3D DATA VISUALIZATION

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Web3D Consortium

Kwan-Hee Yoo
Chungbuk National University
Byounghyun Yoo
Korea Institute of Science and Technology

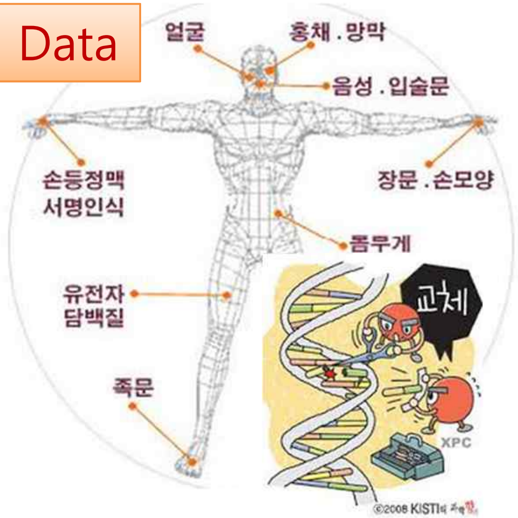
Introduction

- Big Data Generation

Business Data

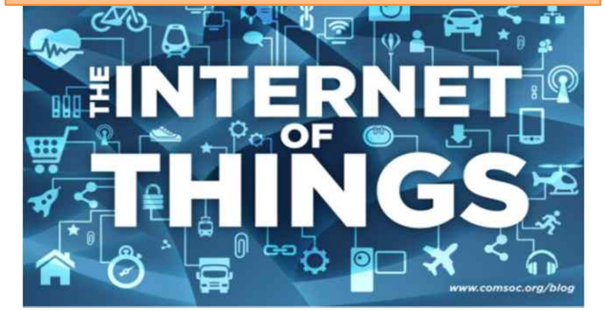
Social Data

Bio Data

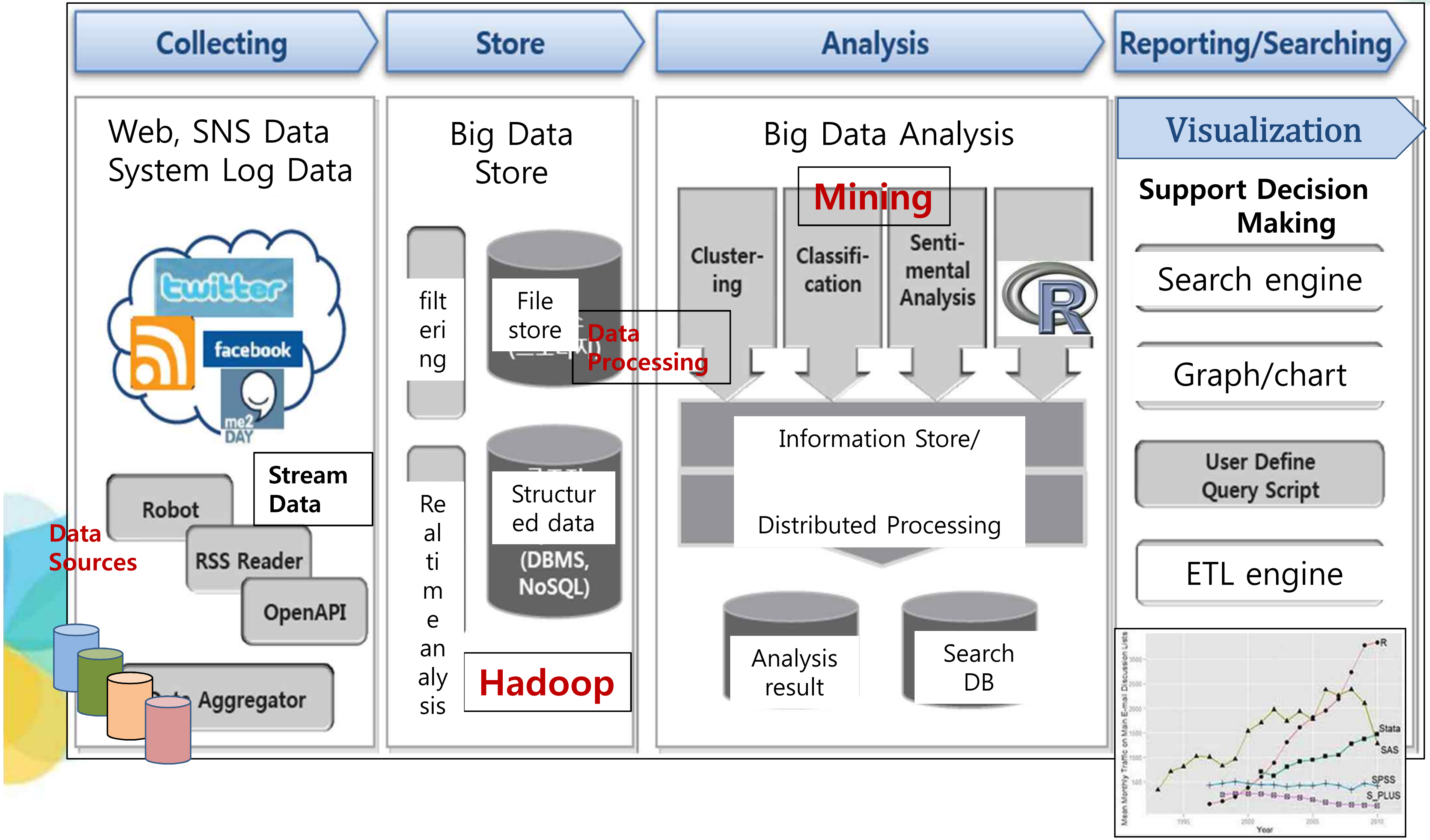


Video
-CCD Camera

IoT / M2M
Geospatioal Data



Data Life Cycle



Collecting

Store

Analysis

Reporting/Searching

Web, SNS Data
System Log Data

Stream Data

Robot

RSS Reader

OpenAPI

Data Aggregator

Data Sources

Big Data Store

filtering

File store

Real time analysis

Structured data (DBMS, NoSQL)

Hadoop

Data Processing

Big Data Analysis

Mining

Clustering

Classification

Sentimental Analysis

Information Store/

Distributed Processing

Analysis result

Search DB

Visualization

Support Decision Making

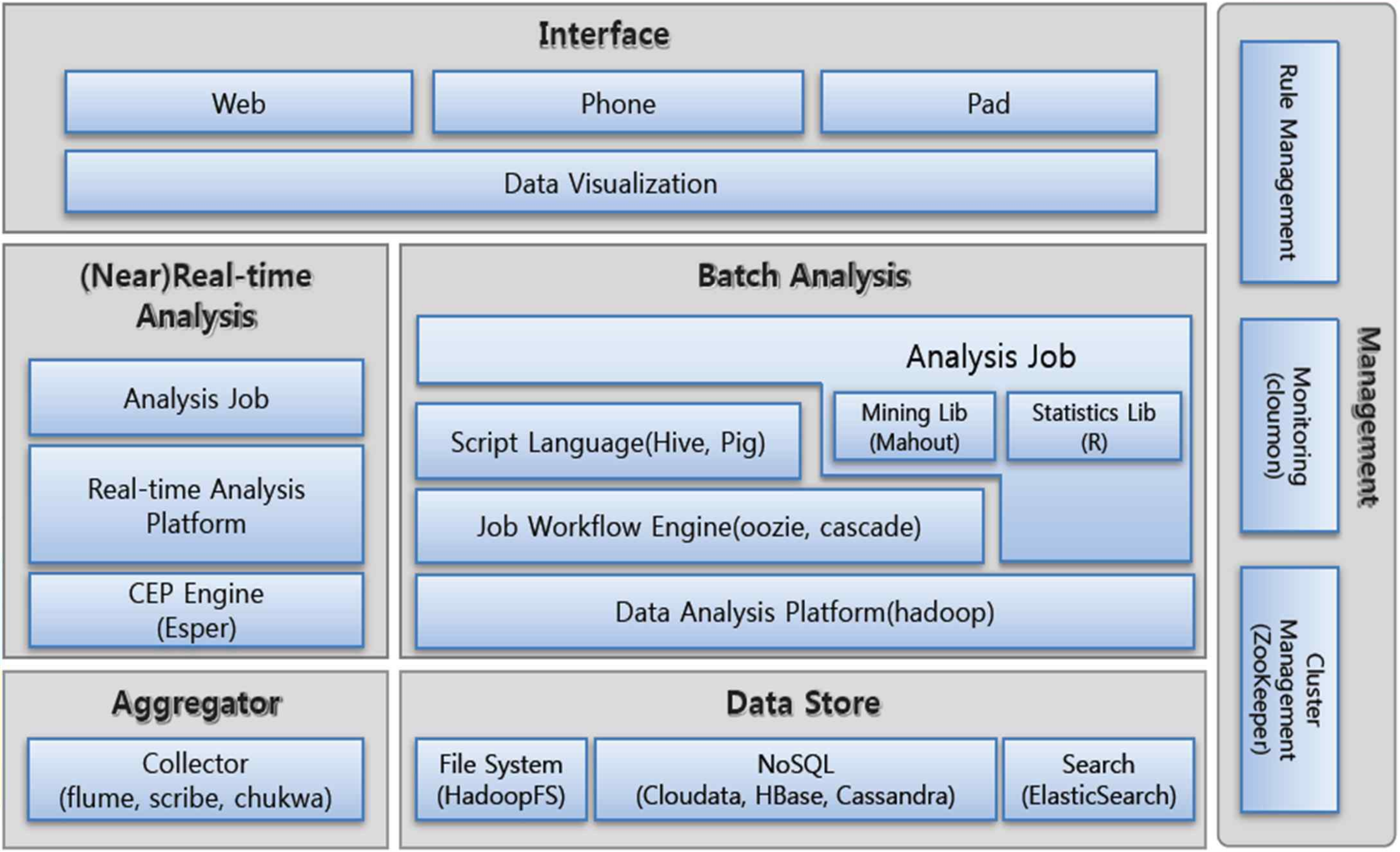
Search engine

Graph/chart

User Define Query Script

ETL engine

Big Data Processing System



Interface

Web

Phone

Pad

Data Visualization

(Near)Real-time Analysis

Analysis Job

Real-time Analysis Platform

CEP Engine (Esper)

Batch Analysis

Analysis Job

Script Language(Hive, Pig)

Mining Lib (Mahout)

Statistics Lib (R)

Job Workflow Engine(oozie, cascade)

Data Analysis Platform(hadoop)

Aggregator

Collector (flume, scribe, chukwa)

Data Store

File System (HadoopFS)

NoSQL (Cloudata, HBase, Cassandra)

Search (ElasticSearch)

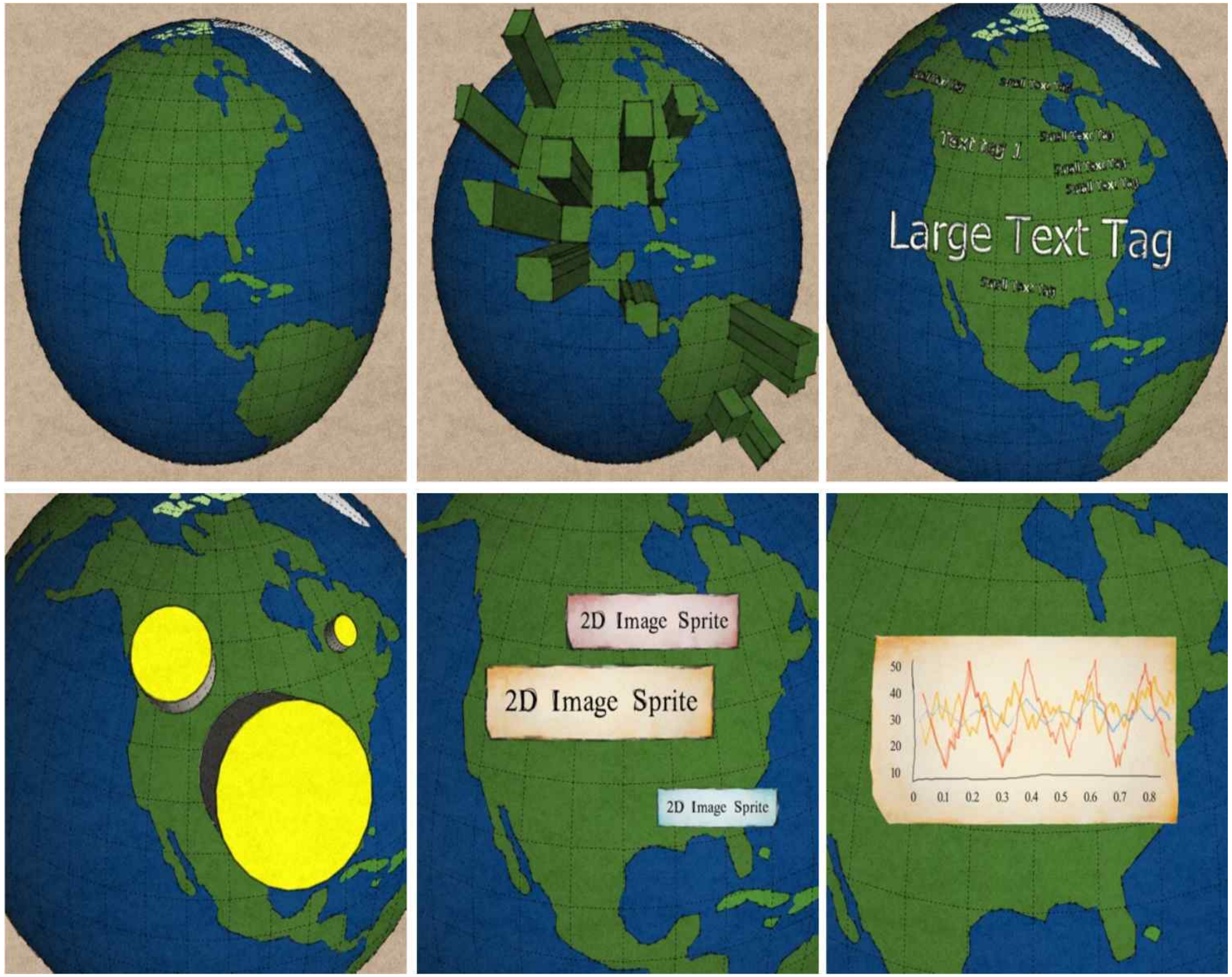
Management

Rule Management

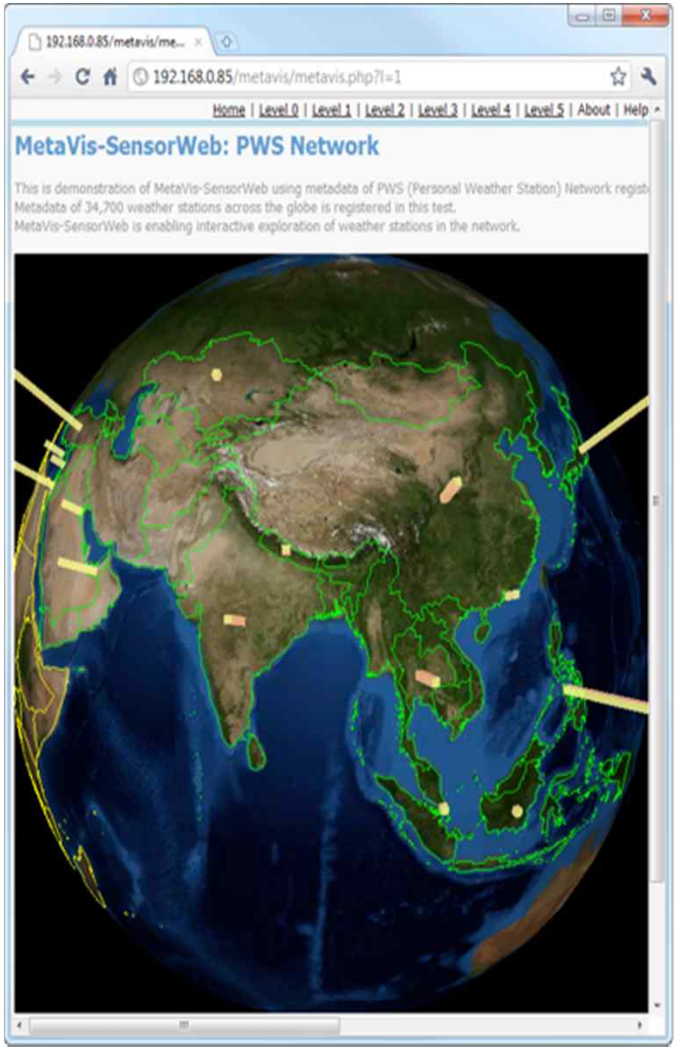
Monitoring (cloumon)

