



State of mago3D, An Open Source Based Digital Twin Platform

2021년 10월 29일

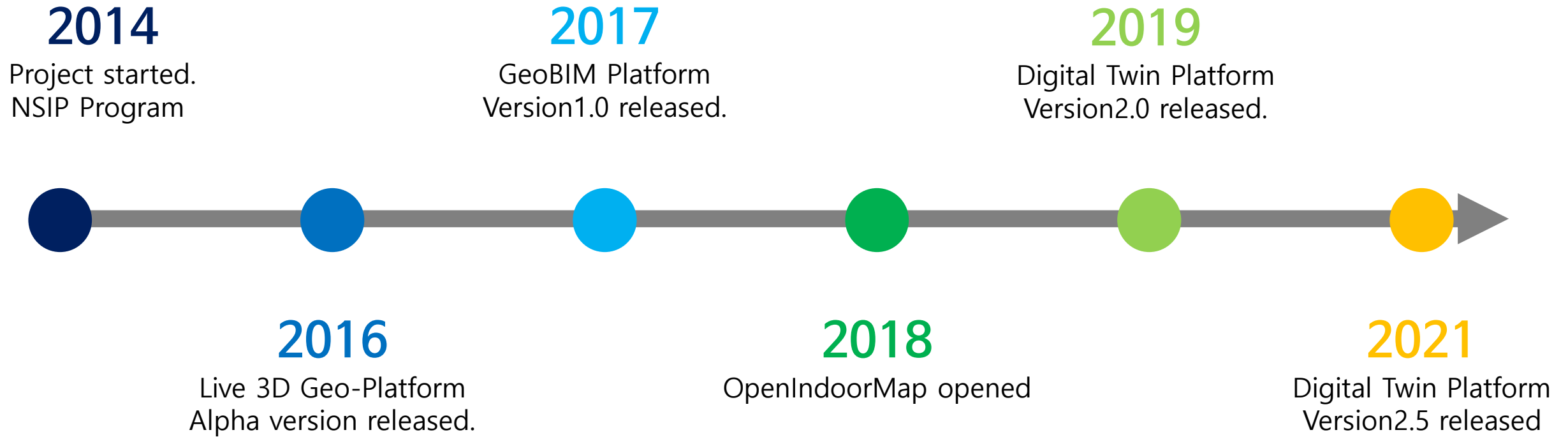
신상희(shshin@gaia3d.com)





