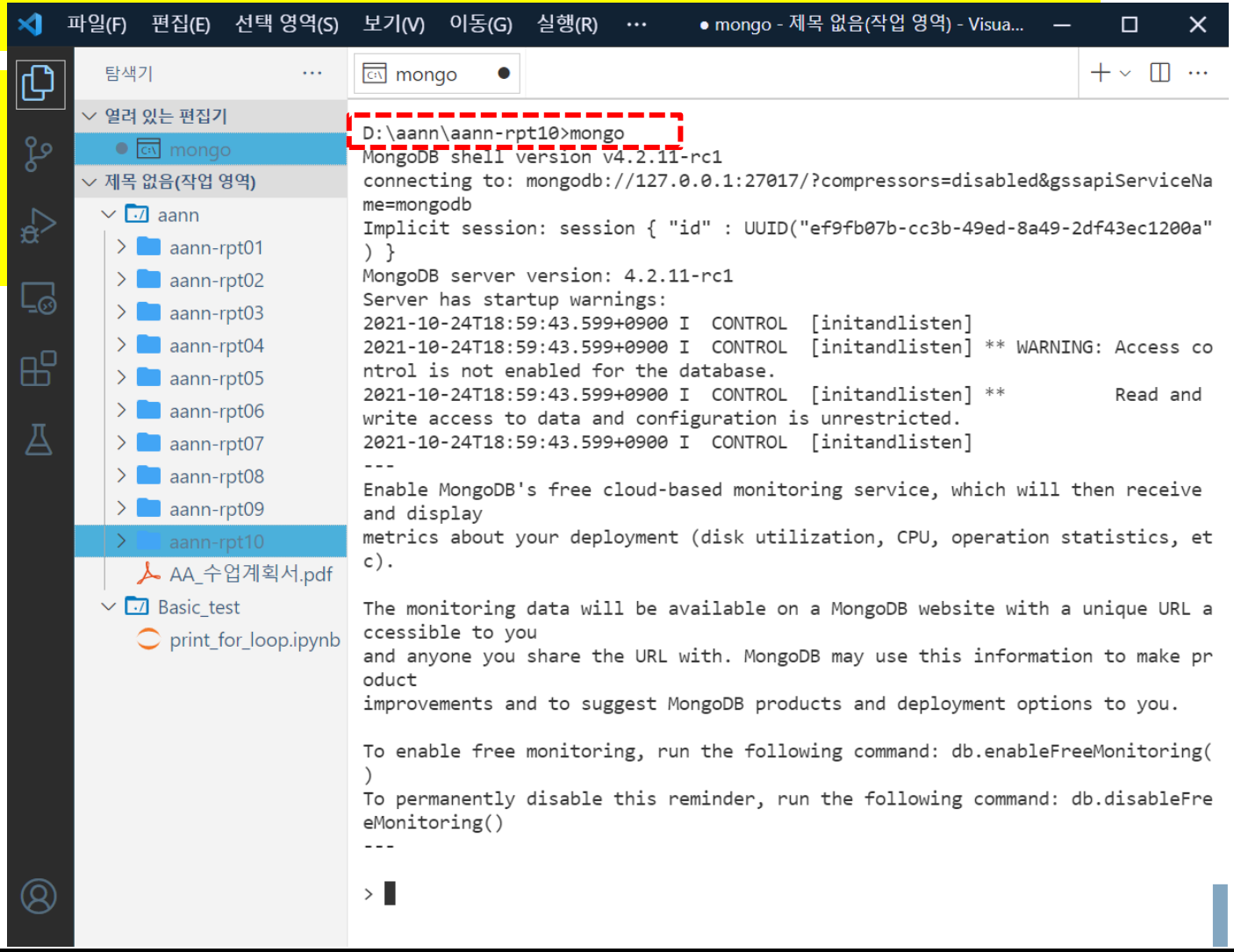
A5.9.2 MongoDB shell – 4

4. Run mongo shell : mongo.exe [use new cmd or Terminal]

- **mongo**

Run in Terminal

mongo



A5.9.2 MongoDB shell - 5

5. mongo shell :