Cluster Management (ZooKeeper)

Visualization template design



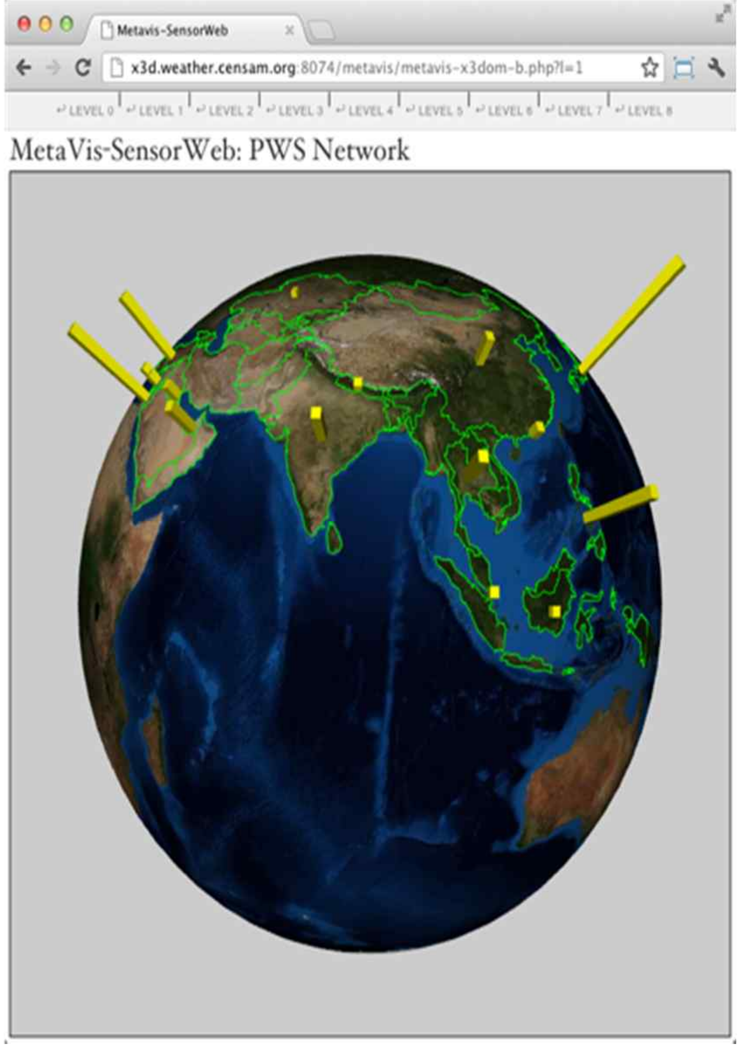
HTML5/X3D integration



192.168.0.85/metavis/me...
192.168.0.85/metavis/metavis.php?l=1
Home | Level 0 | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | About | Help

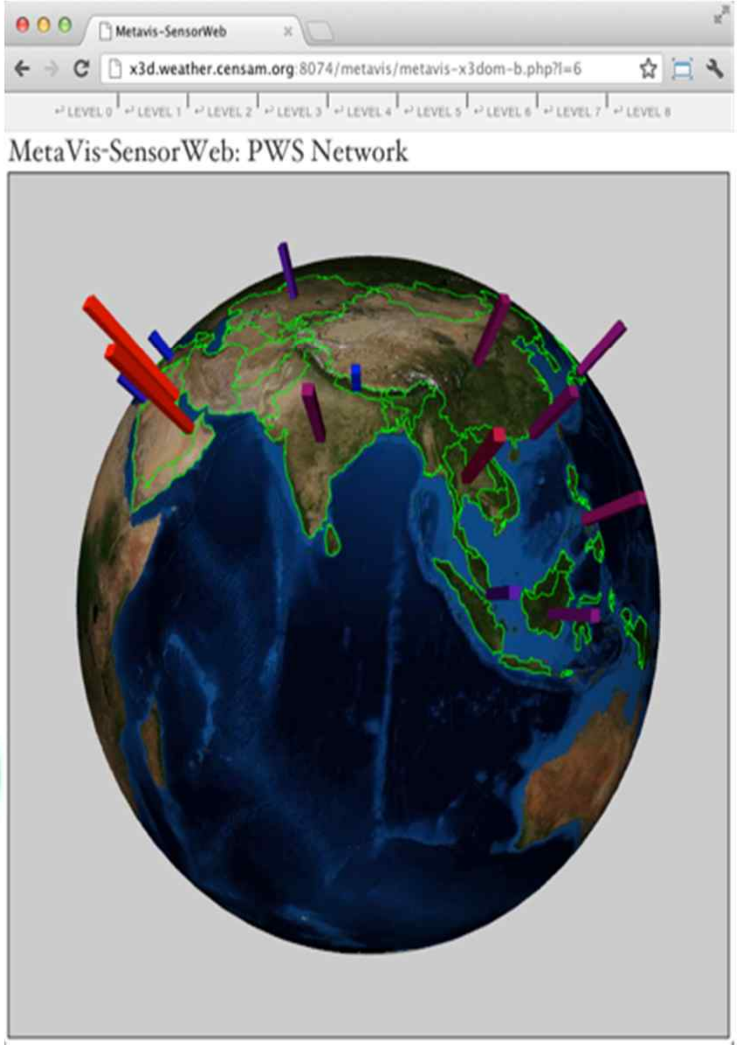
MetaVis-SensorWeb: PWS Network

This is demonstration of MetaVis-SensorWeb using metadata of PWS (Personal Weather Station) Network regist
Metadata of 34,700 weather stations across the globe is registered in this test.
MetaVis-SensorWeb is enabling interactive exploration of weather stations in the network.