MAGO

Goddess of Earth
in Korean old myth



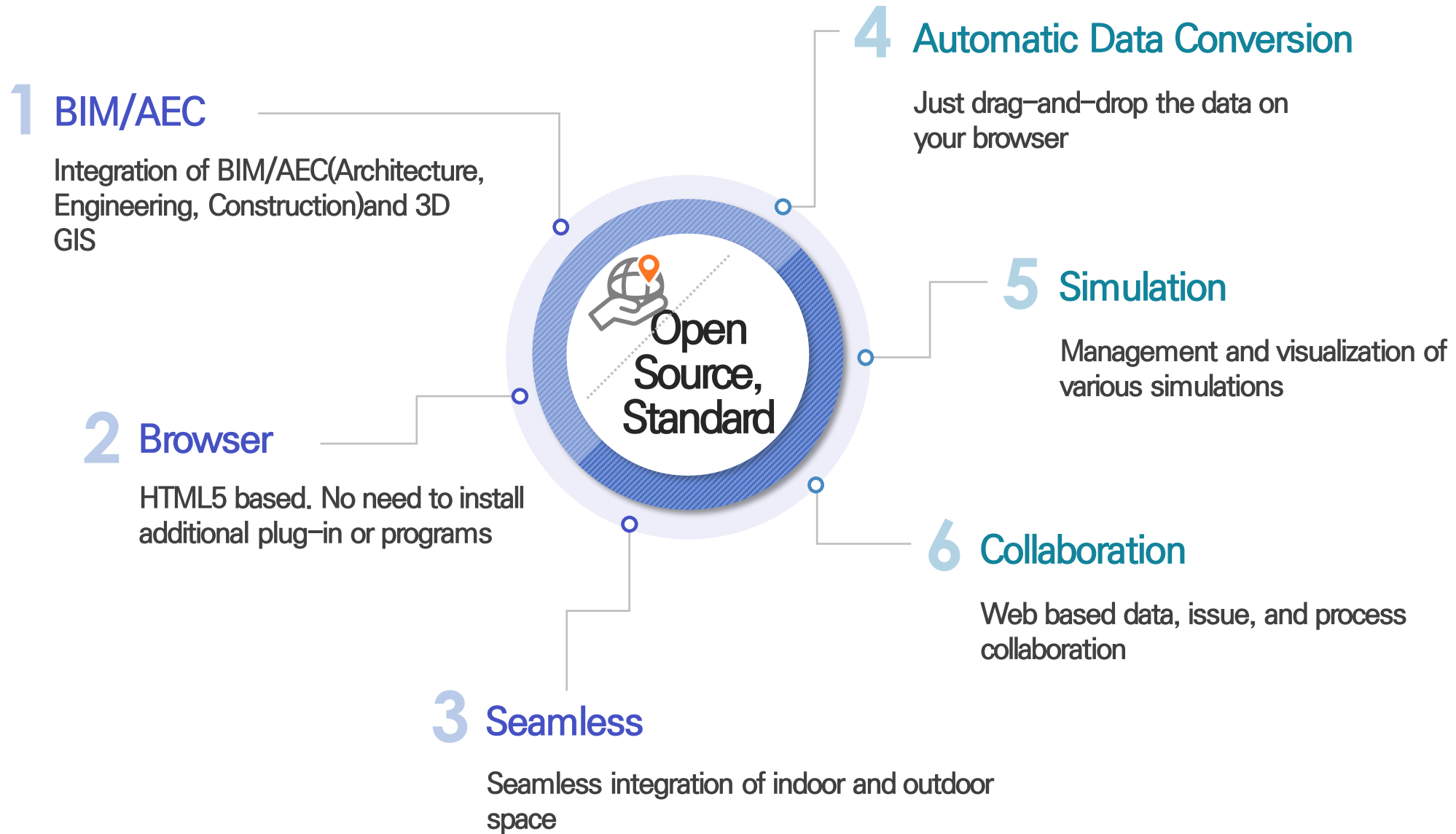
mago3D - Overview

mago3D is an open source based **Digital Twin Platform** that can replicate and simulate the real world objects, processes, and phenomena on web environment. mago3D can integrate, manage, and visualize various kinds of data such as CityGML, IndoorGML, LAS, IFC, 3DS, IoT, and other popular GIS formats.

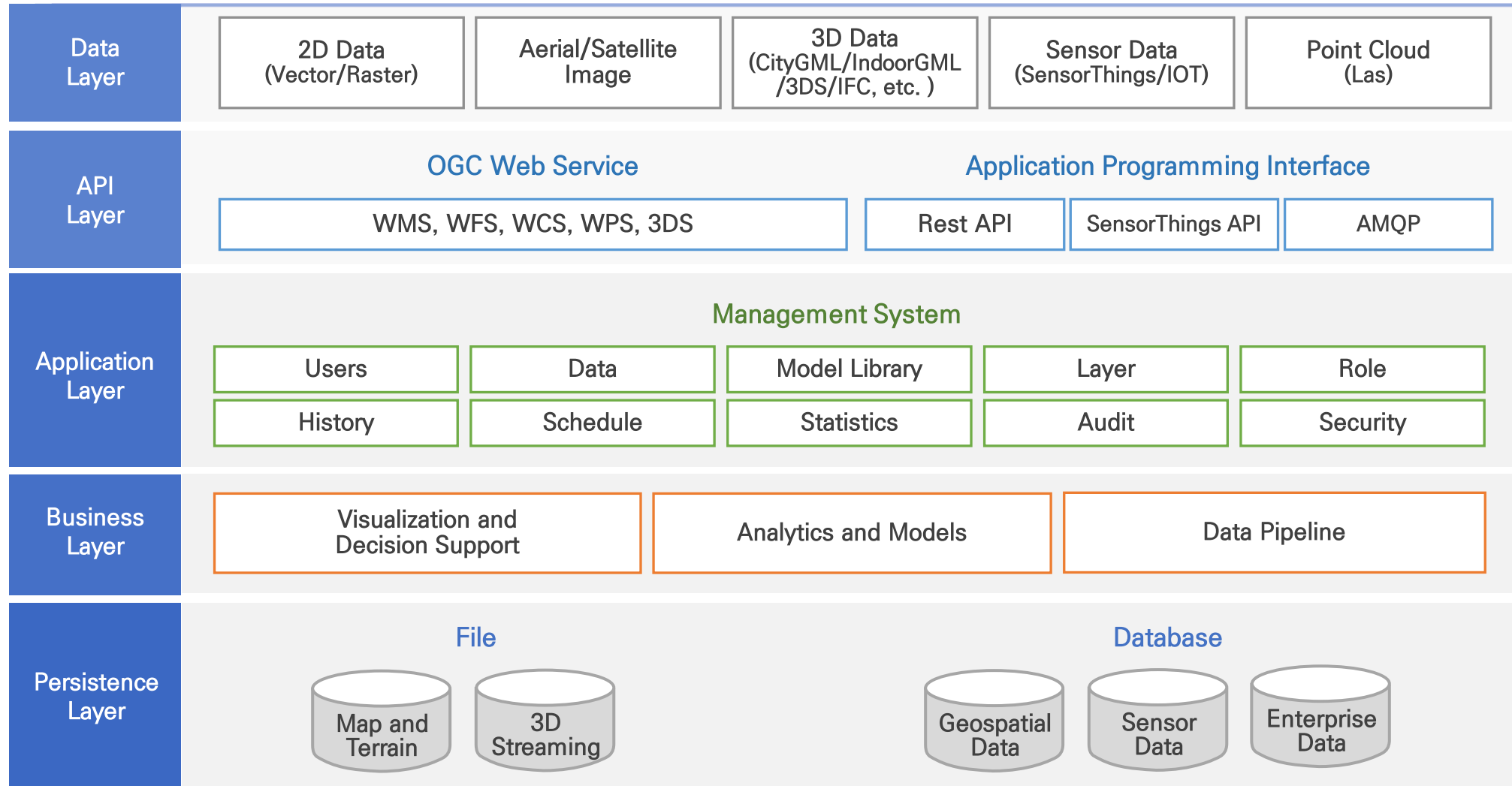
The word cloud features the following terms and their approximate sizes and colors:

- GIS**: Large green letters, with "Seamless" above it.
- Web**: Large black letters, with "2D" and "AI" above it.
- Open Source**: Large orange letters, with "Dashboard" to its right.
- BIM**: Large blue letters, with "3D" and "Analysis" to its right.
- AEC**: Large blue letters, with "Virtual Process" to its left.
- Bigdata**: Large grey letters, with "Engineering Sensor Reports" above it and "User Interface API" to its right.
- Geospatial**: Vertical grey text on the left side.
- Management System**: Grey text below "Bigdata".
- Upload**: Grey text below "Management System".
- Visualization Security IOT**: Grey text at the bottom.
- Construction Digital twin**: Grey text below "Web".
- Simulation Library Architecture**: Grey text below "Web".
- WAS Cloud**: Grey text to the right of "Web".
- Platform Must Layer**: Grey text to the left of "BIM".