Run new cmd

mongo

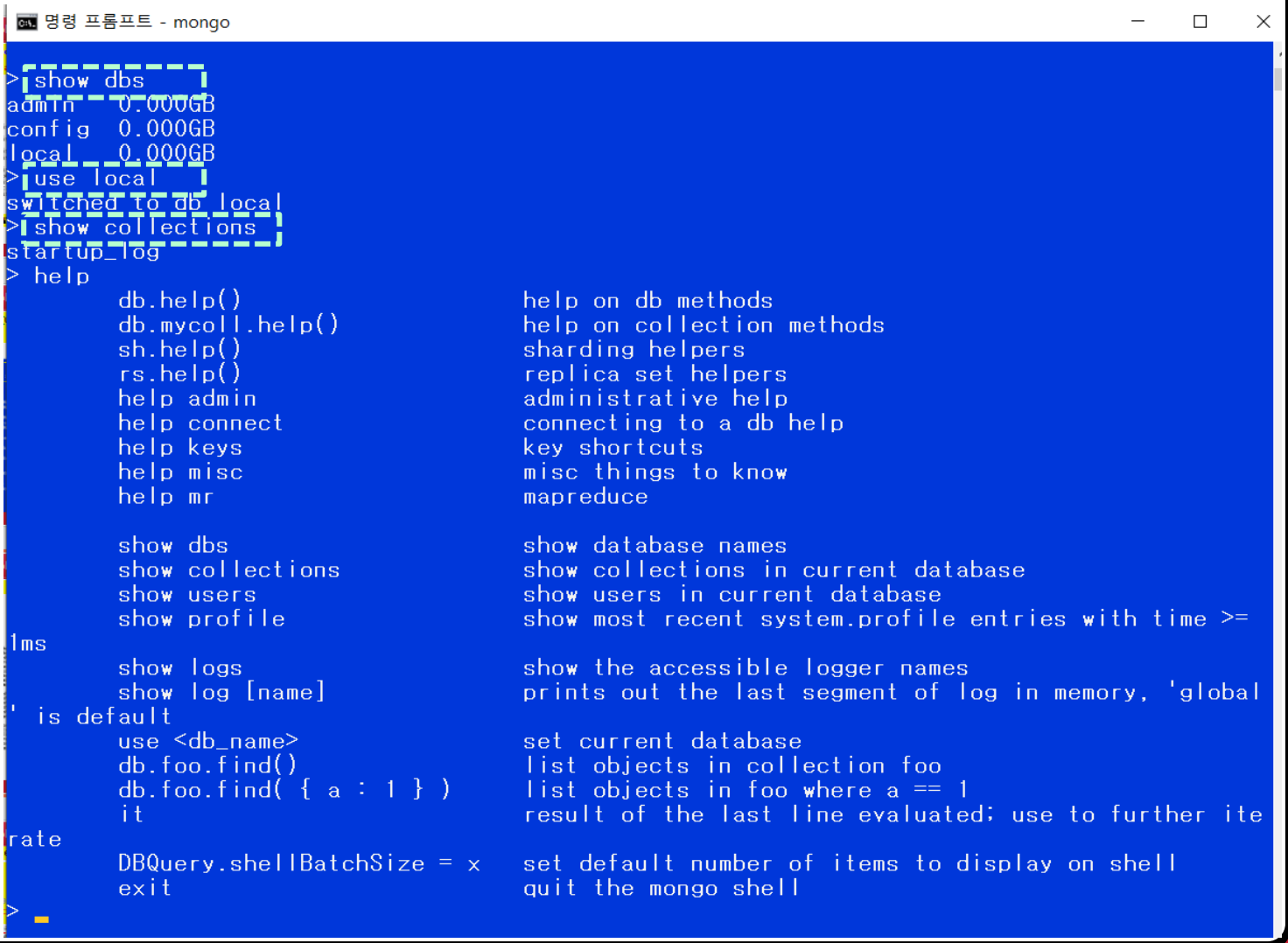
show dbs

use local

show collections

help

exit



A5.9.3 MongoDB shell coding

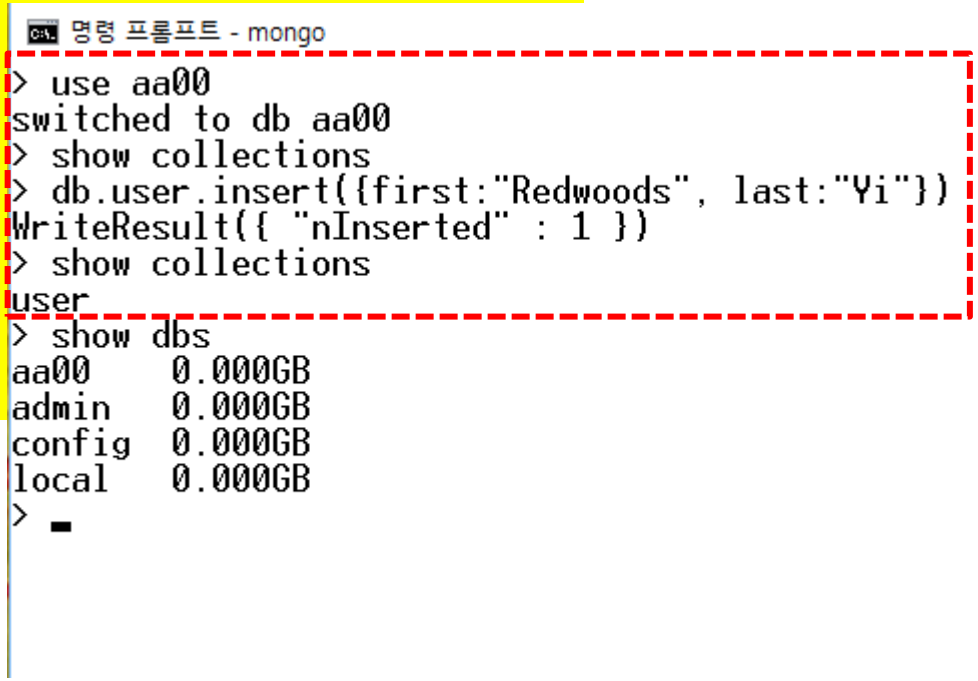
1. make my own db (aann) & insert one record (document)

```
use aa00
show collections

insert record with new collection “user”
db.user.insert({first:”Redwoods”, last:”Yi”})

show collections
→ “user”
show dbs

db.user.find()
```



A5.9.3 MongoDB shell coding

2. insert more records with different schema & show records

insert record2
insert record3

show collections

db.user.find()

db.user.find().pretty()

```
명령 프롬프트 - mongo
> db.user.insert({first:"Chaos", last:"Kim"})
WriteResult({ "nInserted" : 1 })
> db.user.insert({first:"Gildong", last:"Hong"})
WriteResult({ "nInserted" : 1 })
> show collections
user
> db.user.find()
{ "_id" : ObjectId("5a66b44b9f0d55608f5f7582"), "first" : "Redwoods", "last" : "Yi" }
{ "_id" : ObjectId("5a66b5759f0d55608f5f7583"), "first" : "Chaos", "last" : "Kim" }
{ "_id" : ObjectId("5a66b5869f0d55608f5f7584"), "first" : "Gildong", "last" : "Hong" }
> db.user.find().pretty()
{
        "_id" : ObjectId("5a66b44b9f0d55608f5f7582"),
        "first" : "Redwoods",
        "last" : "Yi"
}
{
        "_id" : ObjectId("5a66b5759f0d55608f5f7583"),
        "first" : "Chaos",
        "last" : "Kim"
}
{
        "_id" : ObjectId("5a66b5869f0d55608f5f7584"),
        "first" : "Gildong",
        "last" : "Hong"
}
>
```

_id 는 12bytes의 hexadecimal 값으로서, 각 document의 유일함(uniqueness)을 제공합니다.
이 값의 첫 4bytes는 현재 timestamp, 다음 3bytes는 machine id, 다음 2bytes는 MongoDB 서버의 프로세스id, 마지막 3bytes는 순차번호입니다.