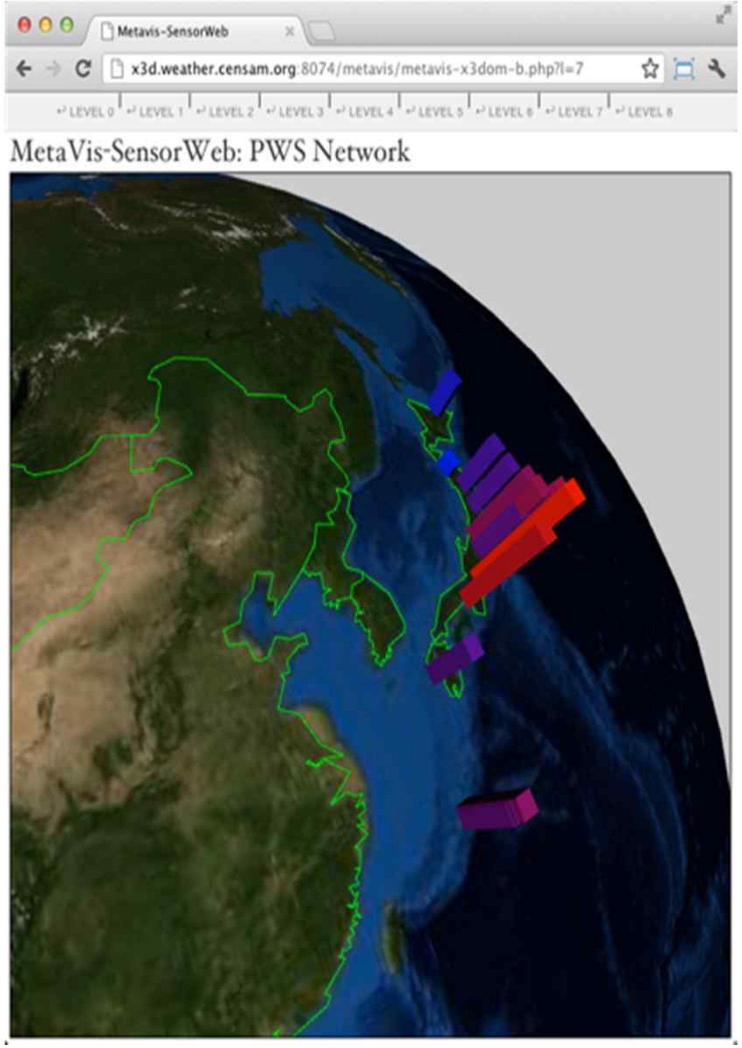


MetaVis-SensorWeb: PWS Network

Geospatial mashups

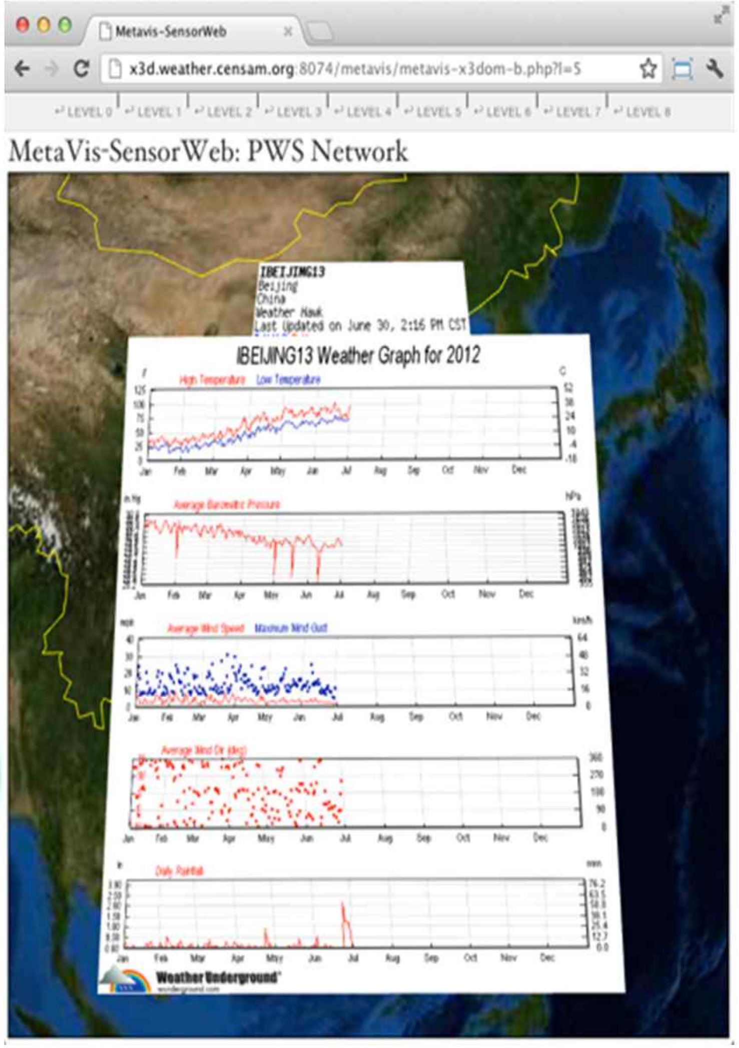


MetaVis-SensorWeb: PWS Network



MetaVis-SensorWeb: PWS Network

Spatiotemporal visualization



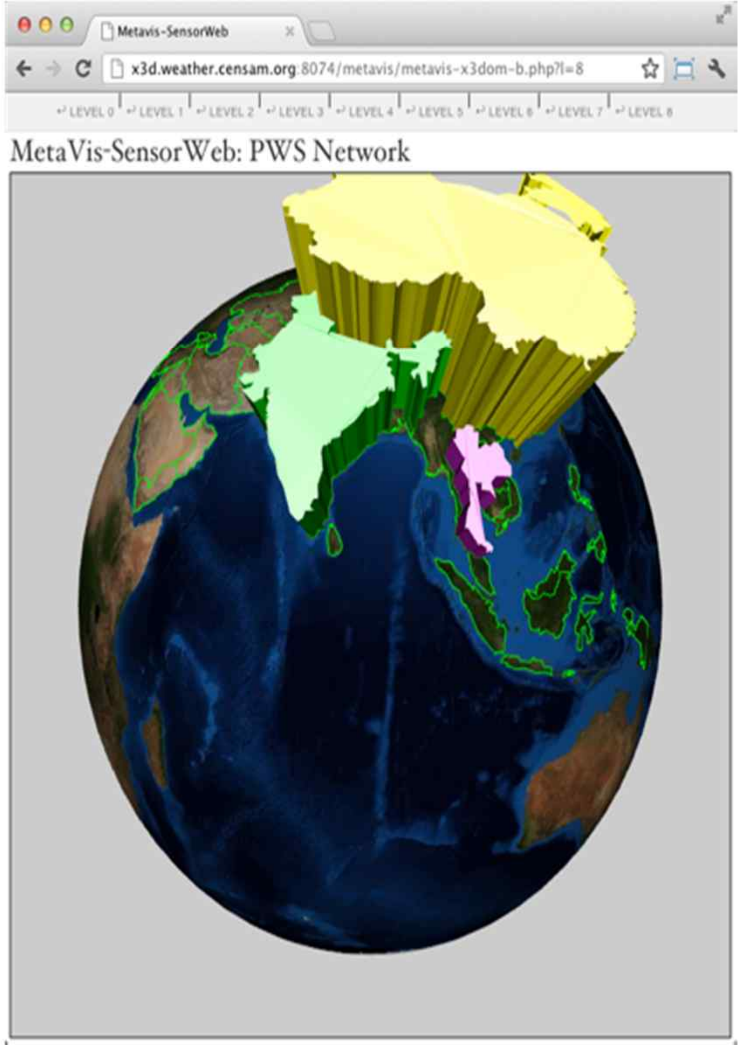
Metavis-SensorWeb

x3d.weather.censam.org:8074/metavis/metavis-x3dom-b.php?l=5

MetaVis-SensorWeb: PWS Network

IBEIJING13
Beijing
China
Weather Hawk
Last Updated on June 30, 2:16 PM CST

IBEIJING13 Weather Graph for 2012

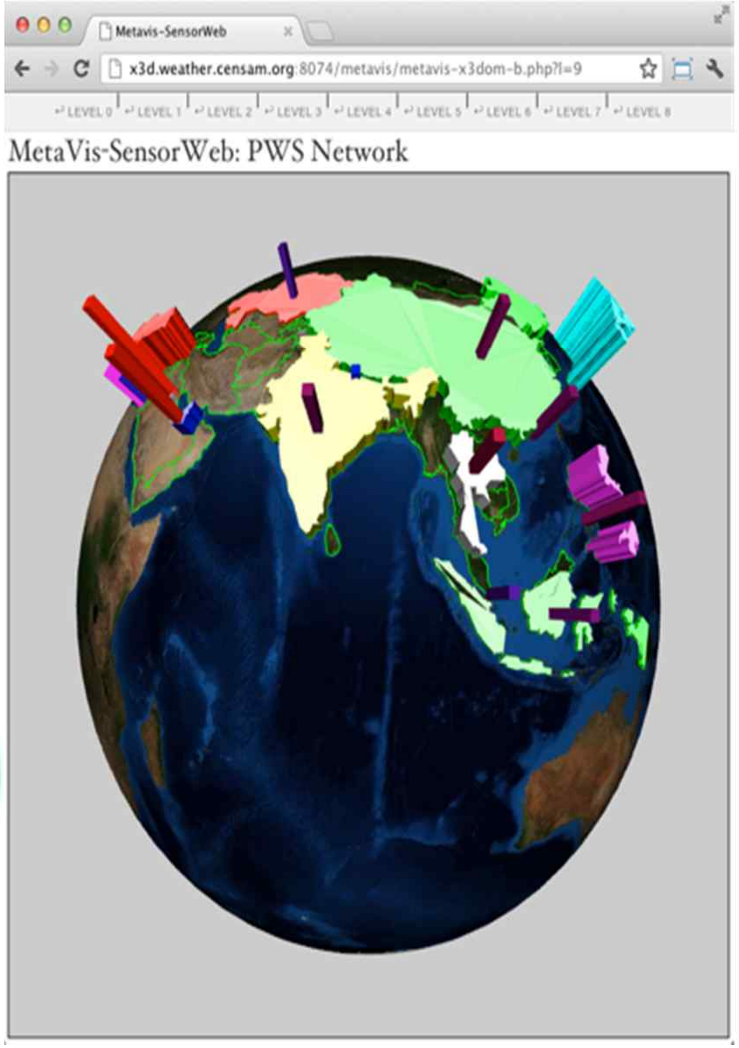


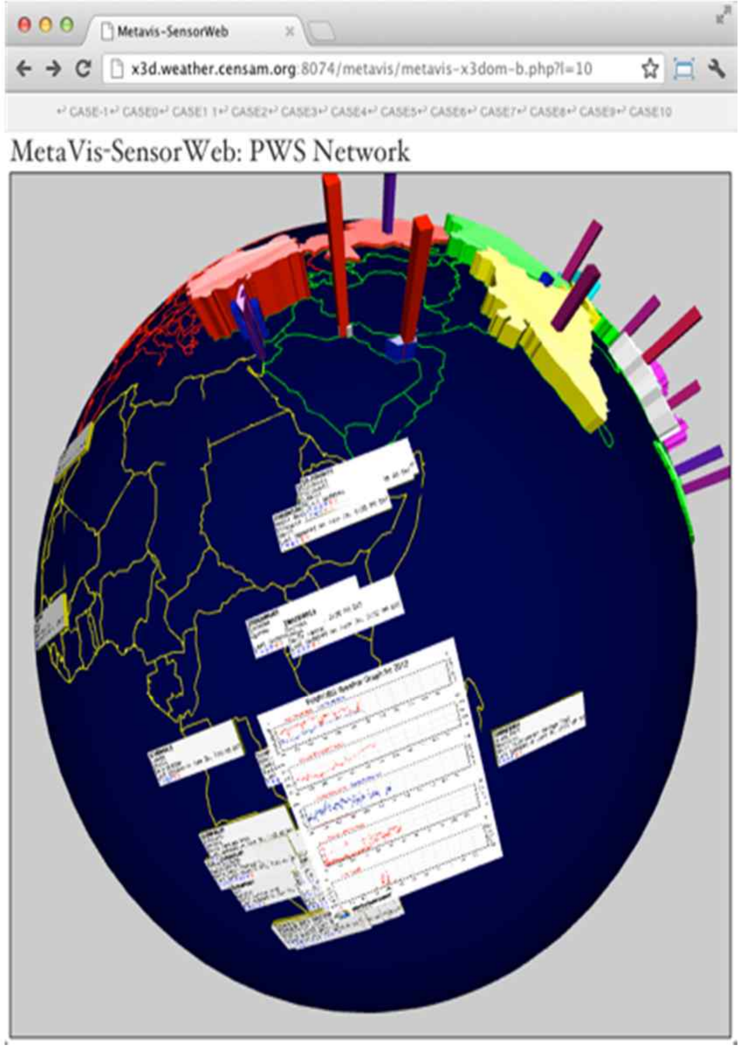
Metavis-SensorWeb

x3d.weather.censam.org:8074/metavis/metavis-x3dom-b.php?l=8

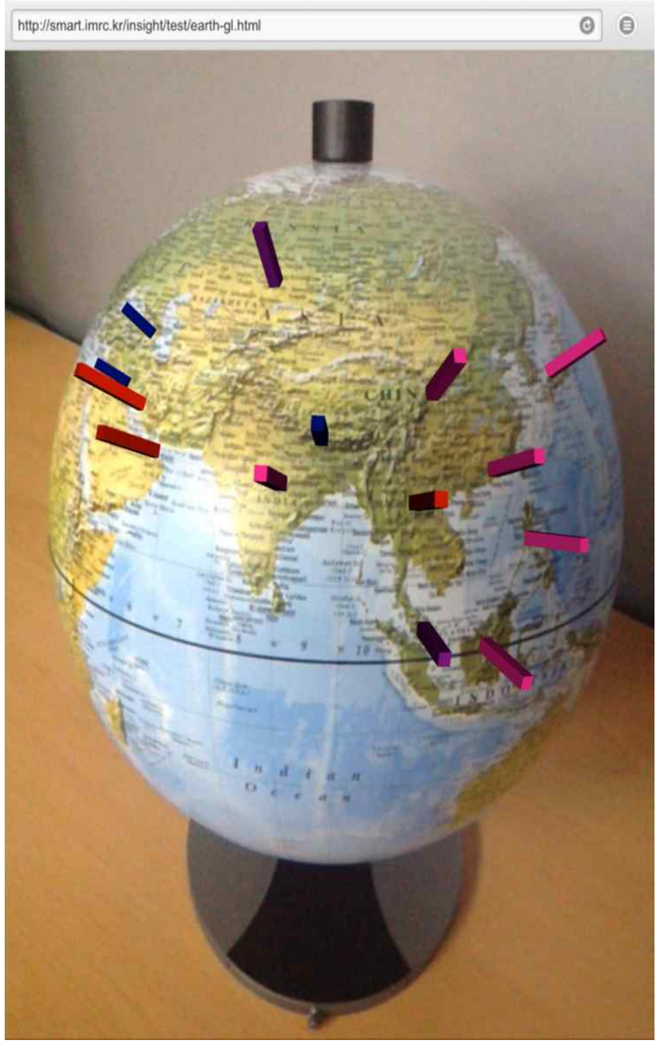
MetaVis-SensorWeb: PWS Network

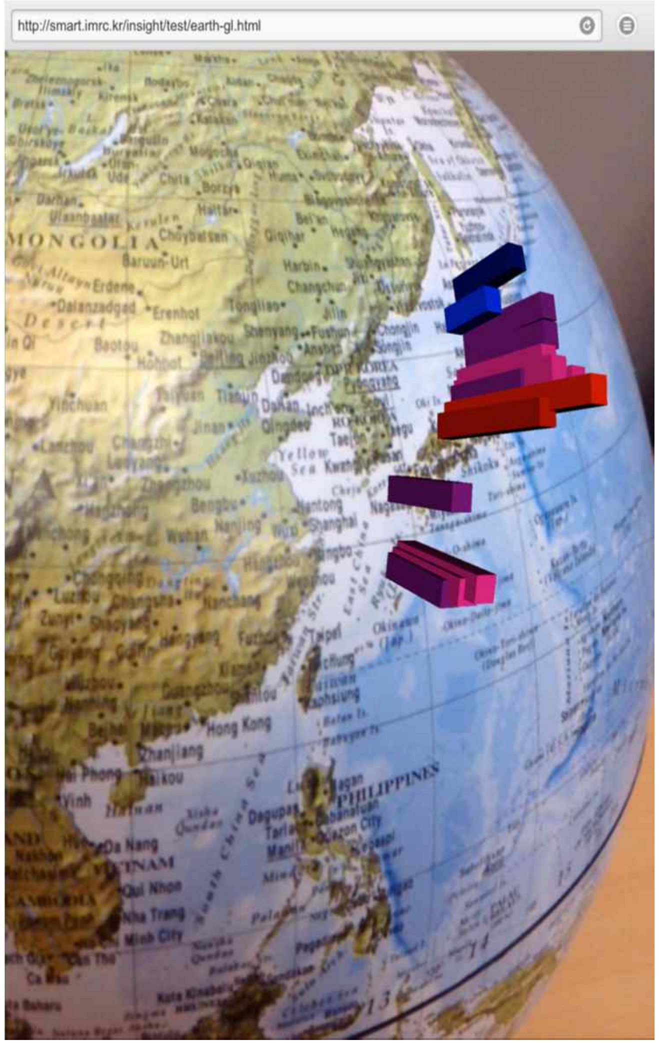
Data-driven visualization


Metavis-SensorWeb
x3d.weather.censam.org:8074/metavis/metavis-x3dom-b.php?l=9
LEVEL 0
LEVEL 1
LEVEL 2
LEVEL 3
LEVEL 4
LEVEL 5
LEVEL 6
LEVEL 7
LEVEL 8
MetaVis-SensorWeb: PWS Network

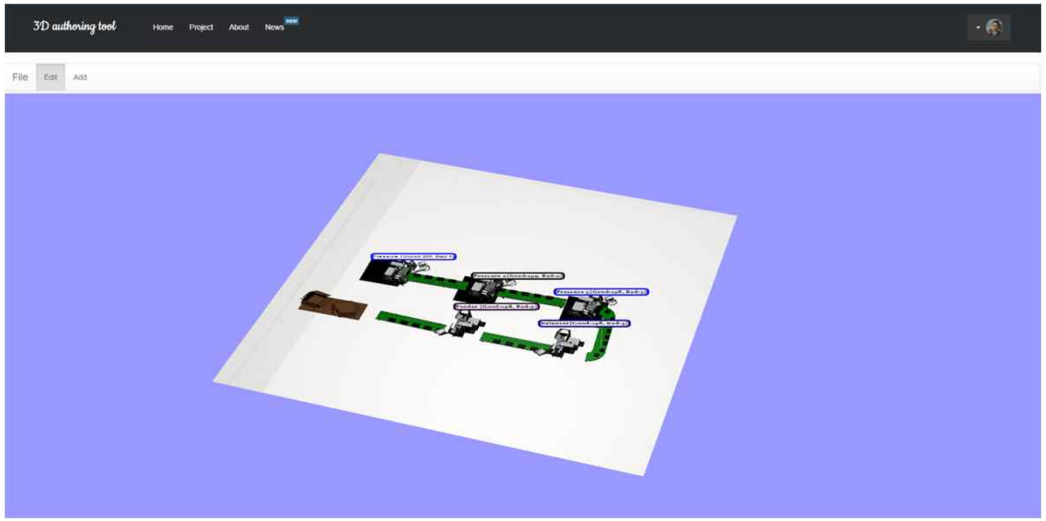

Metavis-SensorWeb
x3d.weather.censam.org:8074/metavis/metavis-x3dom-b.php?l=10
CASE-1
CASE0
CASE1 1
CASE2
CASE3
CASE4
CASE5
CASE6
CASE7
CASE8
CASE9
CASE10
MetaVis-SensorWeb: PWS Network

Mixed and Augmented Reality





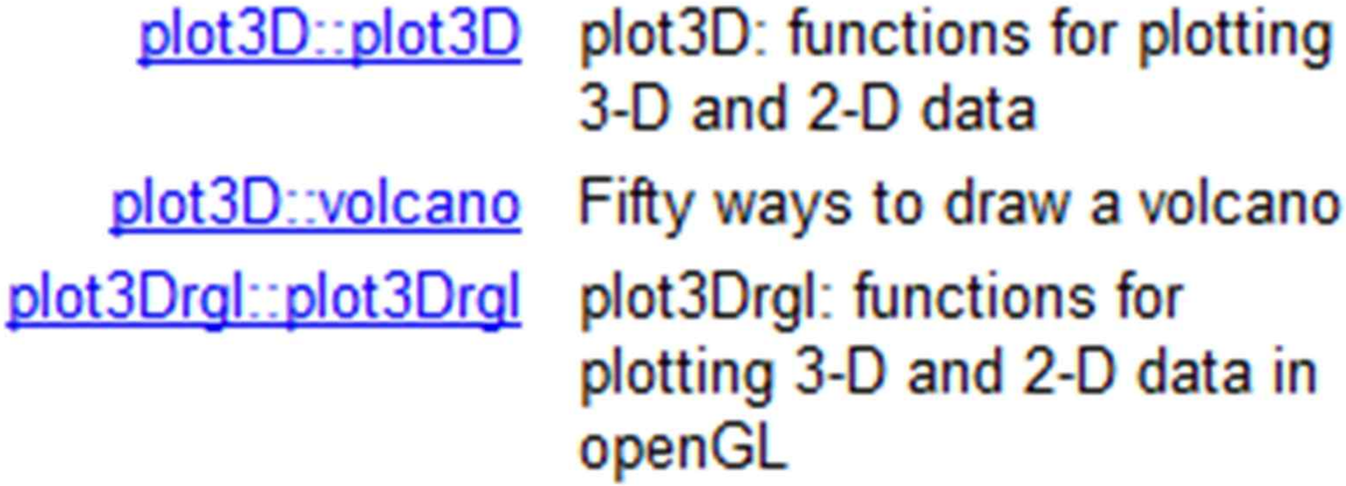
3D Manufacturing Process Visualization based on Big Data



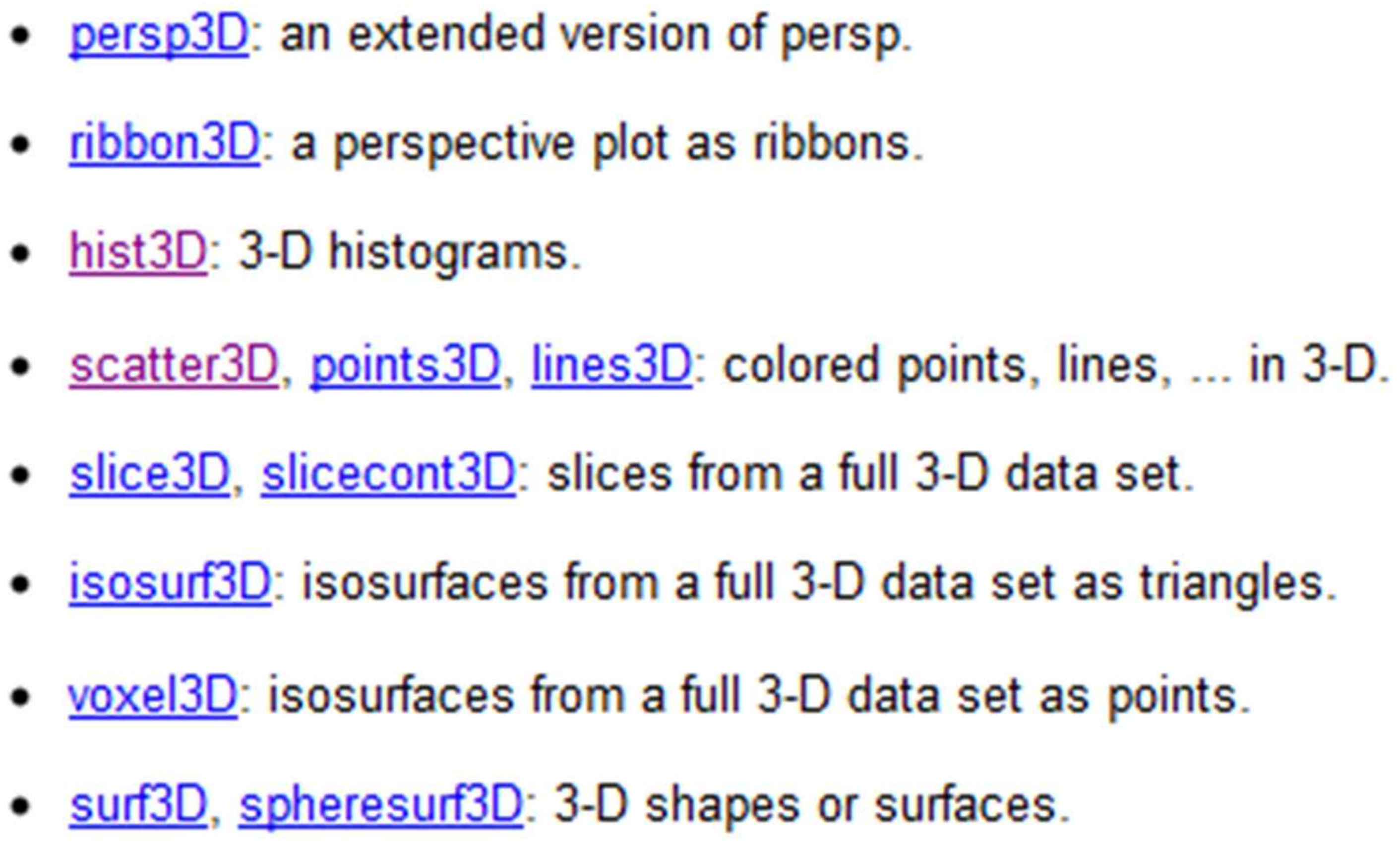
DDV.js based Bigdata visualization

- Apply Many Model Objects (Machines)
- Processing Machine Description
- Analytic Results Visualization on each process