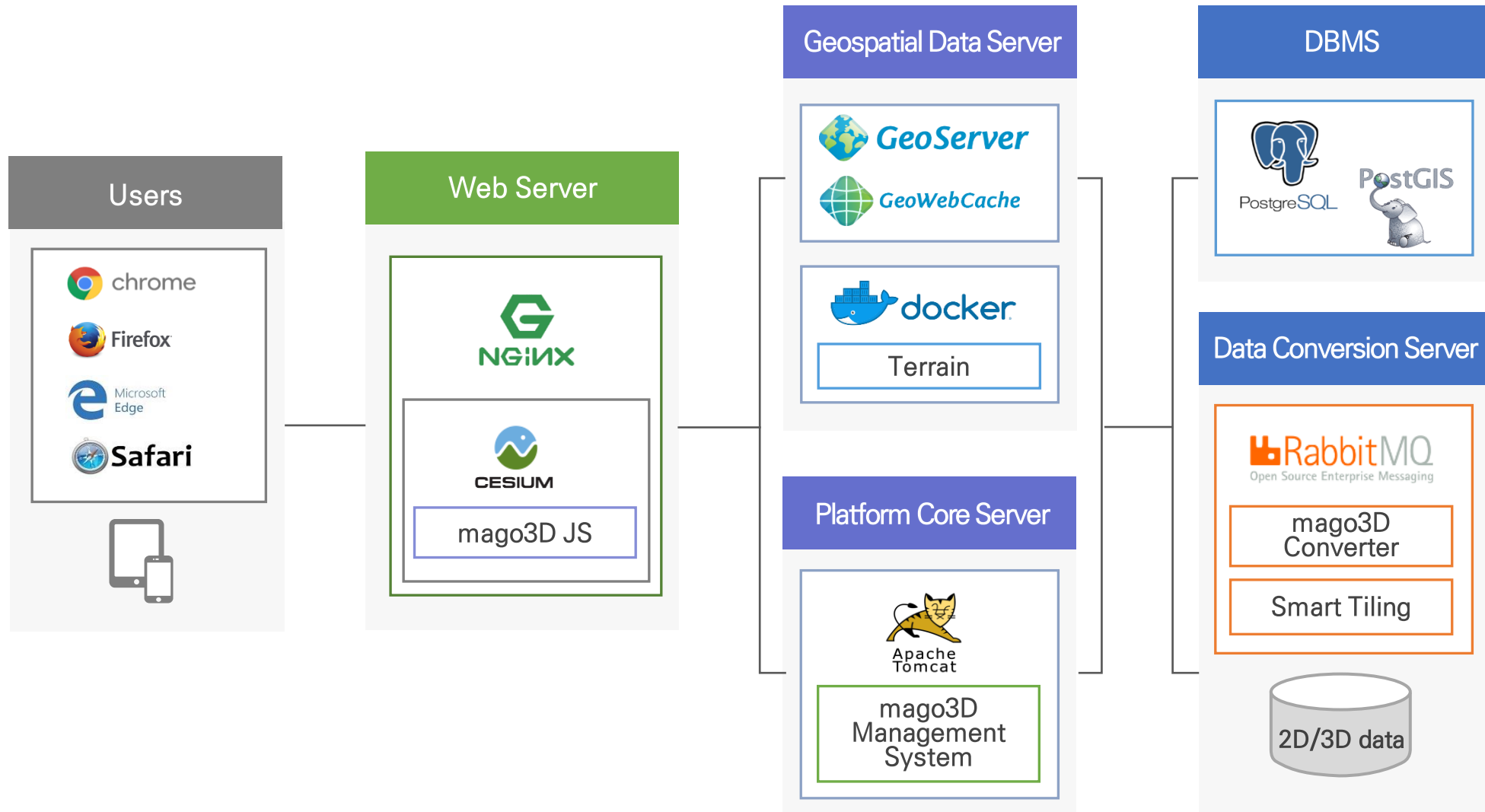




mago3D - System Layers



mago3D - System Architecture



mago3D - Software Components

BackOffice	Log/Build	Logback / Gradle 6
	Schedule/Report	Quartz 2.4.0 / JasperReports 7.5
Presentation Layer	View	HTML5 + Thymeleaf 3.0.11 + Chart js 2.9.3
	WebGL Globe	CesiumJS 1.70 + mago3D JS
Persistence Layer	RDBMS	PostgreSQL 12 + PostGIS 3.0
Data Conversion Layer	Message Queue	HTML5 + Thymeleaf 3.0.11 + Chart js 2.9.3
	Data conversion Server	CesiumJS 1.70 + mago3D JS
Geospatial Data Layer	Terrain Server	GeoServer 2.17.0 + GeoWebCache 1.15.0
	Geospatial Data Server	Docker Engine – CentOS(Community) / window 2.3.0.2
Business Layer	Business Server	mago3D Management System (User, Admin)
	Framework	Spring 5 (Spring boot 2.3) + Mybatis 3.5.4
Infrastructure Layer	Language	Java (OpenJDK 11.0.2)
	WAS	Tomcat 0.0.35
	Web Server	Nginx 1.16
	OS	Linux Centos 7.6 / Window Server 2019

mago3D - Main Features

Automatic Data Conversion	Hassle free data display(Data Uploading → Automatic Data Conversion → Data Display)
Various Formats Supporting	3DS, OBJ, FBX, IFC, CityGML, IndoorGML, LAS, SHP, GPKG, GeoTiff, etc.
Rule Based Management System	Rule based 2D/3D data management for flexible system
Smart Tiling	Increasing large size 3D data streaming speed and rendering quality
Simulation	Sunlight, Shadow, Air pollution, Wind, Town design simulation, etc.
API	Rest, Restful APIs for data, screen handling
Dashboard	Dashboard for monitoring user activities, data, APIs, system health, schedules, etc.
Standard Compliance	Compliant with OGC, buildingSMART, W3C's standards.