A5.9.3 MongoDB shell coding

3. insert more records with different schema & show records

insert record4
with firstName key

db.user.find()

db.user.find().pretty()

```
명령 프롬프트 - mongo
> db.user.insert({firstName:"Fractal", last:"Park"})
WriteResult({ "nInserted" : 1 })
> db.user.find().pretty()
{
        "_id" : ObjectId("5a66b44b9f0d55608f5f7582"),
        "first" : "Redwoods",
        "last" : "Yi"
}
{
        "_id" : ObjectId("5a66b5759f0d55608f5f7583"),
        "first" : "Chaos",
        "last" : "Kim"
}
{
        "_id" : ObjectId("5a66b5869f0d55608f5f7584"),
        "first" : "Gildong",
        "last" : "Hong"
}
{
        "_id" : ObjectId("5a66b6439f0d55608f5f7585"),
        "firstName" : "Fractal",
        "last" : "Park"
}
>
```

Dynamic schema

동적스키마

Note that there are two kinds of schemas in JSON.
Save as

AAnn_mongo_schemas.png

A5.9.3 MongoDB shell coding

4. remove one of records (or documents)

remove record3

db.user.find().pretty()

명령 프롬프트 - mongo

```
> db.user.remove({last:"Kim"})
WriteResult({ "nRemoved" : 1 })
> db.user.find().pretty()
{
        "_id" : ObjectId("5a66b44b9f0d55608f5f7582"),
        "first" : "Redwoods",
        "last" : "Yi"
}
{
        "_id" : ObjectId("5a66b5869f0d55608f5f7584"),
        "first" : "Gildong",
        "last" : "Hong"
}
{
        "_id" : ObjectId("5a66b6439f0d55608f5f7585"),
        "firstName" : "Fractal",
        "last" : "Park"
}
>
```

A5.9.3 MongoDB shell coding

5. update a record

```
db.user.update({last:"Hong"},{$set:{first:"GilDong", age:21}})
```

update record2

db.user.find().pretty()

명령 프롬프트 - mongo

```
> db.user.update({last:"Hong"},{$set:{first:"GilDong", age:21}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.user.find().pretty()
{
        "_id" : ObjectId("5a66b44b9f0d55608f5f7582"),
        "first" : "Redwoods",
        "last" : "Yi"
}
{
        "_id" : ObjectId("5a66b5869f0d55608f5f7584"),
        "first" : "GilDong",
        "last" : "Hong",
        "age" : 21
}
{
        "_id" : ObjectId("5a66b6439f0d55608f5f7585"),
        "firstName" : "Fractal",
        "last" : "Park"
}
> _
```

Note that it is possible to change schema.