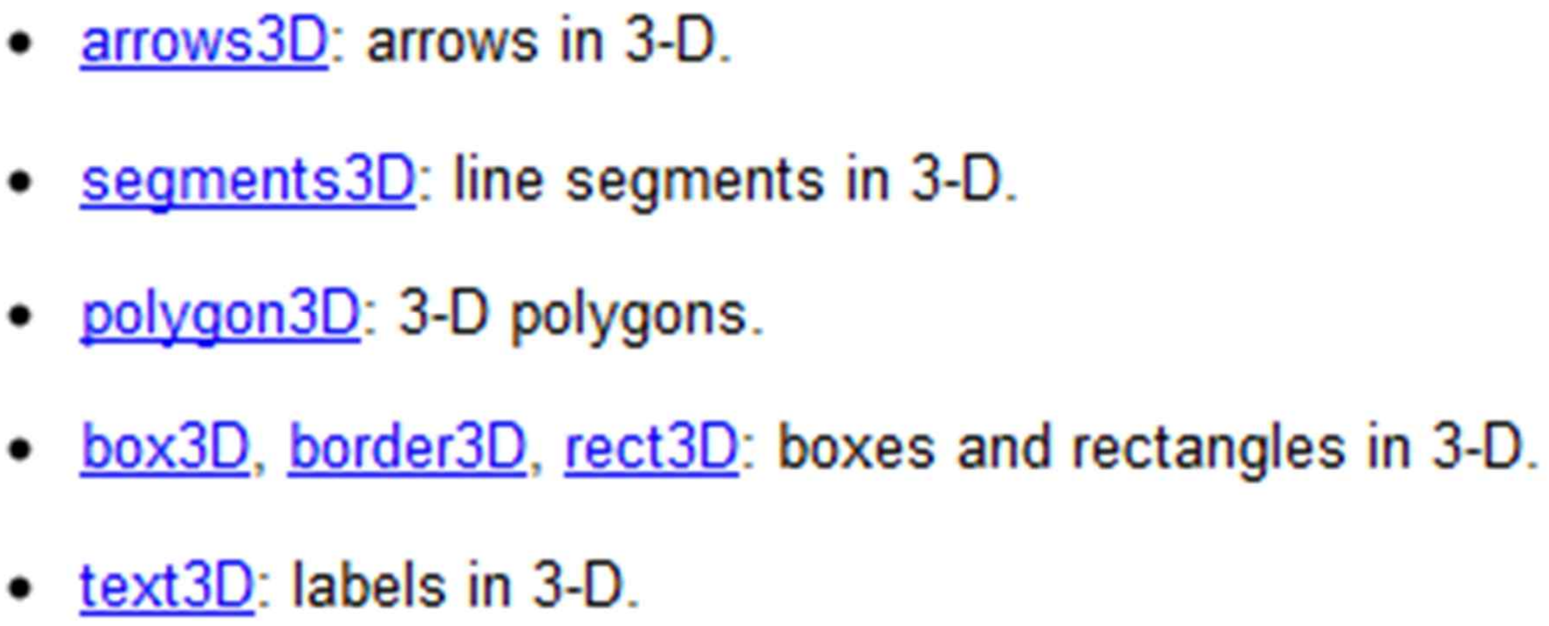
R 3D visualization



plot3D::plot3D	plot3D: functions for plotting 3-D and 2-D data
plot3D::volcano	Fifty ways to draw a volcano
plot3Drgl::plot3Drgl	plot3Drgl: functions for plotting 3-D and 2-D data in openGL



- persp3D: an extended version of persp.
- ribbon3D: a perspective plot as ribbons.
- hist3D: 3-D histograms.
- scatter3D, points3D, lines3D: colored points, lines, ... in 3-D.
- slice3D, slicecont3D: slices from a full 3-D data set.
- isosurf3D: isosurfaces from a full 3-D data set as triangles.
- voxel3D: isosurfaces from a full 3-D data set as points.
- surf3D, spheresurf3D: 3-D shapes or surfaces.



- arrows3D: arrows in 3-D.
- segments3D: line segments in 3-D.
- polygon3D: 3-D polygons.
- box3D, border3D, rect3D: boxes and rectangles in 3-D.
- text3D: labels in 3-D.

3D Data Visualization

- Time series visualization
  - Stick graph, cumulative graph, polyline, curve, points
- Distribution visualization
  - Chart
- Comparison visualization
  - Different stick graphs
- Correlation visualization
  - Tree, Graph
- Spatial visualization
  - Map, Mark

3D Data Visualization using HTML5/X3D

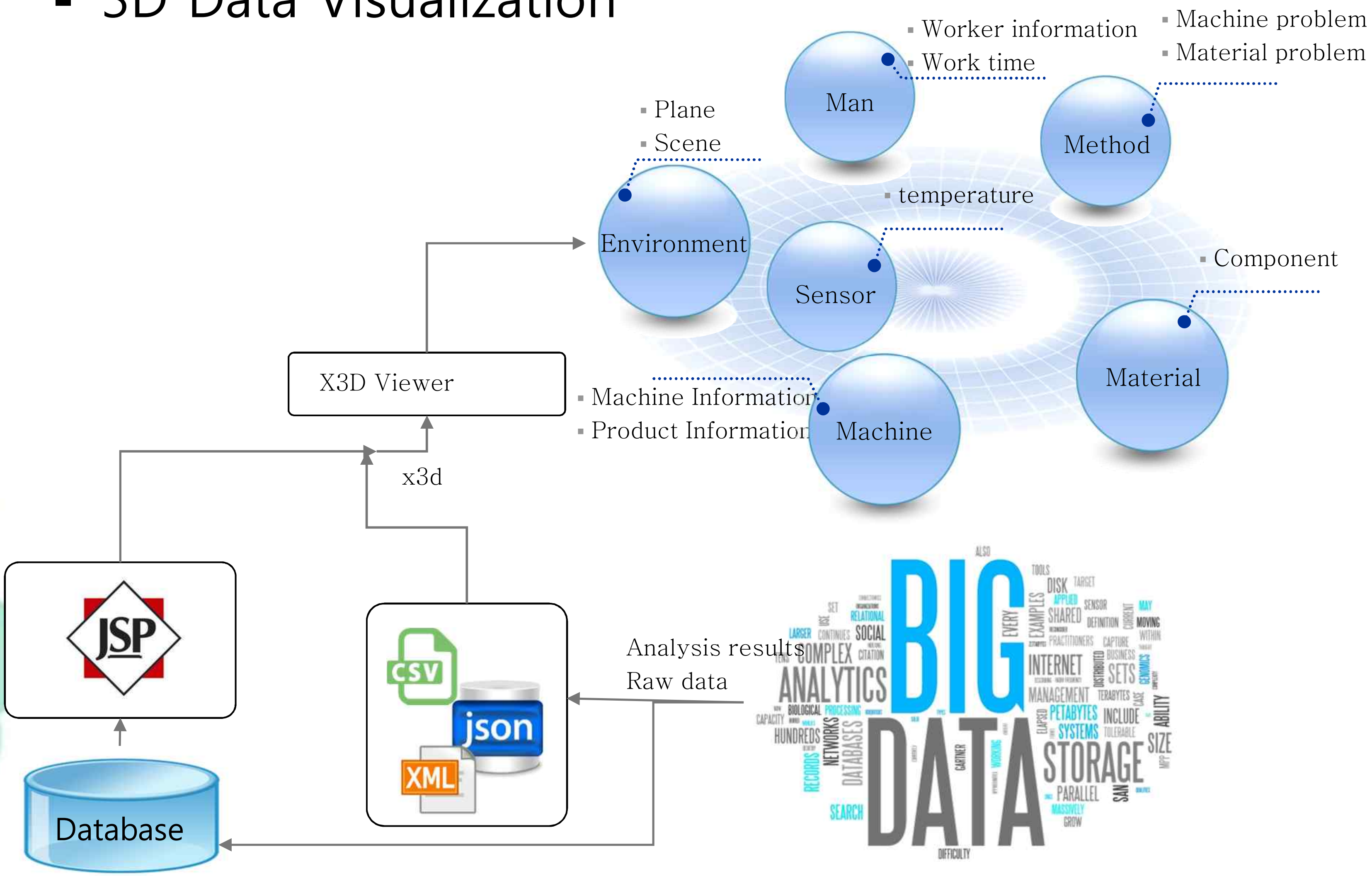
- Define drawing primitives for five kinds visualizations of big data analytics results
- Classify the primitives into five kinds, time-series, distribution, comparison, correlation, spatial visualizations
- Integrating HTML5 (SVG) and X3D based big data visualization
- The work will be done similar to Medical WG

3D Data Visualization using HTML5/X3D

Can X3D/HTML5 nodes support functions to visualize analytics results of big data ?

- Time series visualization
  - Stick graph, cumulative graph, polyline, curve, points
- Distribution visualization
  - Chart
- Comparison visualization
  - Different stick graphs
- Correlation visualization
  - Tree, Graph
- Spatial visualization
  - Map, Mark