2D/3D Data Upload and Automatic Conversion

3D Data Uploading

데이터명 *	IFC 파일 자동 변환	데이터 그룹 *	기본
공유 유형 *	공통	데이터 타입 *	IFC
높이 설정 방법	Terrain(지형)으로 부터 높이 설정	대표 위치 (경도)	127
용도 *	<input checked="" type="radio"/> 단일형 <input type="radio"/> 복합형	설명	IFC

파일 업로딩

Image

GeoTiff

Vector

GPKG, SHP, GML

3D

CityGML, IndoorGML, 3DS, OBJ, DAE

BIM

IFC

Point Cloud

LAS

Upload

Reset

List

2D Data Uploading

레이어 그룹명 *	기본레이어	공유 유형	<input checked="" type="radio"/> 공개 <input type="radio"/> 비공개 <input type="radio"/> 그룹
레이어 명	시도 시군구	레이어 Key	idistrict
OGC Web Services *	WMS	Cache 사용 여부	<input checked="" type="radio"/> 사용 <input type="radio"/> 미사용
레이어 타입 *	Vector	도형 타입	Polygon
좌측한 제한	#E47467	좌측한 두께	1
우측한 제한	#119F00	투명도	100%
레이어 표시 순서	1	표시 순서(Index)	1
기본 표시	<input checked="" type="radio"/> 사용 <input type="radio"/> 미사용	사용 여부	<input checked="" type="radio"/> 사용 <input type="radio"/> 미사용
Label 표시 여부	<input checked="" type="radio"/> 표시 <input type="radio"/> 비표시	설명	idistrict text
좌표계	EPSG:5176	SHP 파일 인코딩	UTF-8

파일 업로딩

0.5 KB
시도시군구(문)

10 KB
시도시군구(문)

0.1 KB
시도시군구(문)

84 b
시도시군구(문)

2D/3D Display



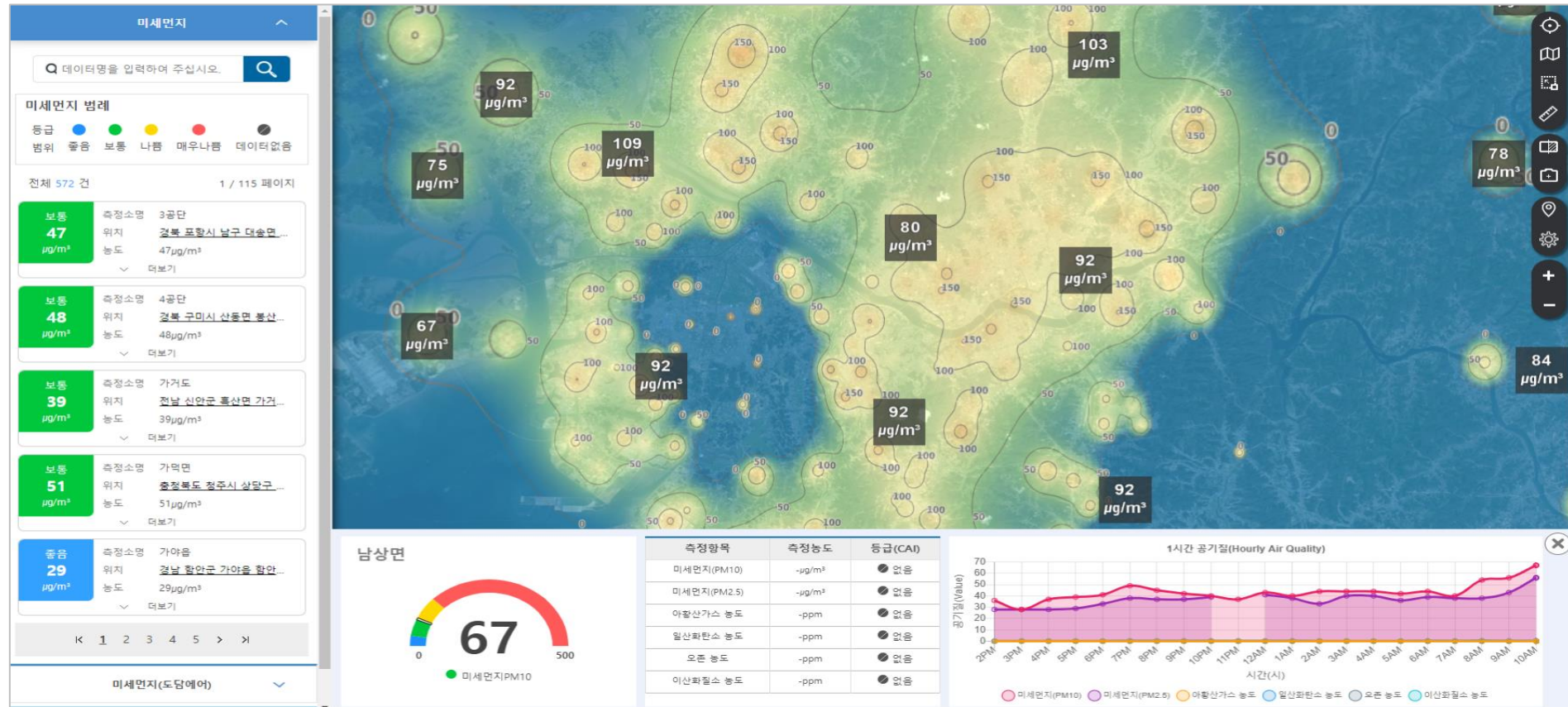
The screenshot displays the mago3D software interface. On the left is a sidebar with navigation options: 검색 (Search), 데이터 (Data), 변환 (Convert), 공간분석 (Spatial Analysis), 시물레이션 (Simulation), 시민참여 (Citizen Participation), 레이어 (Layers), and 환경설정 (Settings). The main window shows a 3D rendering of a city with numerous high-rise buildings. A data table is overlaid on the left side of the 3D view, listing road signs. The table has columns for '번호' (Number), '공유 유형' (Share Type), '데이터명' (Data Name), '표시' (Display), and '이동' (Move). The data rows are as follows:

번호	공유 유형	데이터명	표시	이동
63	C	road sign 9	관리자	
62	C	road sign 8	관리자	
61	C	road sign 7	관리자	
60	C	road sign 62	관리자	
	C	road sign 61	관리자	

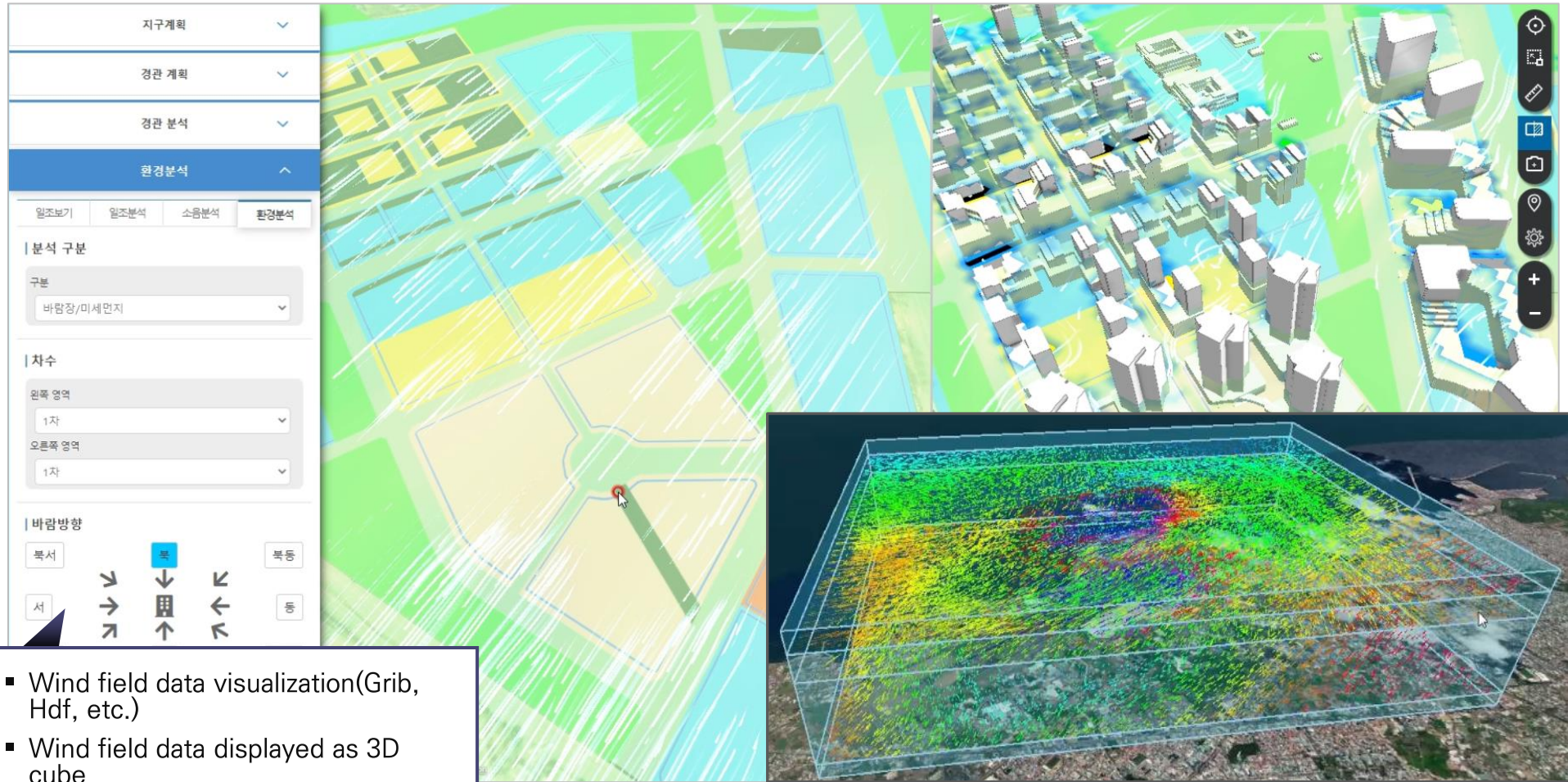
Below the table, a callout box contains an icon of a grid and the text: **Smart Tiling:** Increasing large 3D data streaming speed and rendering quality.