Save as

AAnn_mongo_update.png

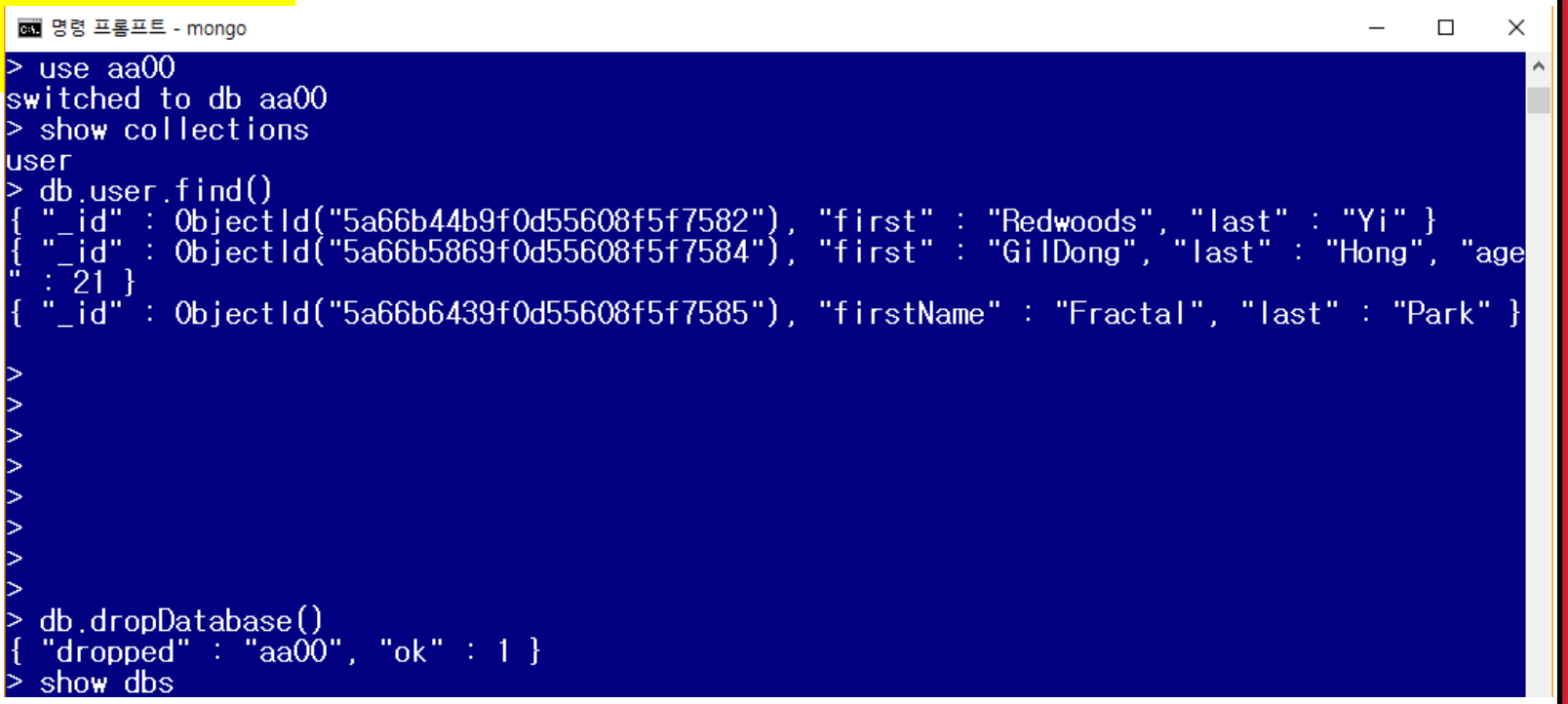
A5.9.3 MongoDB shell coding

6. Delete(or remove) DB

use dbName

db.dropDatabase()