▪ 3D Data Visualization



- Worker information
- Work time

- Machine problem
- Material problem

- Plane
- Scene

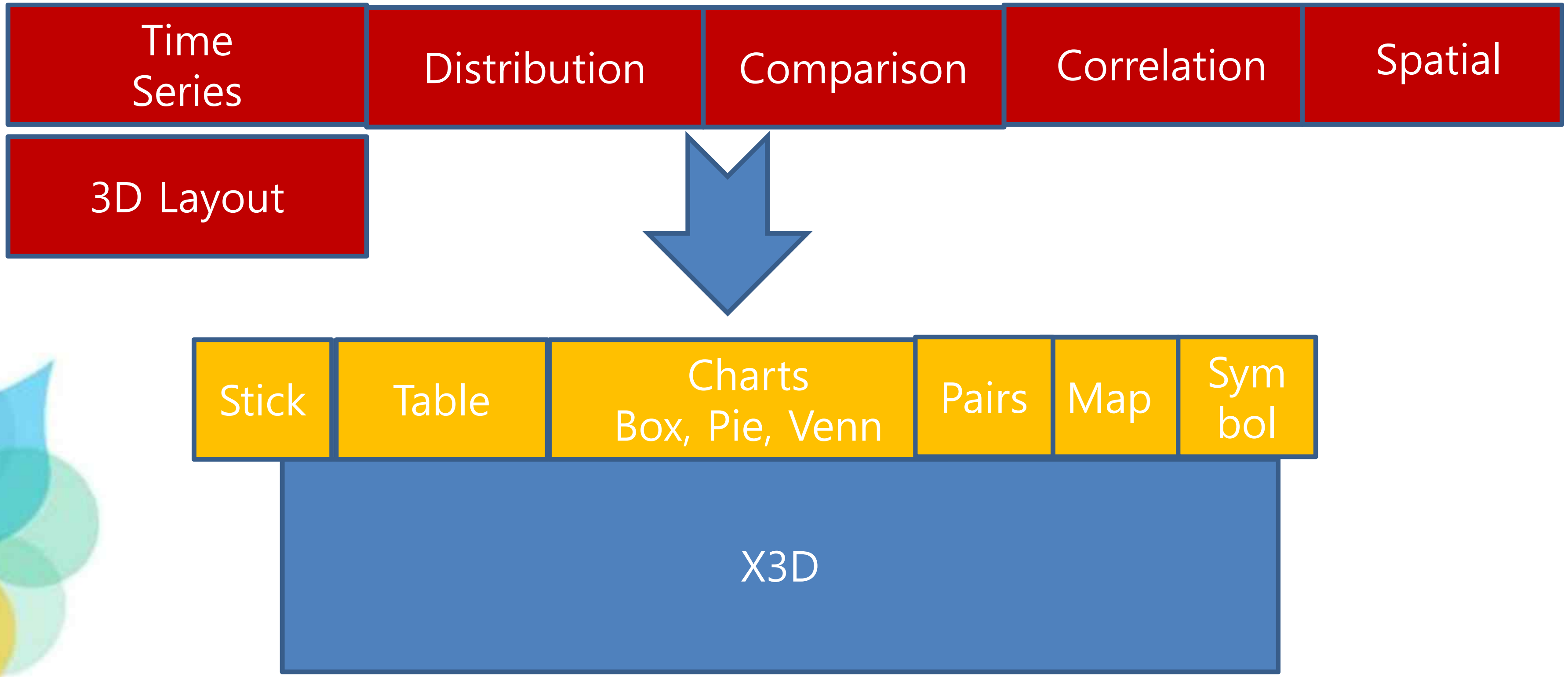
- temperature

- Component

- Machine Information
- Product Information

Analysis results
Raw data

Big Data Visualization using HTML5/three.js



Time Series

Distribution

Comparison

Correlation

Spatial

3D Layout

Stick

Table

Charts Box, Pie, Venn

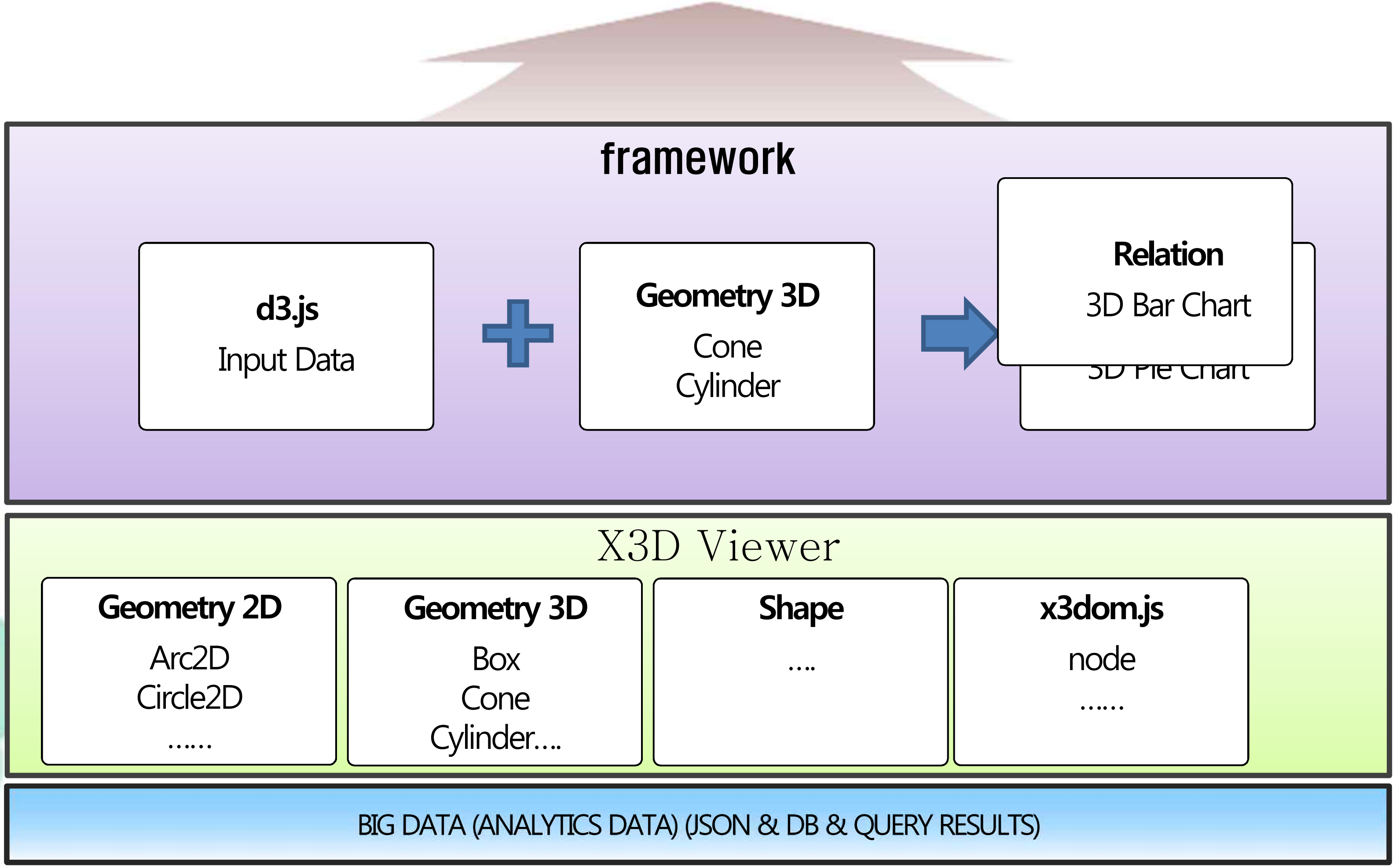
Pairs

Map

Symbol

X3D

Data Driven Visualization



framework

d3.js
Input Data

Geometry 3D
Cone
Cylinder

Relation
3D Bar Chart
3D Pie Chart

X3D Viewer

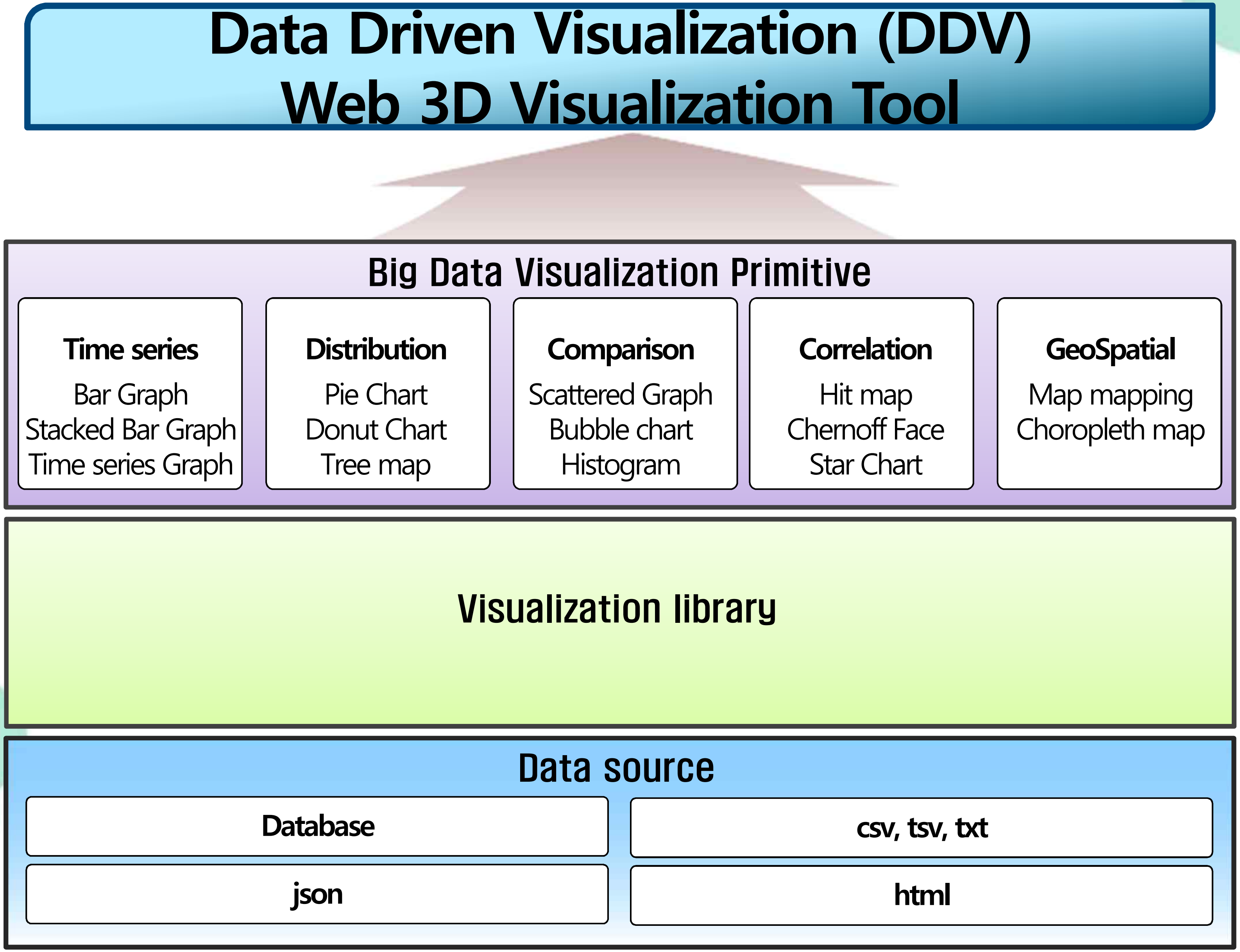
Geometry 2D
Arc2D
Circle2D
……

Geometry 3D
Box
Cone
Cylinder….

Shape
….

x3dom.js
node
……

BIG DATA (ANALYTICS DATA) (JSON & DB & QUERY RESULTS)



Data Driven Visualization (DDV) Web 3D Visualization Tool

Big Data Visualization Primitive

Time series
Bar Graph
Stacked Bar Graph
Time series Graph

Distribution
Pie Chart
Donut Chart
Tree map

Comparison
Scattered Graph
Bubble chart
Histogram

Correlation
Hit map
Chernoff Face
Star Chart

GeoSpatial
Map mapping
Choropleth map

Visualization library

Data source

Database

csv, tsv, txt

json

html

DDV

DDVEnvironment

DDVMachine

DDVMeterial

DDVMan

DDVMethod

DDVSensor

- 3D Environment

Data	Txt
	Array
	json, csv, tsv
	Database Query

3D Data Visualization	DDV.js + html5 + DDV => 3D Object + 3D Properties

- 3D Layout

Layout	Coordinates
	Properties

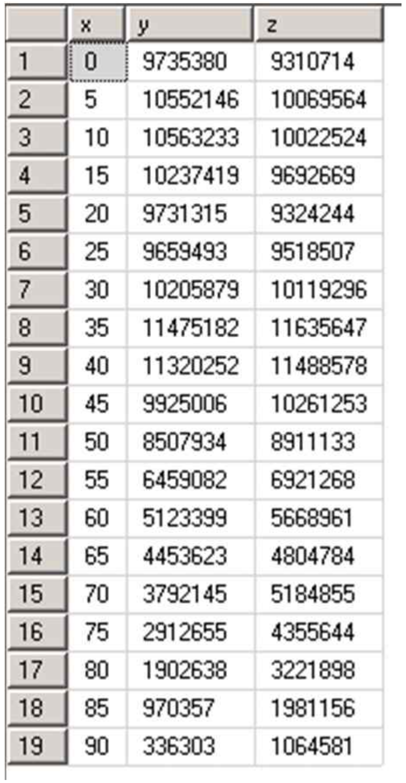
- Components

Class	Detail
Components	DDVEnvironment
	DDVMachine
	DDVMeterial
	DDVMan
	DDVMethod
	DDVSensor

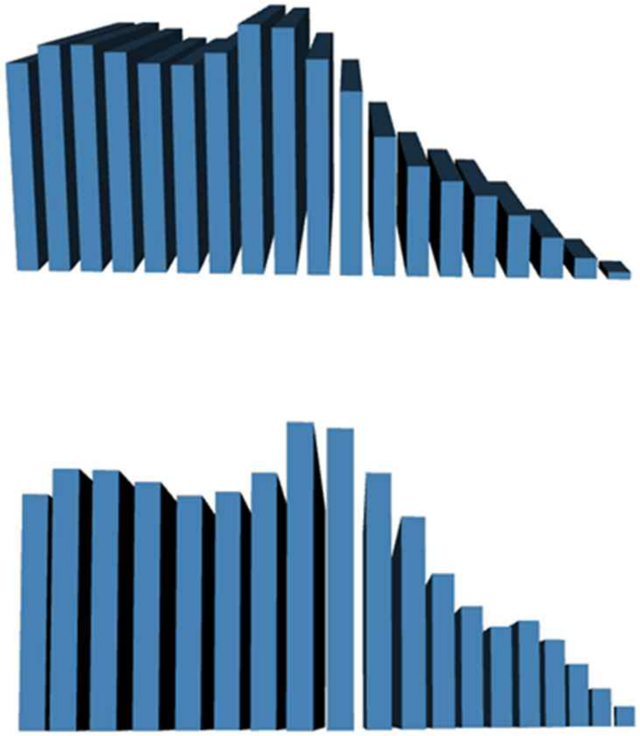
Plane
Scene
Layout
Menu(DDV manu)
3D Model Object(Machine, Conveyor …)
Temperature
Error Information
Database(data gathering)
Data 3D visualization
Label
DDVaddControls
Animation
Popup menu
Edit model option
Add new model

Use Case

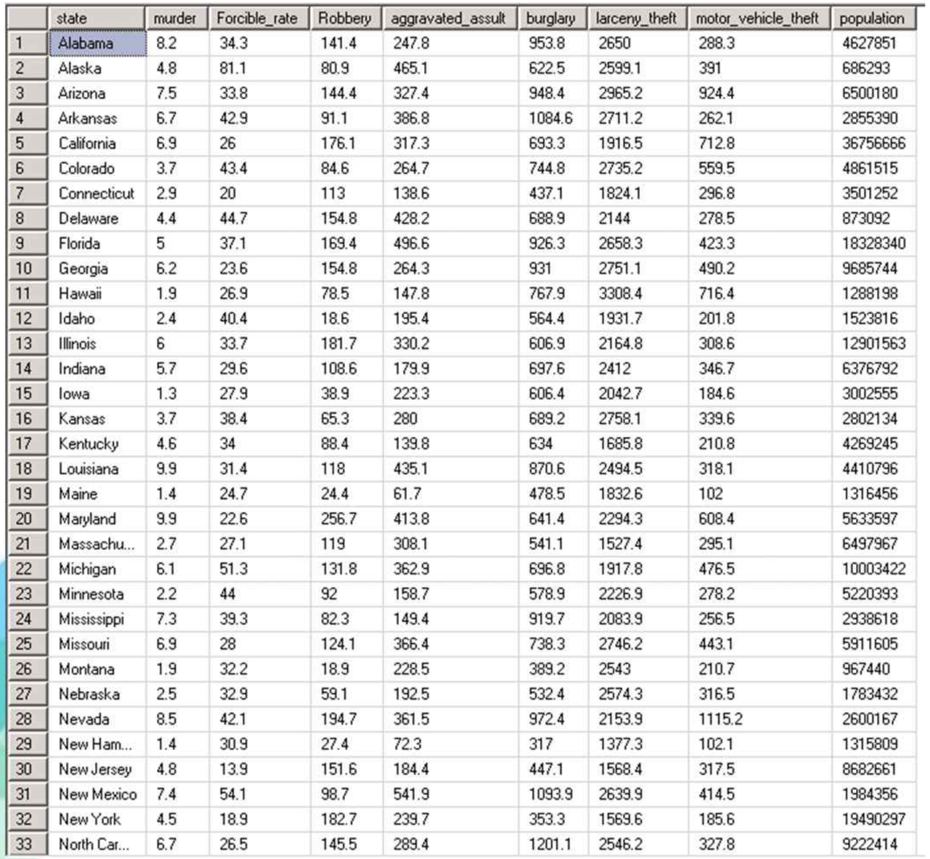
- DDV3Dbar graph for (x age, y men, z women)



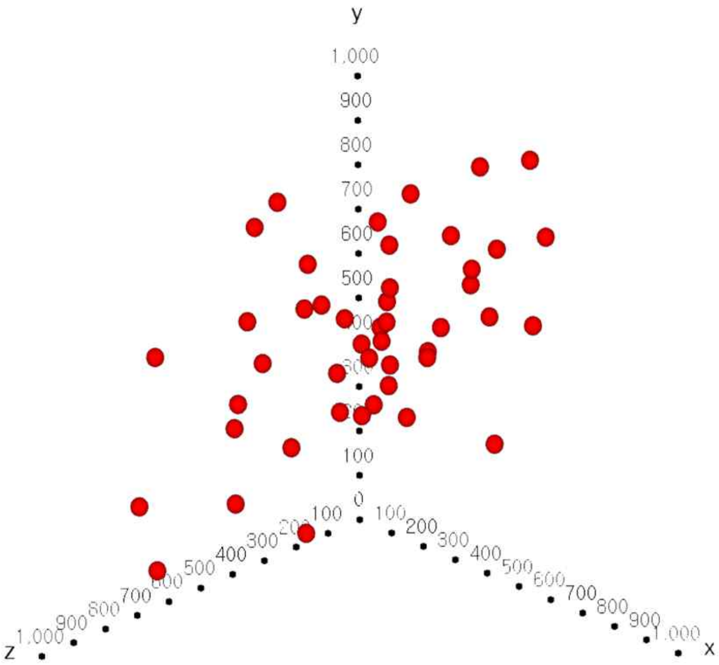
	x	y	z
1	0	9735380	9310714
2	5	10552146	10069564
3	10	10563233	10022524
4	15	10237419	9692669
5	20	9731315	9324244
6	25	9659493	9518507
7	30	10205879	10119296
8	35	11475182	11635647
9	40	11320252	11488578
10	45	9925006	10261253
11	50	8507934	8911133
12	55	6459082	6921268
13	60	5123399	5668961
14	65	4453623	4804784
15	70	3792145	5184855
16	75	2912655	4355644
17	80	1902638	3221898
18	85	970357	1981156
19	90	336303	1064581



- DDV3Dscatter plot visualization for (x:murder,y:thief,z:population)

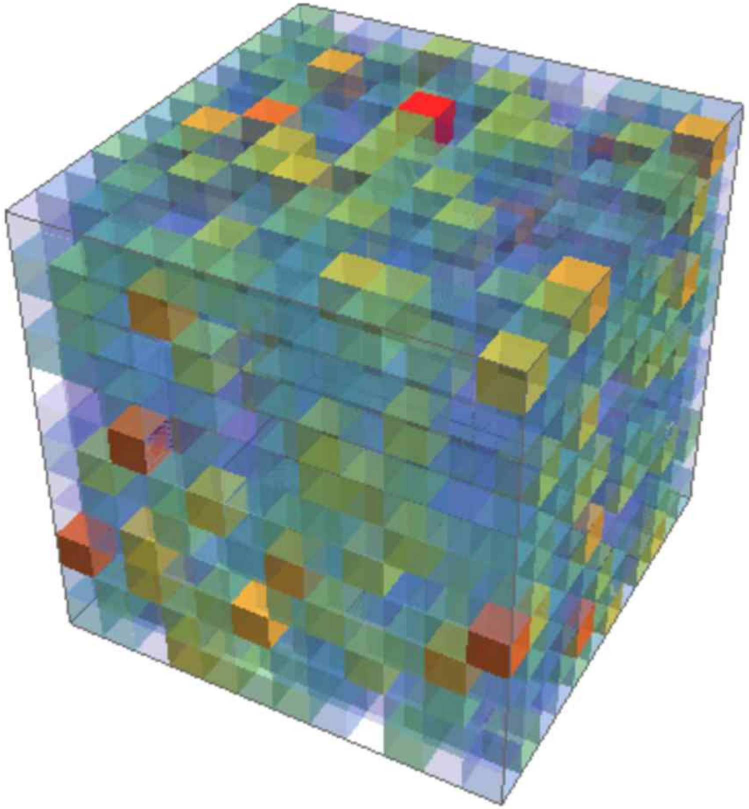


	state	murder	Forcible_rate	Robbery	aggravated_assult	burglary	larceny_theft	motor_vehicle_theft	population
1	Alabama	8.2	34.3	141.4	247.8	953.8	2650	288.3	4627851
2	Alaska	4.8	81.1	80.9	465.1	622.5	2599.1	391	686293
3	Arizona	7.5	33.8	144.4	327.4	948.4	2965.2	924.4	6500180
4	Arkansas	6.7	42.9	91.1	386.8	1084.6	2711.2	262.1	2855390
5	California	6.9	26	176.1	317.3	693.3	1916.5	712.8	36756666
6	Colorado	3.7	43.4	84.6	264.7	744.8	2735.2	559.5	4861515
7	Connecticut	2.9	20	113	138.6	437.1	1824.1	296.8	3501252
8	Delaware	4.4	44.7	154.8	428.2	688.9	2144	278.5	873092
9	Florida	5	37.1	169.4	496.6	926.3	2658.3	423.3	18328340
10	Georgia	6.2	23.6	154.8	264.3	931	2751.1	490.2	9685744
11	Hawaii	1.9	26.9	78.5	147.8	767.9	3308.4	716.4	1288198
12	Idaho	2.4	40.4	18.6	195.4	564.4	1931.7	201.8	1523816
13	Illinois	6	33.7	181.7	330.2	606.9	2164.8	308.6	12901563
14	Indiana	5.7	29.6	108.6	179.9	697.6	2412	346.7	6376792
15	Iowa	1.3	27.9	38.9	223.3	606.4	2042.7	184.6	3002555
16	Kansas	3.7	38.4	65.3	280	689.2	2758.1	339.6	2802134
17	Kentucky	4.6	34	88.4	139.8	634	1685.8	210.8	4269245
18	Louisiana	9.9	31.4	118	435.1	870.6	2494.5	318.1	4410796
19	Maine	1.4	24.7	24.4	61.7	478.5	1832.6	102	1316456
20	Maryland	9.9	22.6	256.7	413.8	641.4	2294.3	608.4	5633597
21	Massachu...	2.7	27.1	119	308.1	541.1	1527.4	295.1	6497967
22	Michigan	6.1	51.3	131.8	362.9	696.8	1917.8	476.5	10003422
23	Minnesota	2.2	44	92	158.7	578.9	2226.9	278.2	5220393
24	Mississippi	7.3	39.3	82.3	149.4	919.7	2083.9	256.5	2938618
25	Missouri	6.9	28	124.1	366.4	738.3	2746.2	443.1	5911605
26	Montana	1.9	32.2	18.9	228.5	389.2	2543	210.7	967440
27	Nebraska	2.5	32.9	59.1	192.5	532.4	2574.3	316.5	1783432
28	Nevada	8.5	42.1	194.7	361.5	972.4	2153.9	1115.2	2600167
29	New Ham...	1.4	30.9	27.4	72.3	317	1377.3	102.1	1315809
30	New Jersey	4.8	13.9	151.6	184.4	447.1	1568.4	317.5	8682661
31	New Mexico	7.4	54.1	98.7	541.9	1093.9	2639.9	414.5	1984356
32	New York	4.5	18.9	182.7	239.7	353.3	1569.6	185.6	19490297
33	North Car...	6.7	26.5	145.5	289.4	1201.1	2546.2	327.8	9222414