IoT - SensorThings API

- GDAL Grid : Create 2D grid from scattered sensor data
- GDAL Contour : Extract isoline from grid data

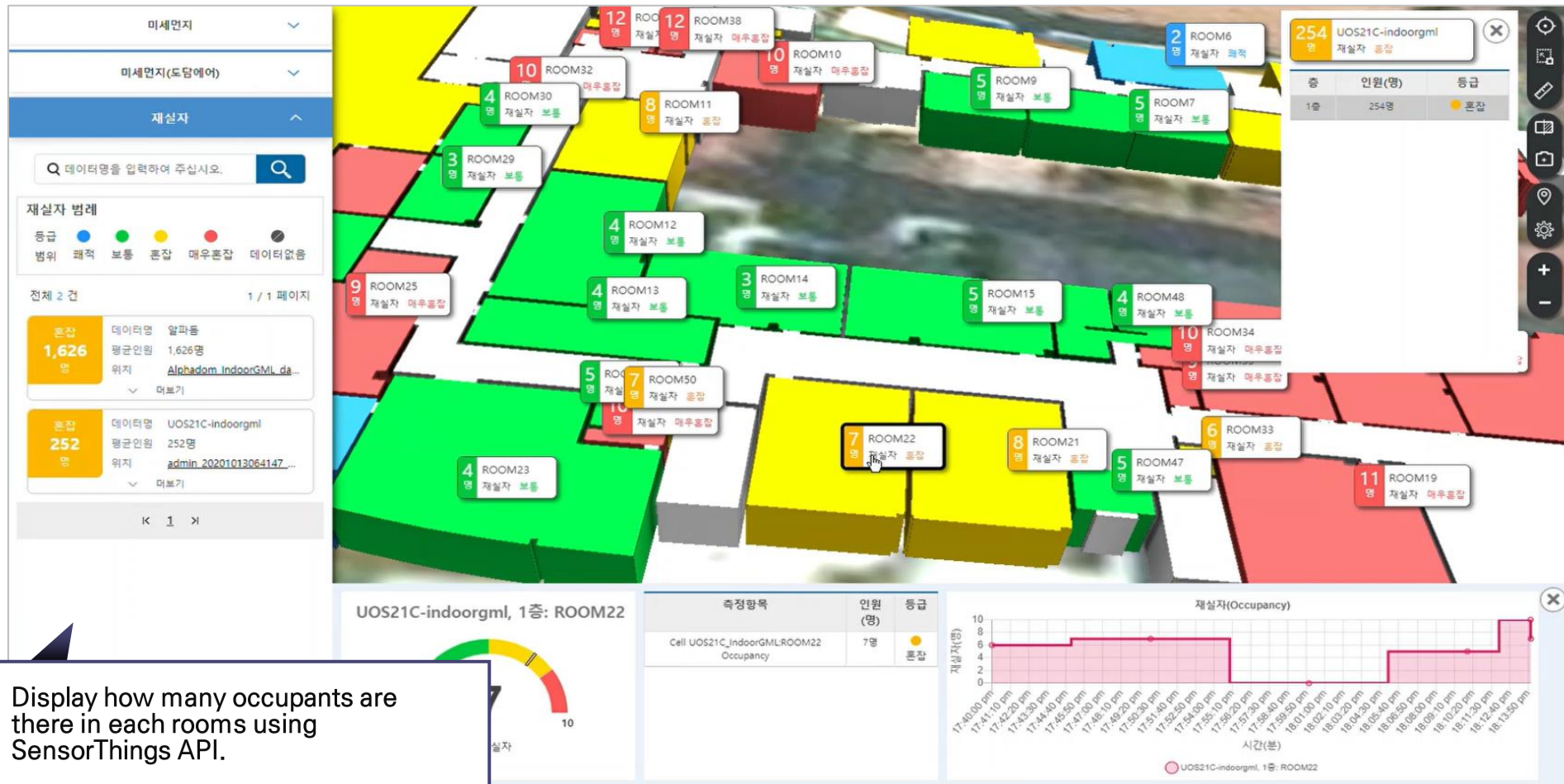


Wind



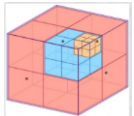
- Wind field data visualization(Grib, Hdf, etc.)
- Wind field data displayed as 3D cube

Indoor Occupant(SensorThings API)



Display how many occupants are there in each rooms using SensorThings API.