show dbs



Node.js

+

MongoDB

A5.9.4 MongoDB + Node.js：mongoose

Fork me on GitHub

mongoose

elegant mongodb object modeling for node.js

read the docs　discover plugins

Star　Version 6.0.12　Fork

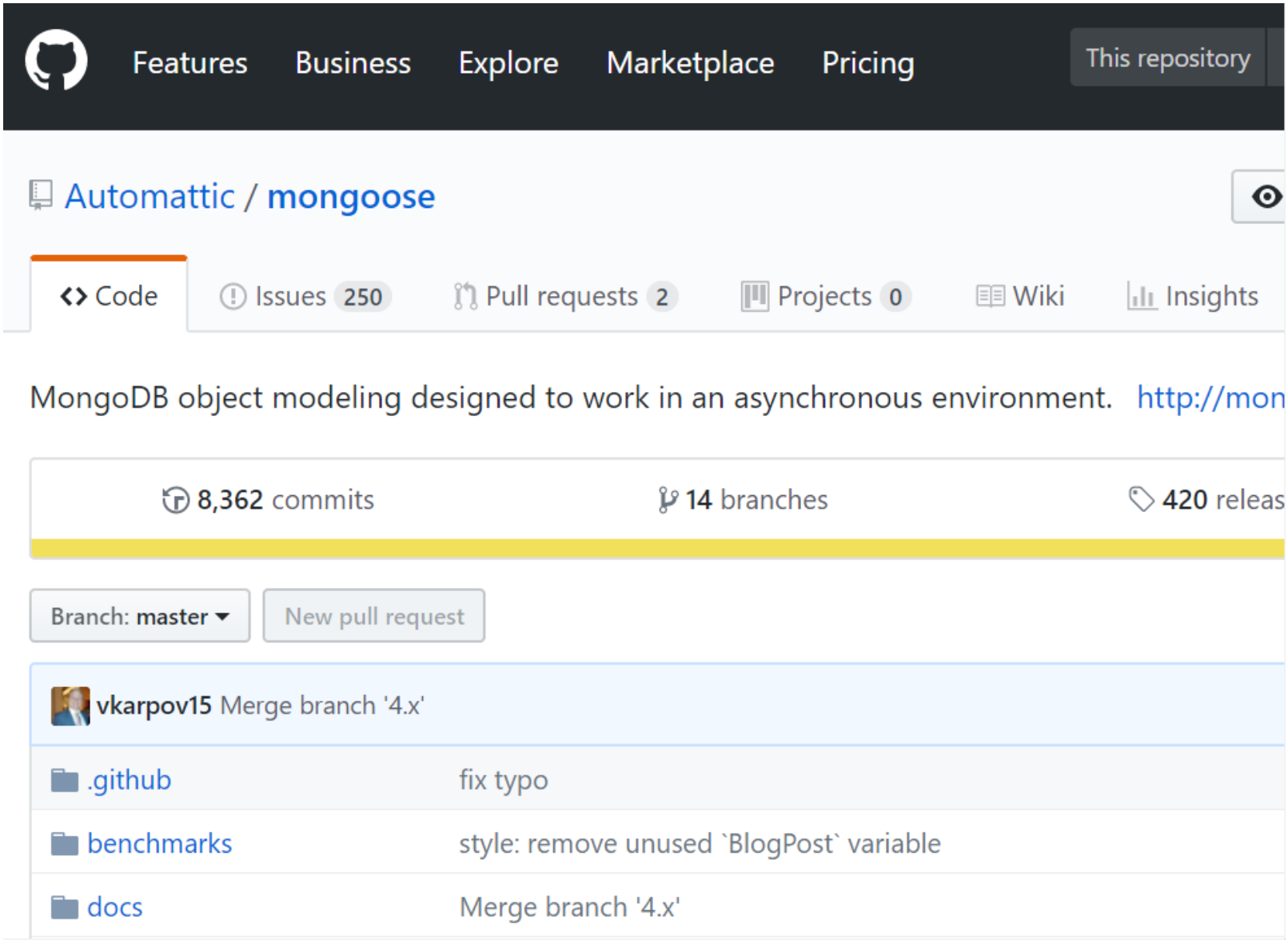
Let's face it, **writing MongoDB validation, casting and business logic boilerplate is a drag**. That's why we wrote Mongoose.

```
const mongoose = require('mongoose');
mongoose.connect('mongodb://localhost:27017/test');

const Cat = mongoose.model('Cat', { name: String });
```

http://mongoosejs.com/

A5.9.4 MongoDB + Node.js : mongoose



https://github.com/Automattic/mongoose

A5.9.4 MongoDB + Node.js : mongooseJS

1. Install mongoose in node.js project http://mongoosejs.com/

- Go to cds_dht22 project
- npm install --save mongoose (버전 : 6.0.12)