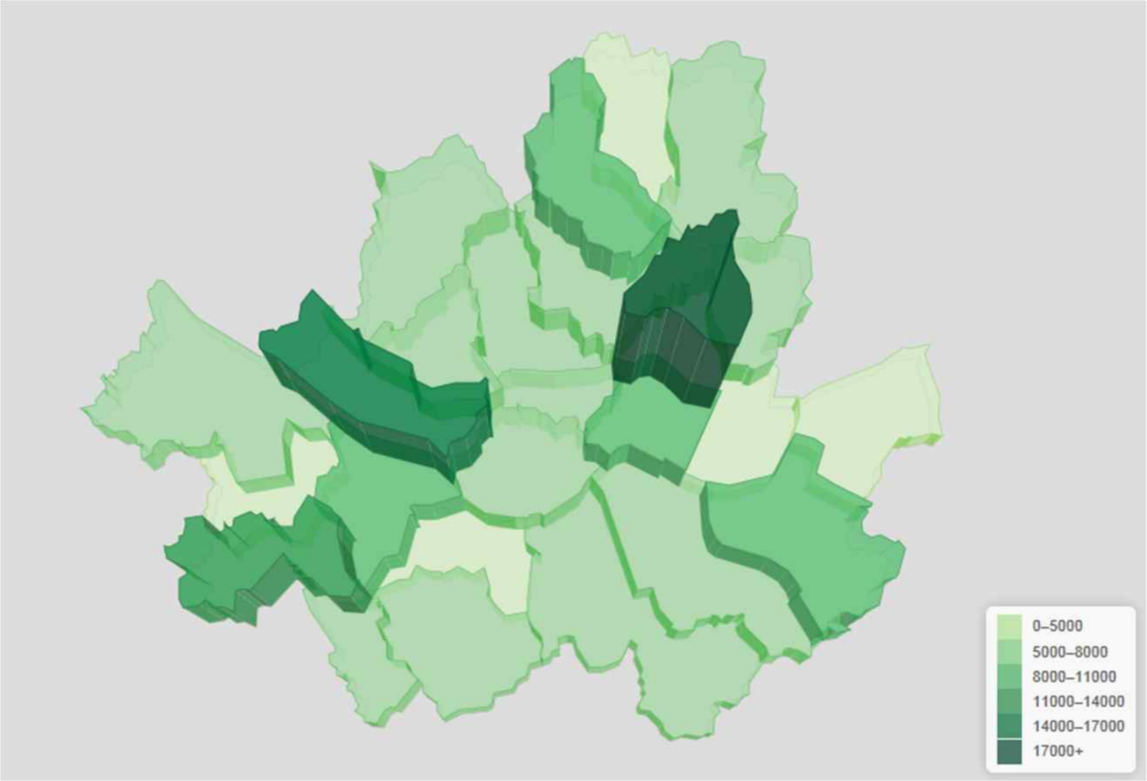


- DDV3DPieChart

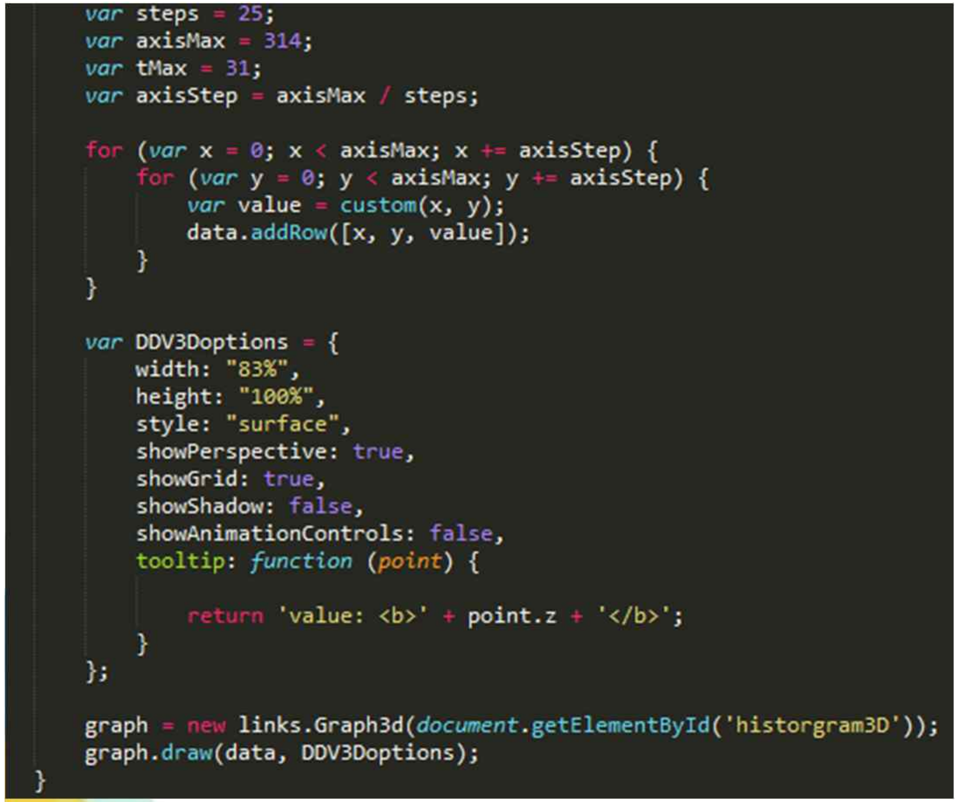
- DDV3DHeatmap



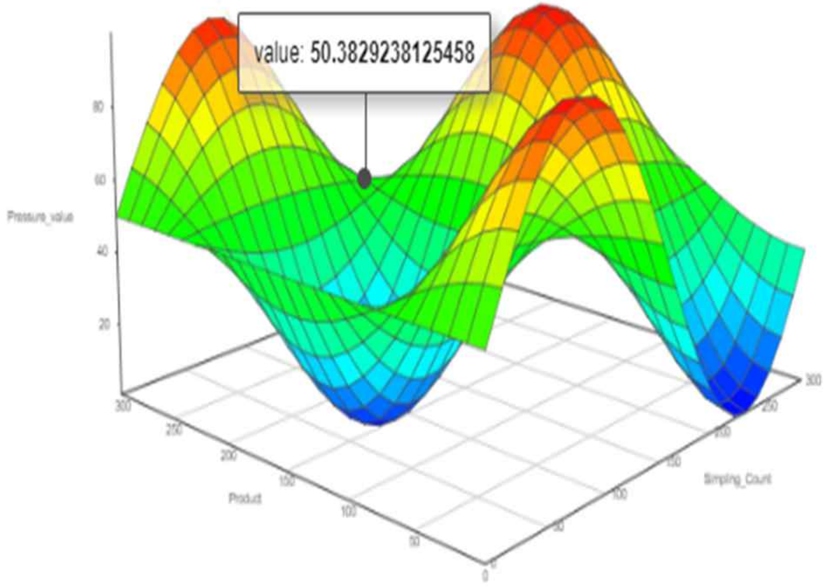
- DDV3DGeo Visualization



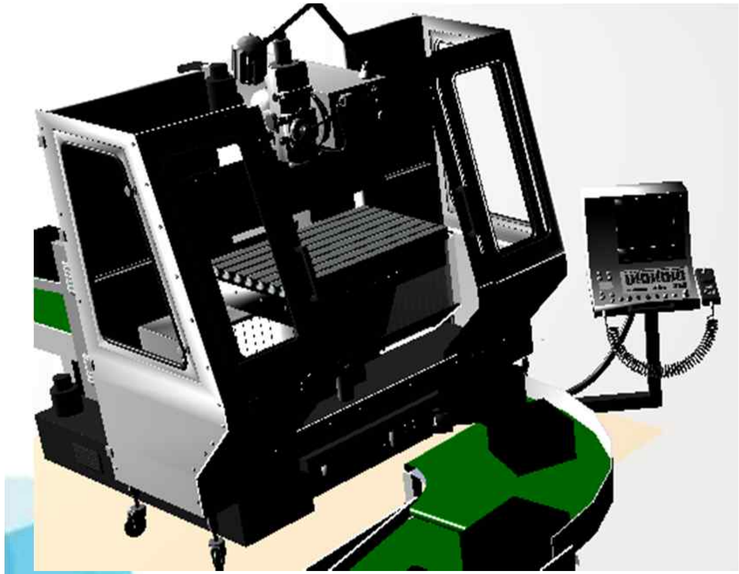
- DDV3D Histogram from Database

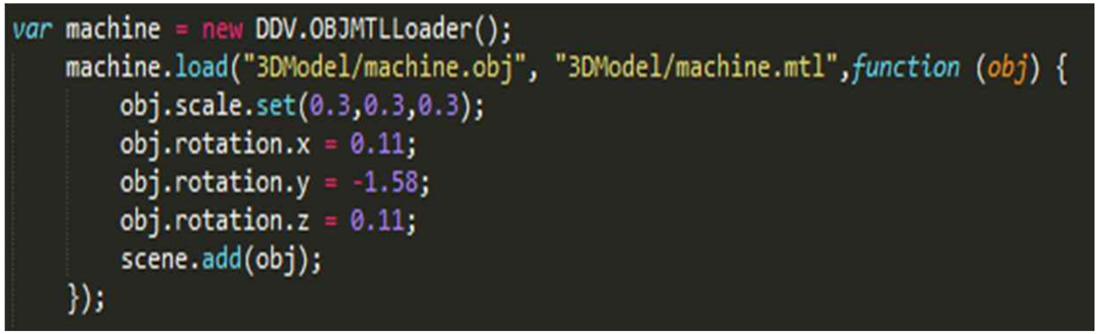


```
    var steps = 25;
    var axisMax = 314;
    var tMax = 31;
    var axisStep = axisMax / steps;

    for (var x = 0; x < axisMax; x += axisStep) {
        for (var y = 0; y < axisMax; y += axisStep) {
            var value = custom(x, y);
            data.addRow([x, y, value]);
        }
    }

    var DDV3Doptions = {
        width: "83%",
        height: "100%",
        style: "surface",
        showPerspective: true,
        showGrid: true,
        showShadow: false,
        showAnimationControls: false,
        tooltip: function (point) {

            return 'value: <b>' + point.z + '</b>';
        }
    };

    graph = new links.Graph3d(document.getElementById('historgram3D'));
    graph.draw(data, DDV3Doptions);
}
```



Load Model object and mtl file

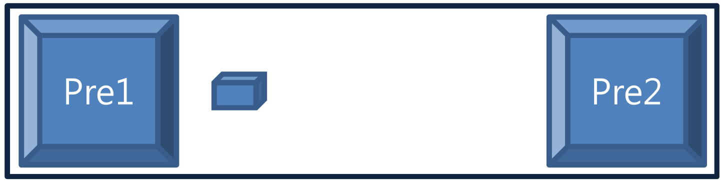


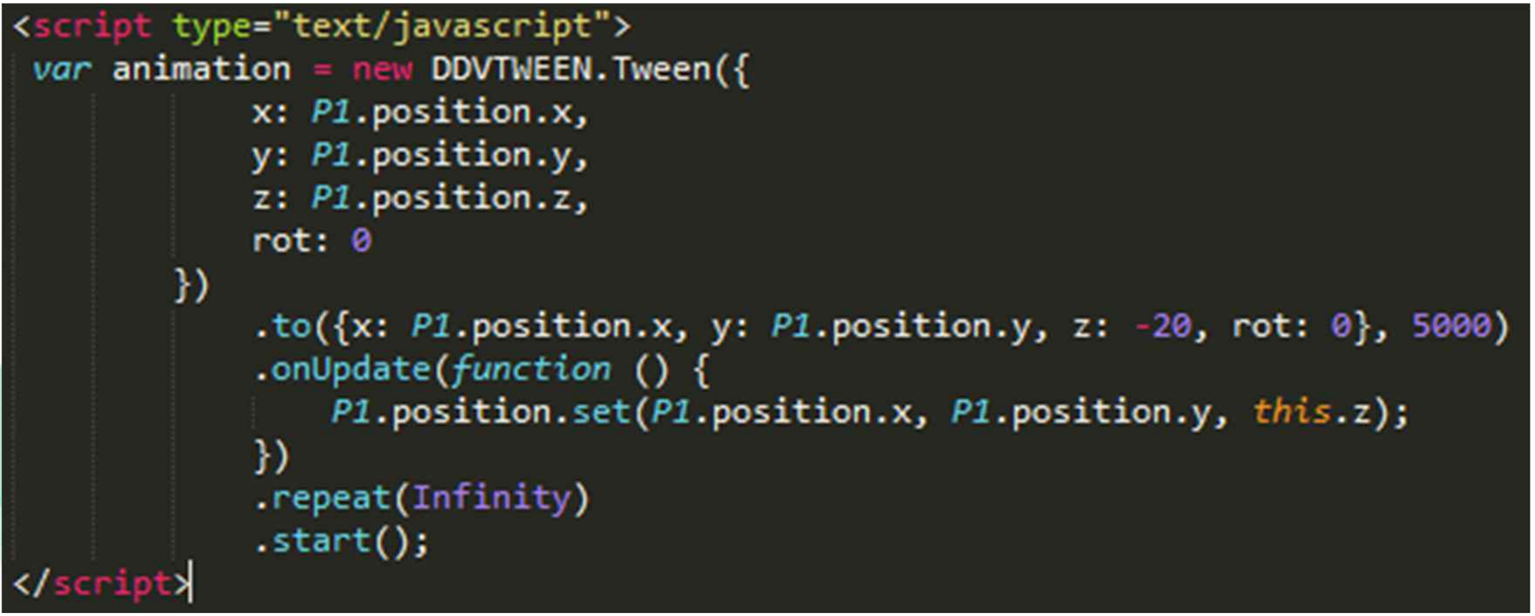


```
var machine = new DDV.OBJMTLLoader();
    machine.load("3DModel/machine.obj", "3DModel/machine.mtl",function (obj) {
        obj.scale.set(0.3,0.3,0.3);
        obj.rotation.x = 0.11;
        obj.rotation.y = -1.58;
        obj.rotation.z = 0.11;
        scene.add(obj);
    });
```