| Point Cloud



Optimized performance using pyramidal data structure

Town Planning

Town Planning Simulation using 3D Library

Trees			Lights		Buildings		
벚나무	소나무	은행나무	양날형	현날형	고층	저층	주상복합 등

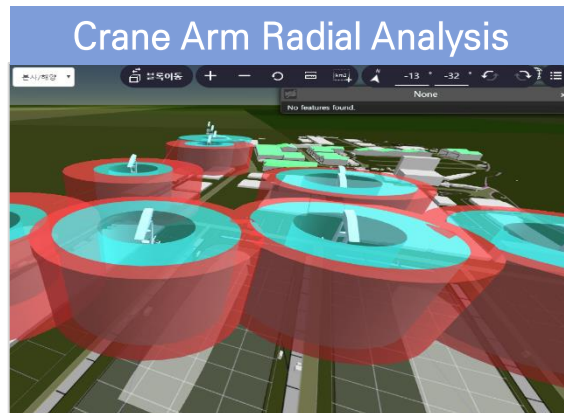
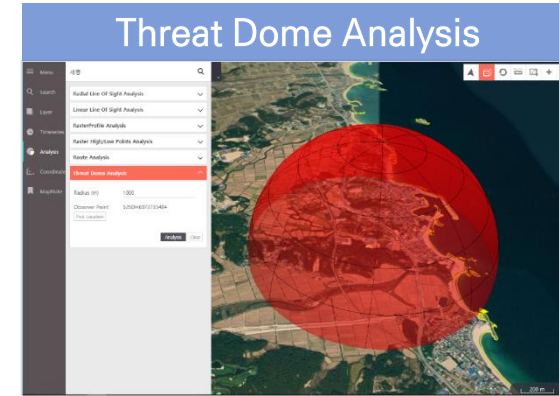
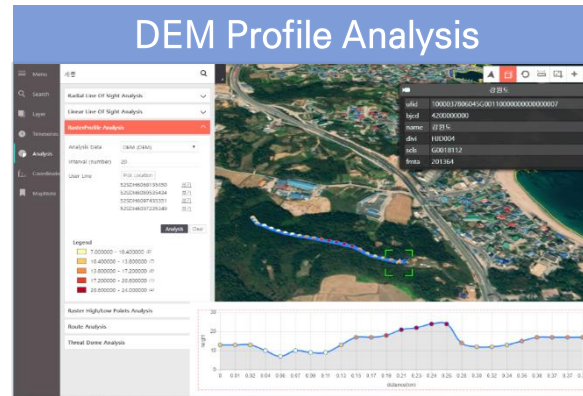
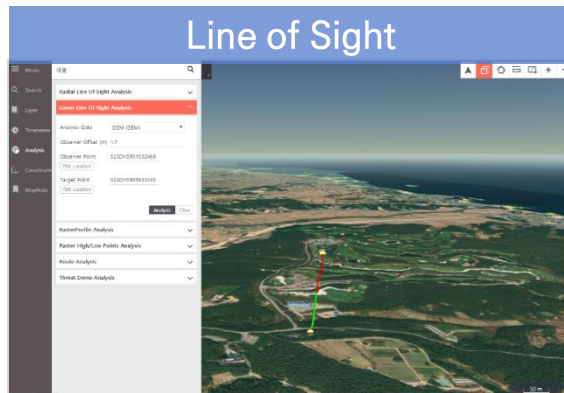
구분	값	구분	값
사업지구	개발지구	위치	인천광역시 계양구
면적(㎡)	3,346,214	계획 세대수	19,000
계획 인구수	108,000	변경 세대수	19,728
		변경 인구수	45,374