문제 출력 디버그 콘솔 터미널 cmd

```
D:\aann\aann-rpt10\cds_dht22>npm install --save mongoose
npm notice created a lockfile as package-lock.json. You should commit this
file.
npm WARN cds_dht22@1.0.0 No repository field.

+ mongoose@6.0.12
added 24 packages from 60 contributors, removed 10 packages and audited 68
packages in 2.941s

4 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities
```

A5.9.4 MongoDB + Node.js : mongoose

2. node.js project using mongoose (use VSCode)

- cds_dht22 project
- New file: dbtest.js
- Run:
  node dbtest

aann > aann-rpt10 > cds_dht22 > JS dbtest.js > ...

```
1   // dbtest.js
2   var mongoose = require("mongoose");
3   mongoose.connect("mongodb://localhost/test", {
4     useNewUrlParser: true,
5     useUnifiedTopology: true,
6   });
7
8   var SensorSchema = new mongoose.Schema({
9     data: String,
10    created: Date,
11  });
12
13  // data model
14  var Sensor = mongoose.model("Sensor", SensorSchema);
15
16  var sensor1 = new Sensor({ data: "124", created: new Date() });
17  sensor1.save();
18
19  var sensor2 = new Sensor({ data: "573", created: new Date() });
20  sensor2.save();
21
22  console.log("Sensor data were saved in MongoDB");
```

```
Sensor data were saved in MongoDB
```

A5.9.4 MongoDB + Node.js : mongoose

3. node.js project using mongoose (mongo shell)