Color
texture

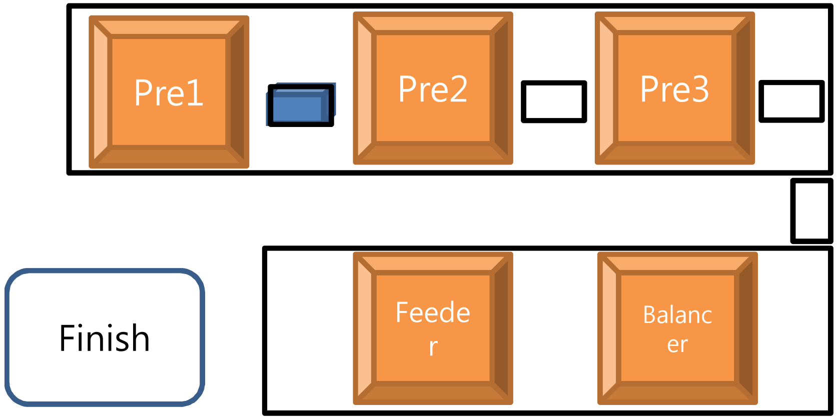
DDVTween.js Animation

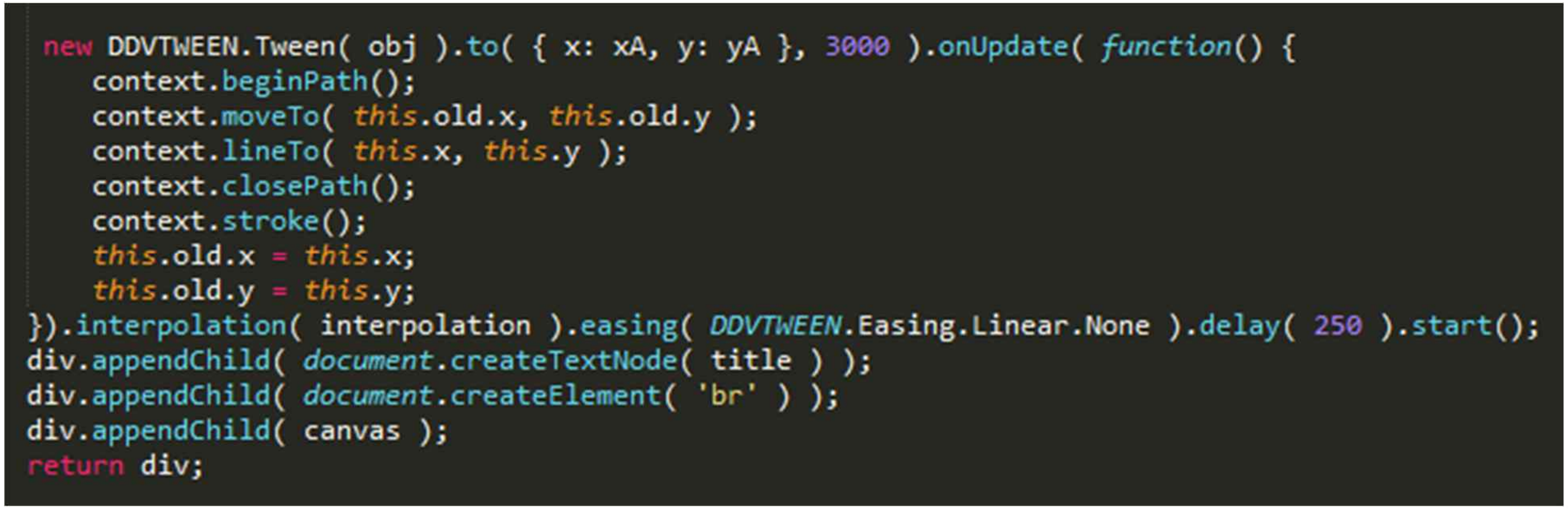




```
<script type="text/javascript">
 var animation = new DDVTWEEN.Tween({
            x: P1.position.x,
            y: P1.position.y,
            z: P1.position.z,
            rot: 0
        })
            .to({x: P1.position.x, y: P1.position.y, z: -20, rot: 0}, 5000)
            .onUpdate(function () {
                P1.position.set(P1.position.x, P1.position.y, this.z);
            })
            .repeat(Infinity)
            .start();
</script>
```

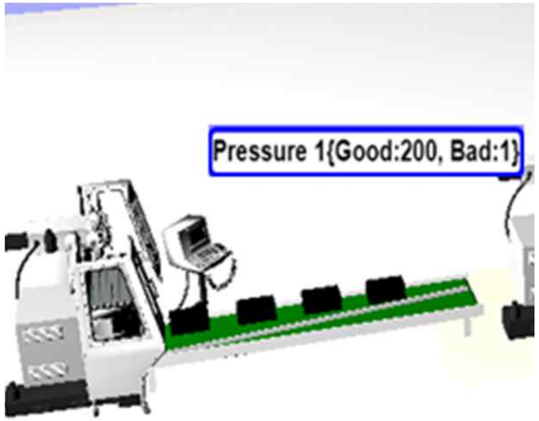
DDVTween.js interpolation Animation

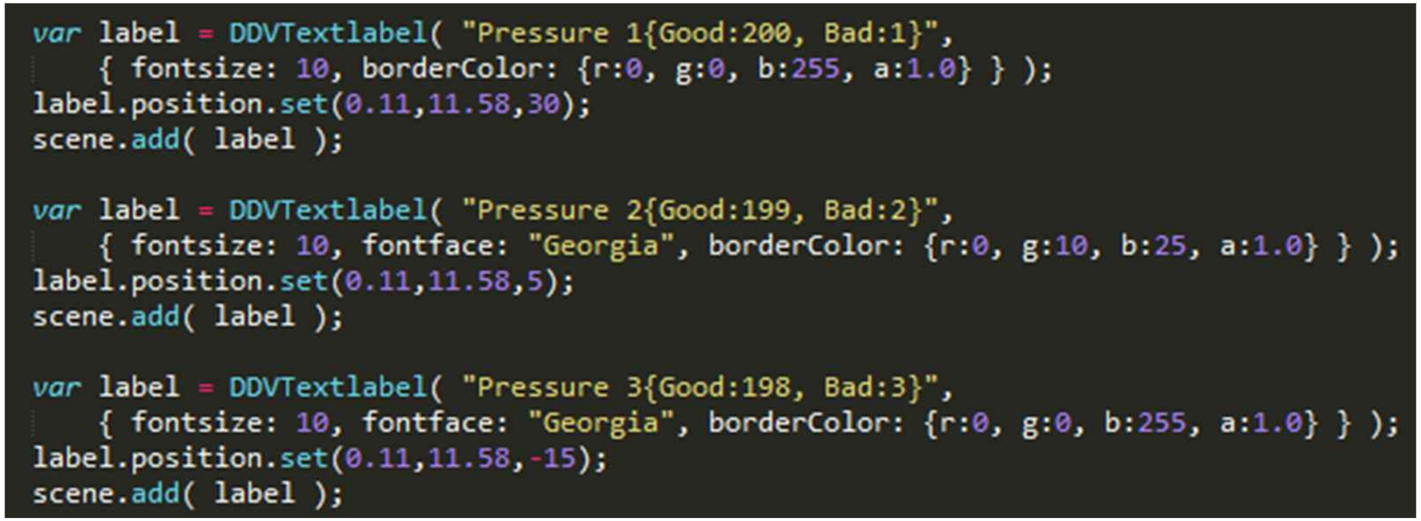




```
new DDVTWEEN.Tween( obj ).to( { x: xA, y: yA }, 3000 ).onUpdate( function() {
  context.beginPath();
  context.moveTo( this.old.x, this.old.y );
  context.lineTo( this.x, this.y );
  context.closePath();
  context.stroke();
  this.old.x = this.x;
  this.old.y = this.y;
}).interpolation( interpolation ).easing( DDVTWEEN.Easing.Linear.None ).delay( 250 ).start();
div.appendChild( document.createTextNode( title ) );
div.appendChild( document.createElement( 'br' ) );
div.appendChild( canvas );
return div;
```

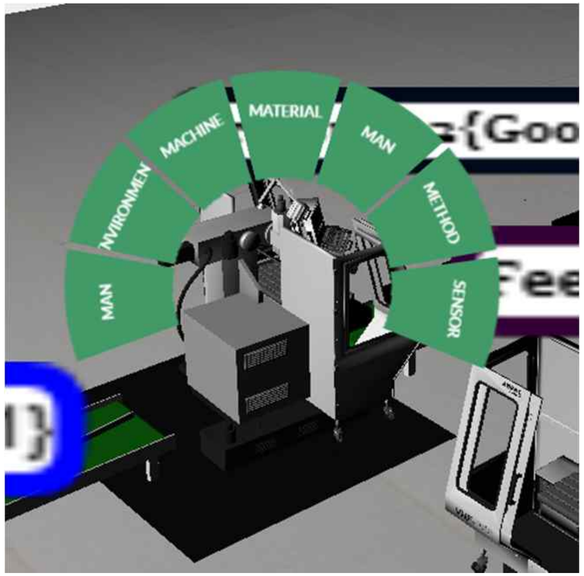
DDVLabel

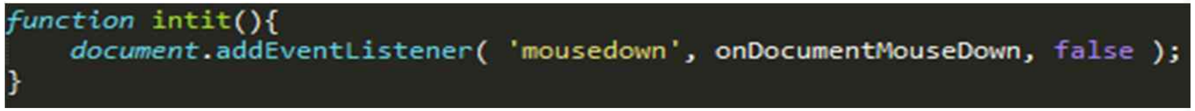




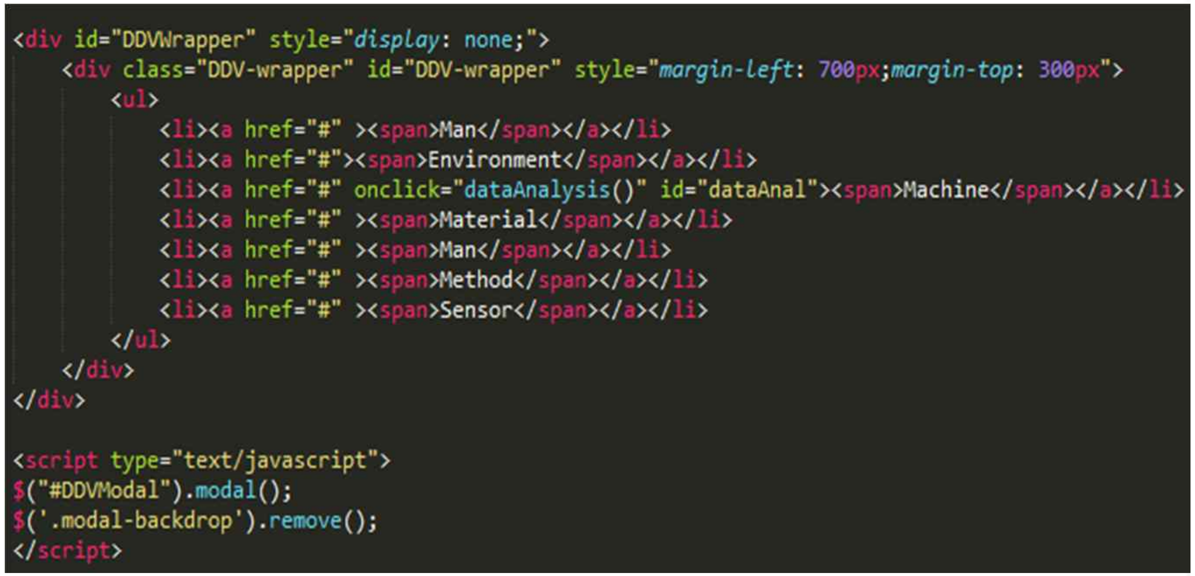
```
var label = DDVTextlabel( "Pressure 1{Good:200, Bad:1}",
    { fontsize: 10, borderColor: {r:0, g:0, b:255, a:1.0} } );
label.position.set(0.11,11.58,30);
scene.add( label );

var label = DDVTextlabel( "Pressure 2{Good:199, Bad:2}",
    { fontsize: 10, fontface: "Georgia", borderColor: {r:0, g:10, b:25, a:1.0} } );
label.position.set(0.11,11.58,5);
scene.add( label );

var label = DDVTextlabel( "Pressure 3{Good:198, Bad:3}",
    { fontsize: 10, fontface: "Georgia", borderColor: {r:0, g:0, b:255, a:1.0} } );
label.position.set(0.11,11.58,-15);
scene.add( label );
```

DDVMenu onmodels



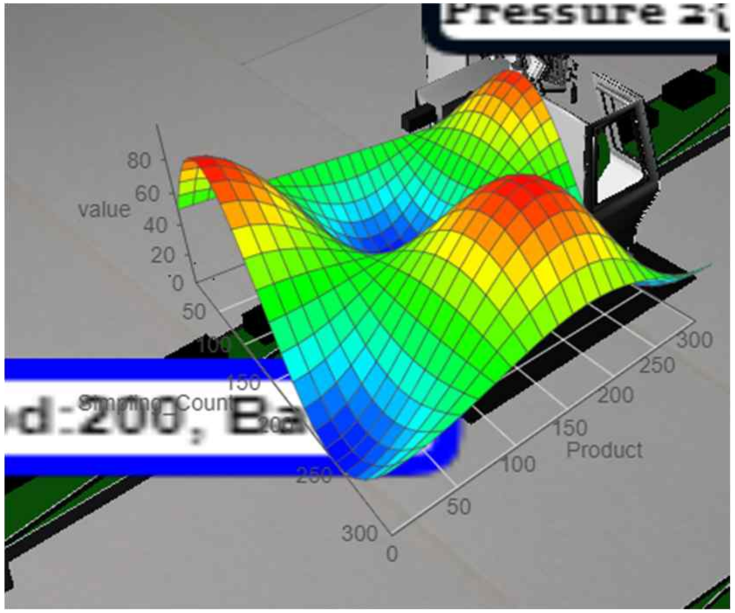


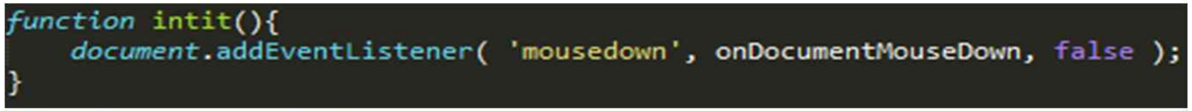
```
function intit(){
    document.addEventListener( 'mousedown', onDocumentMouseDown, false );
}
```



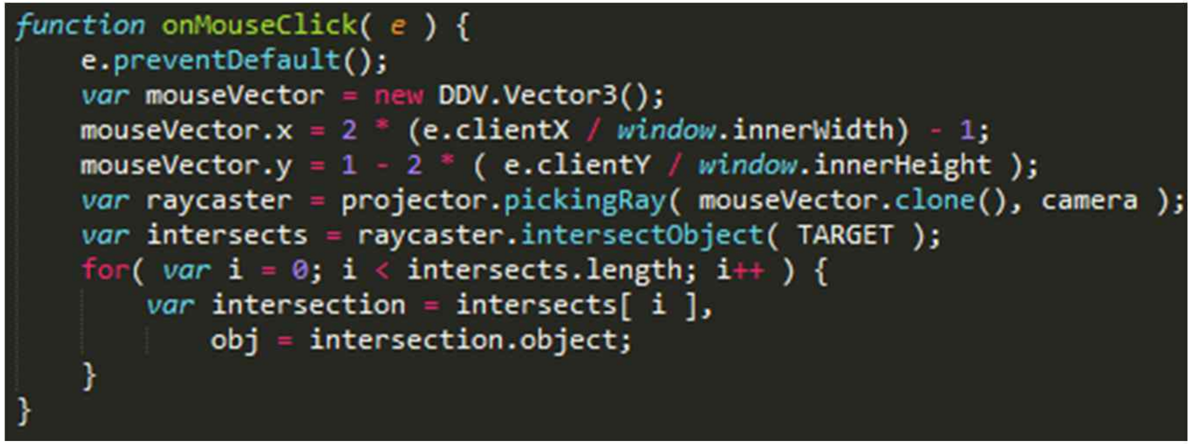
```
<div id="DDVWrapper" style="display: none;">
    <div class="DDV-wrapper" id="DDV-wrapper" style="margin-left: 700px;margin-top: 300px">
        <ul>
            <li><a href="#" ><span>Man</span></a></li>
            <li><a href="#"><span>Environment</span></a></li>
            <li><a href="#" onclick="dataAnalysis()" id="dataAnal"><span>Machine</span></a></li>
            <li><a href="#" ><span>Material</span></a></li>
            <li><a href="#" ><span>Man</span></a></li>
            <li><a href="#" ><span>Method</span></a></li>
            <li><a href="#" ><span>Sensor</span></a></li>
        </ul>
    </div>
</div>

<script type="text/javascript">
$("#DDVModal").modal();
$('.modal-backdrop').remove();
</script>
```

DDVClick Menu Item



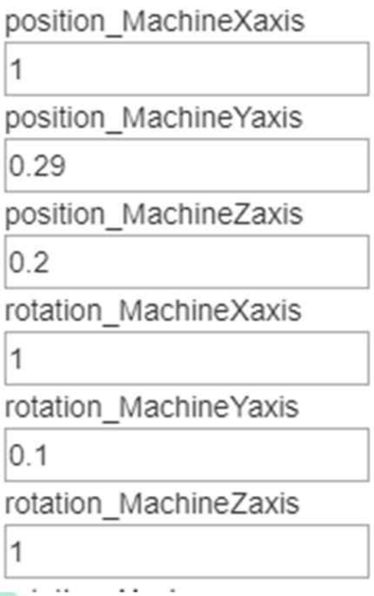


```
function intit(){
    document.addEventListener( 'mousedown', onDocumentMouseDown, false );
}
```