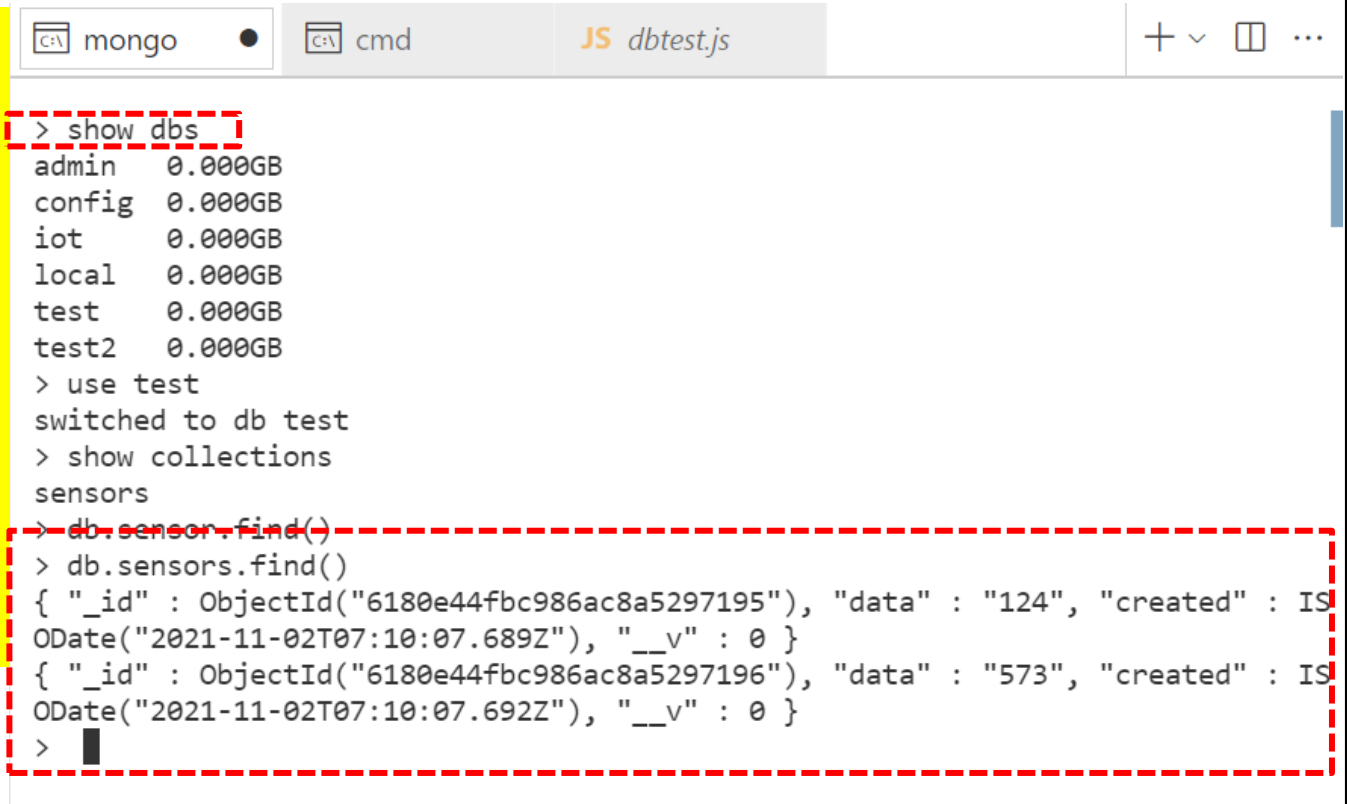
Mongo shell

> show dbs

> use test

> show collections

> db.sensors.find()
.pretty()



A5.9.4 MongoDB + Node.js : mongoose

4. dbtest2.js

aann > aann-rpt10 > cds_dht22 > JS dbtest2.js > getDateString

```
1   // dbtest2.js
2   var mongoose = require("mongoose");
3   mongoose.connect("mongodb://localhost/test2", {
4     useNewUrlParser: true,
5     useUnifiedTopology: true,
6   });
7   var SensorSchema = new mongoose.Schema({
8     data: String,
9     created: String,
10  });
11  // data model
12  var Sensor = mongoose.model("Sensor", SensorSchema);
13
14  var sensor1 = new Sensor({ data: "124", created: getDateString() });
15  sensor1.save();
16  var sensor2 = new Sensor({ data: "573", created: getDateString() });
17  sensor2.save();
18
19  console.log("[dbtest2.js]: Sensor data were saved in MongoDB");
20  // helper function to get a nicely formatted date string
21  function getDateString() {
22    var time = new Date().getTime();
23    // 32400000 is (GMT+9 Korea, GimHae)
24    // for your timezone just multiply +/-GMT by 3600000
25    var datestr = new Date(time + 32400000)
26      .toISOString()
27      .replace(/T/, " ")
28      .replace(/Z/, "");
29    return datestr;
30  }
```

```
var SensorSchema = new mongoose.Schema({
        data: String,
        created: String
});
```

A5.9.4 MongoDB + Node.js : mongoose

5. dbtest2.js (change Schema & check using mongo shell)

Mongo shell

> show dbs

> use test2

> show collections

> db.sensors.find()
.pretty()

```
> show dbs
admin   0.000GB
config  0.000GB
iot     0.000GB
local   0.000GB
test    0.000GB
test2   0.000GB
> use test2
switched to db test2
> db.sensors.find().pretty()
{
        "_id" : ObjectId("6181d4c4501d6bc94cfa6903"),
        "data" : "124",
        "created" : "2021-11-03 09:16:04.448",
        "__v" : 0
}
{
        "_id" : ObjectId("6181d4c4501d6bc94cfa6904"),
        "data" : "573",
        "created" : "2021-11-03 09:16:04.451",
        "__v" : 0
}
>
```

[Practice]

- [wk09: mongoDB test]
  - Insert documents to test mongodb
  - Upload folder: aann-rpt09
  - Use repo “aann” in github

wk09 : Practice : aann-rpt09

- [Target of this week]
  - Complete your works : **mongoDB test.**
  - **Save your outcomes and upload outputs in github**

제출폴더명 : **aann-rpt09** 에 아래 파일을 추가

- 제출할 파일들

① **AAnn_mongo_schemas.png**

② **AAnn_mongo_update.png**

③ **dbtest.js (cds_dht22 folder)**

④ **dbtest2.js (cds_dht22 folder)**

Email : chaos21c@gmail.com

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

Target of this class