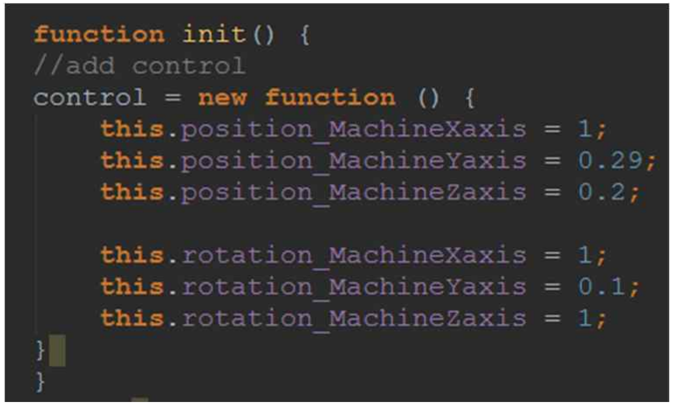


```
function onMouseClick( e ) {
    e.preventDefault();
    var mouseVector = new DDV.Vector3();
    mouseVector.x = 2 * (e.clientX / window.innerWidth) - 1;
    mouseVector.y = 1 - 2 * ( e.clientY / window.innerHeight );
    var raycaster = projector.pickingRay( mouseVector.clone(), camera );
    var intersects = raycaster.intersectObject( TARGET );
    for( var i = 0; i < intersects.length; i++ ) {
        var intersection = intersects[ i ],
            obj = intersection.object;
    }
}
```

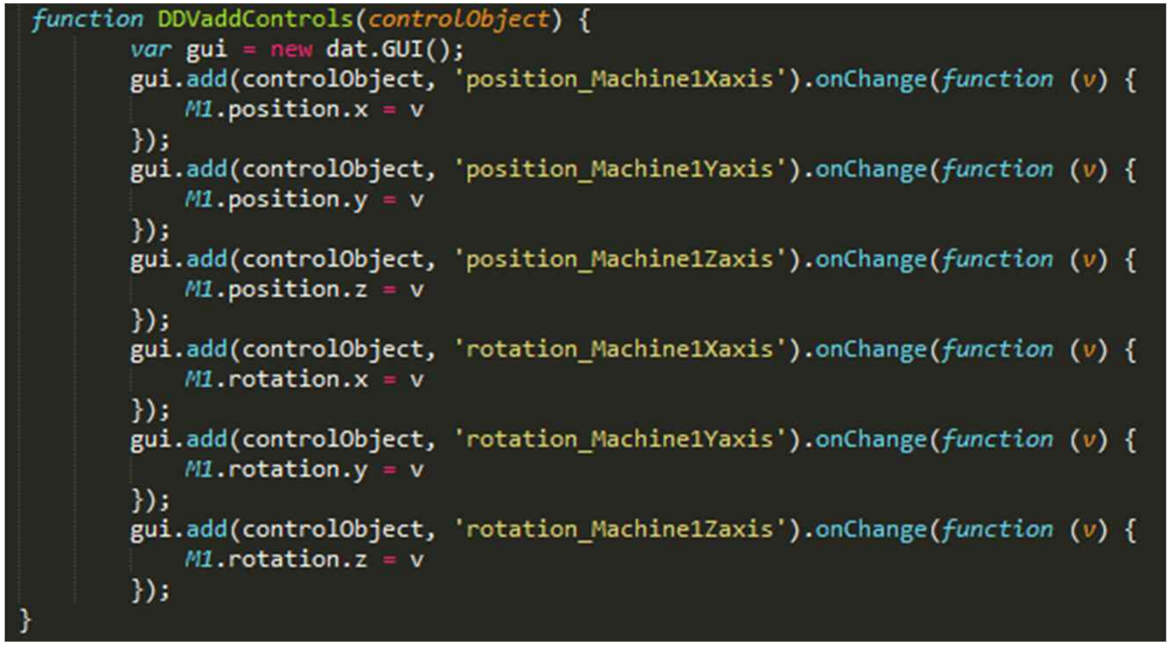
DDVPosition/ DDVRotation



position_MachineXaxis
1
position_MachineYaxis
0.29
position_MachineZaxis
0.2
rotation_MachineXaxis
1
rotation_MachineYaxis
0.1
rotation_MachineZaxis
1

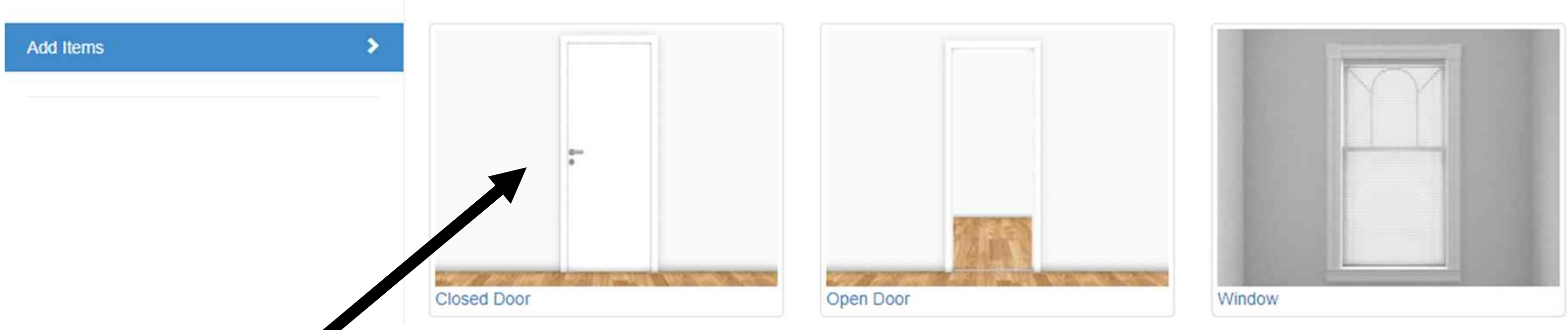


```
function init() {
//add control
control = new function () {
    this.position_MachineXaxis = 1;
    this.position_MachineYaxis = 0.29;
    this.position_MachineZaxis = 0.2;

    this.rotation_MachineXaxis = 1;
    this.rotation_MachineYaxis = 0.1;
    this.rotation_MachineZaxis = 1;
}
}
```



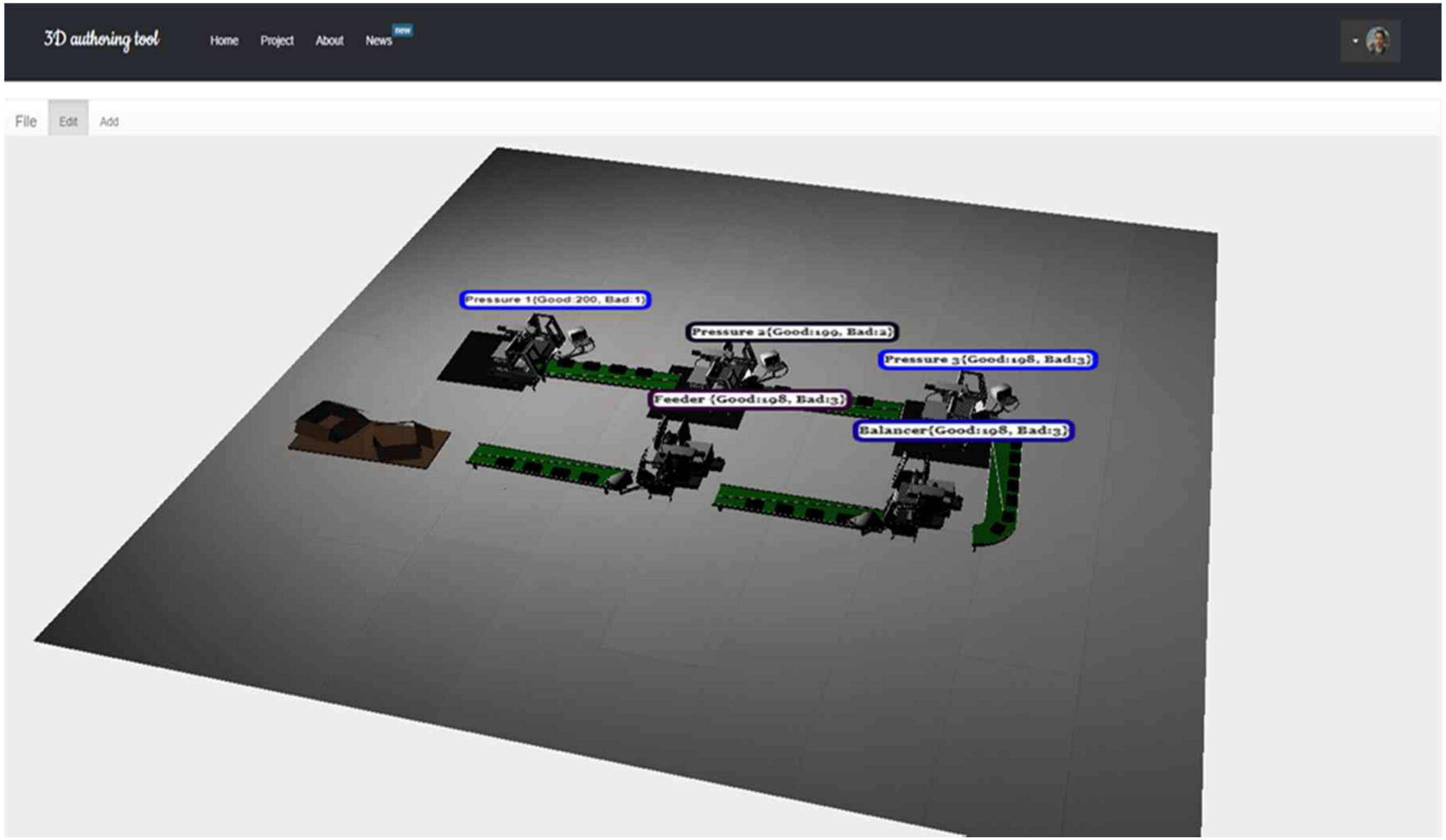
```
function DDVaddControls(controlObject) {
        var gui = new dat.GUI();
        gui.add(controlObject, 'position_Machine1Xaxis').onChange(function (v) {
            M1.position.x = v
        });
        gui.add(controlObject, 'position_Machine1Yaxis').onChange(function (v) {
            M1.position.y = v
        });
        gui.add(controlObject, 'position_Machine1Zaxis').onChange(function (v) {
            M1.position.z = v
        });
        gui.add(controlObject, 'rotation_Machine1Xaxis').onChange(function (v) {
            M1.rotation.x = v
        });
        gui.add(controlObject, 'rotation_Machine1Yaxis').onChange(function (v) {
            M1.rotation.y = v
        });
        gui.add(controlObject, 'rotation_Machine1Zaxis').onChange(function (v) {
            M1.rotation.z = v
        });
}
```

Add 3D Object

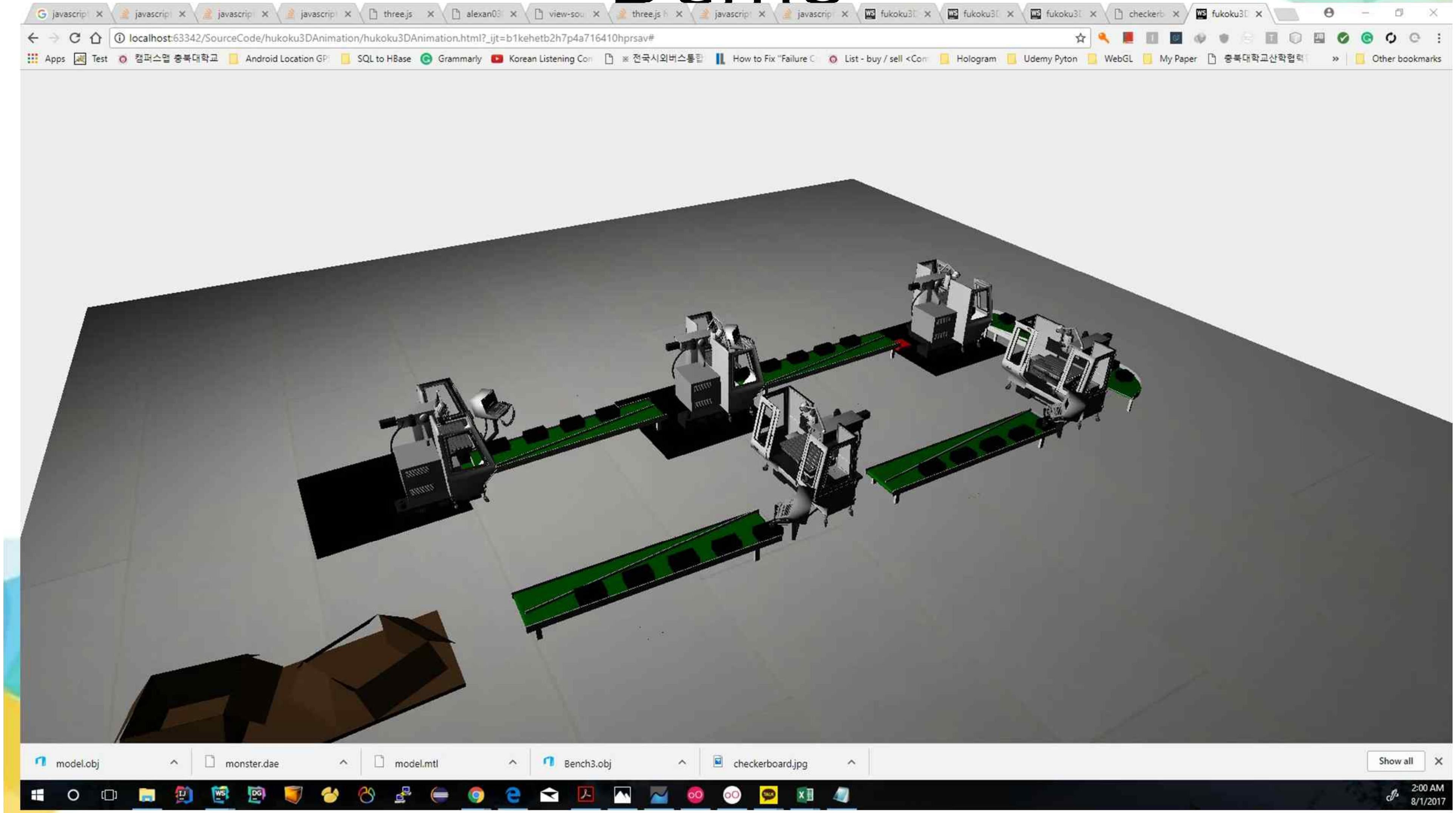


3D Model Object

Authoring tool UI


3D authoring tool
Home
Project
About
News
new
File
Edit
Add
Pressure 1{Good:200, Bad:1}
Pressure 2{Good:199, Bad:2}
Pressure 3{Good:198, Bad:3}
Feeder {Good:198, Bad:3}
Balancer{Good:198, Bad:3}

Demo



localhost:63342/SourceCode/hukoku3DAnimation/hukoku3DAnimation.html?_ijt=b1kehetb2h7p4a716410hprsav#

- ## 3D Components

Class	Detail
3D Components	3D Treemap
	3D Tree
	3D Pack
	3D Partition
	3D Force
	3D Bundle
	3D Chord
	3D Cluster
	3D Stack
	3D Hierarchy

3D Graph
3D accumulation stick graph
3D Point Graph
3D Time Series Graph
3D Stage Graph
3D Pie Chart
3D Donut Chart
3D accumulation stick graph
3D accumulation continuous graph
3D Scatter Plot
3D Bubble Chart
3D Histogram
3D Density Graph
3D Heatmap
3D Chernoff Face
3D Star Chart
Various Visualization on 3D Map
Charts on 3D Map

CONTENTS

Class	Description
DDVTimeseries	3D Graph
	3D accumulation stick graph
	3D Point Graph
	3D Time Series Graph
	3D Stage Graph
DDVDistribution	3D Pie Chart
	3D Donut Chart
	3D accumulation stick graph
	3D Tree map
	3D accumulation continuous graph
DDVRelation	3D Scatter Plot
	3D Bubble Chart
	3D Histogram
	3D Density Graph
DDVComparison	3D Heatmap
	3D Chernoff Face
	3D Star Chart
	3D parallel coordinates
DDVSpatial	Various Visualization on 3D Map
	Charts on 3D Map

Future Plan

- Design Database(Store 3D Object information)
- Data gathering(apply into 3D manufacturing animation)
- Remake layout and default model Object(When startup program)
- Animation (When products or machines have problem alert message)
- Live data (Label) on each machines
- Apply 3D visualization (3D Bar chart, 3D Histogram)
- Add functions(Environment, Machine, Material, Man, Method, Sensor)
- Design hand robot (Pressure1,2,3 …)
- Update UI authoring tool
- Users select specific location in scene and than add 3D object

Thank You!