구분	기준	허용	변경
건폐율(%)	50	20.35	99.65
용적률(%)	48	280	99.99
용도지구	공동주택		
세대수		12,938	

구분	기준	계획
층수(층)	35	15
배치면적(㎡)	1,200	1,200
면적(㎡)	105,840	105,840
용량	84	
주요도판	2.0	

2D/3D Analysis

Expand analytical functions using OGC WPS

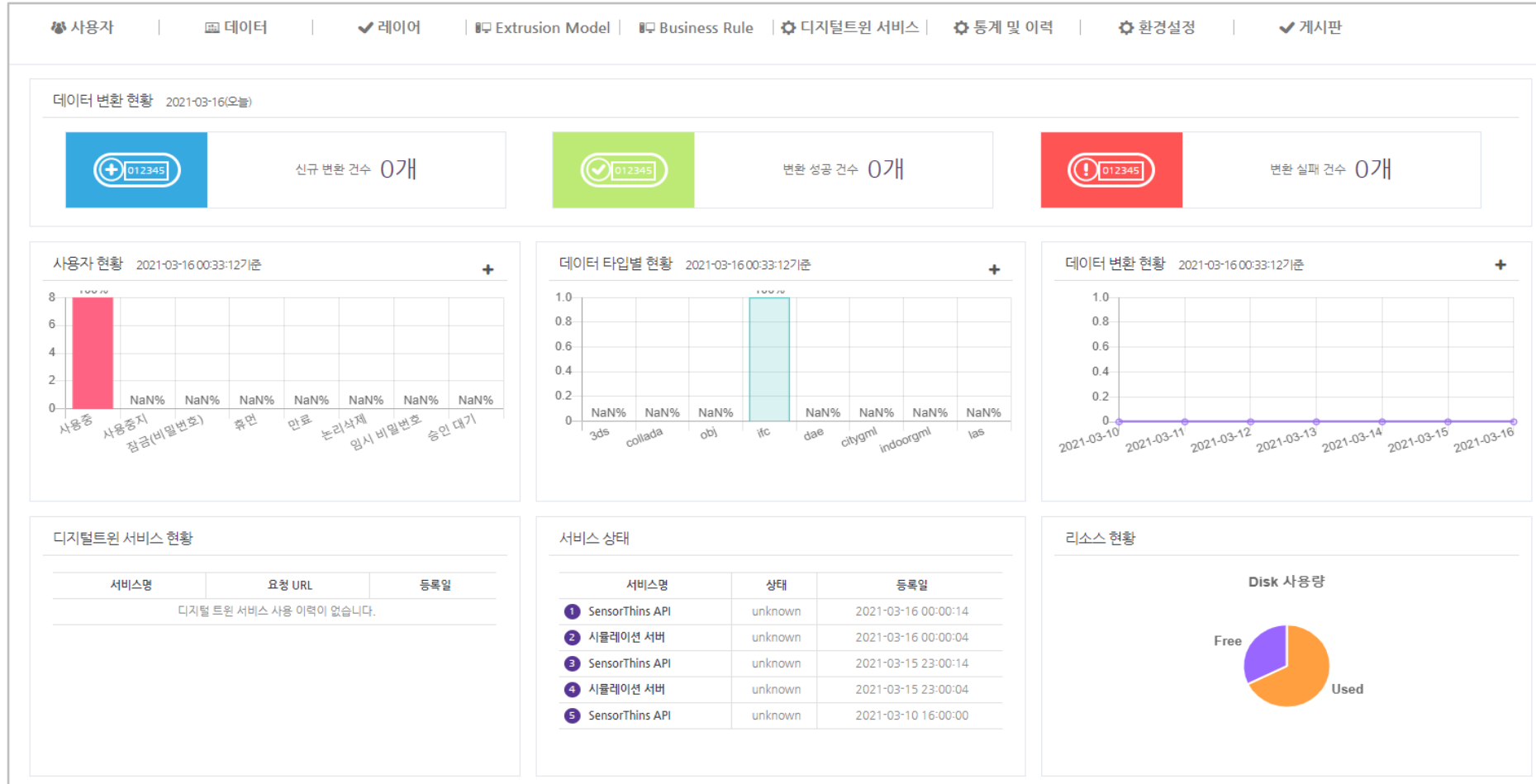


Autonomous Vehicle Monitoring



Display the current location of autonomous vehicles

Dashboard



Real Cases - BIM Integration

Building

Locale

Neighborhood

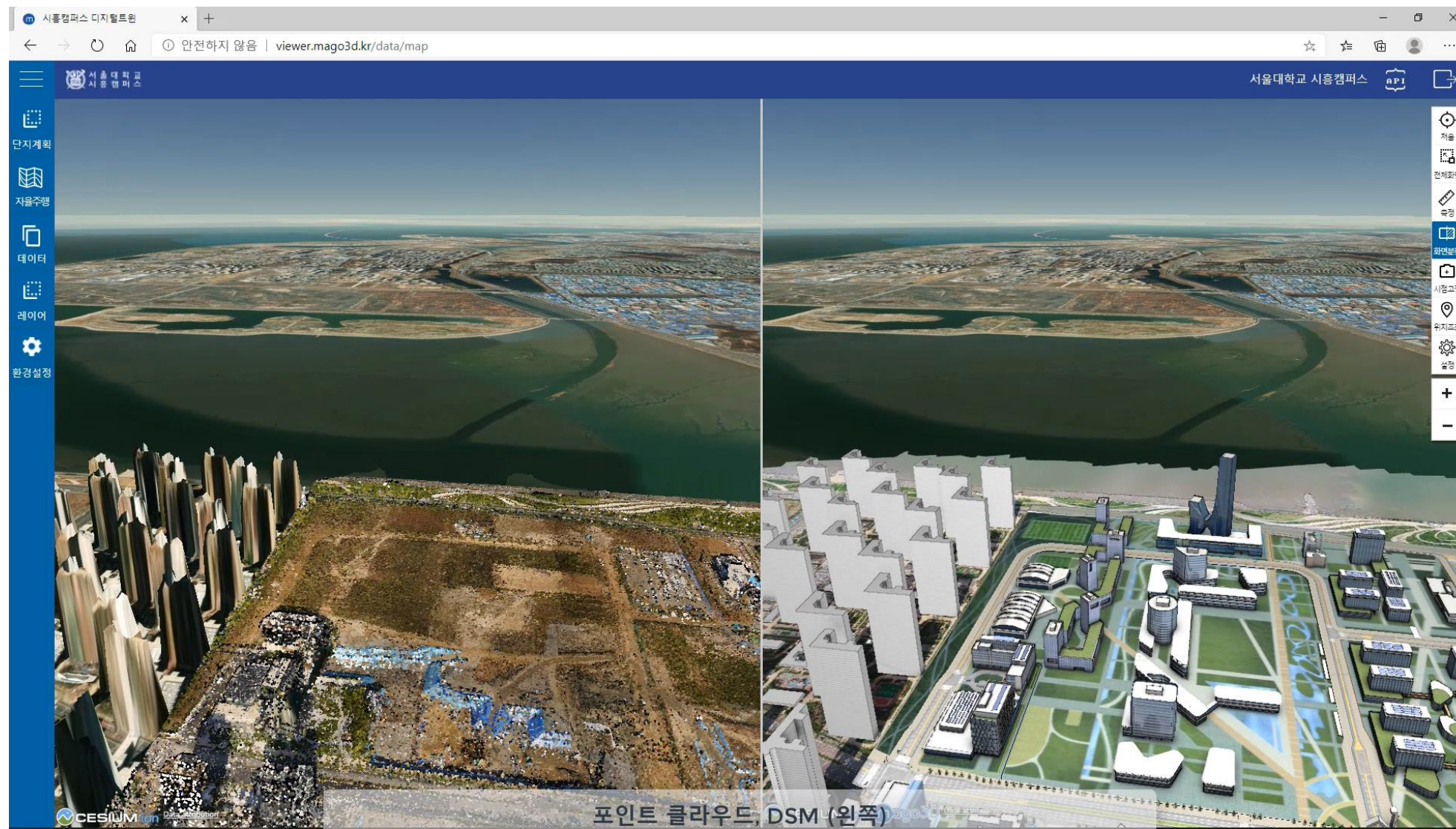
City

Region

Nation



Real Cases - Before & After Construction





LH Digital Twin

내 디지털트윈 플랫폼

두번째 스토리 - 지구계획 시뮬레이션

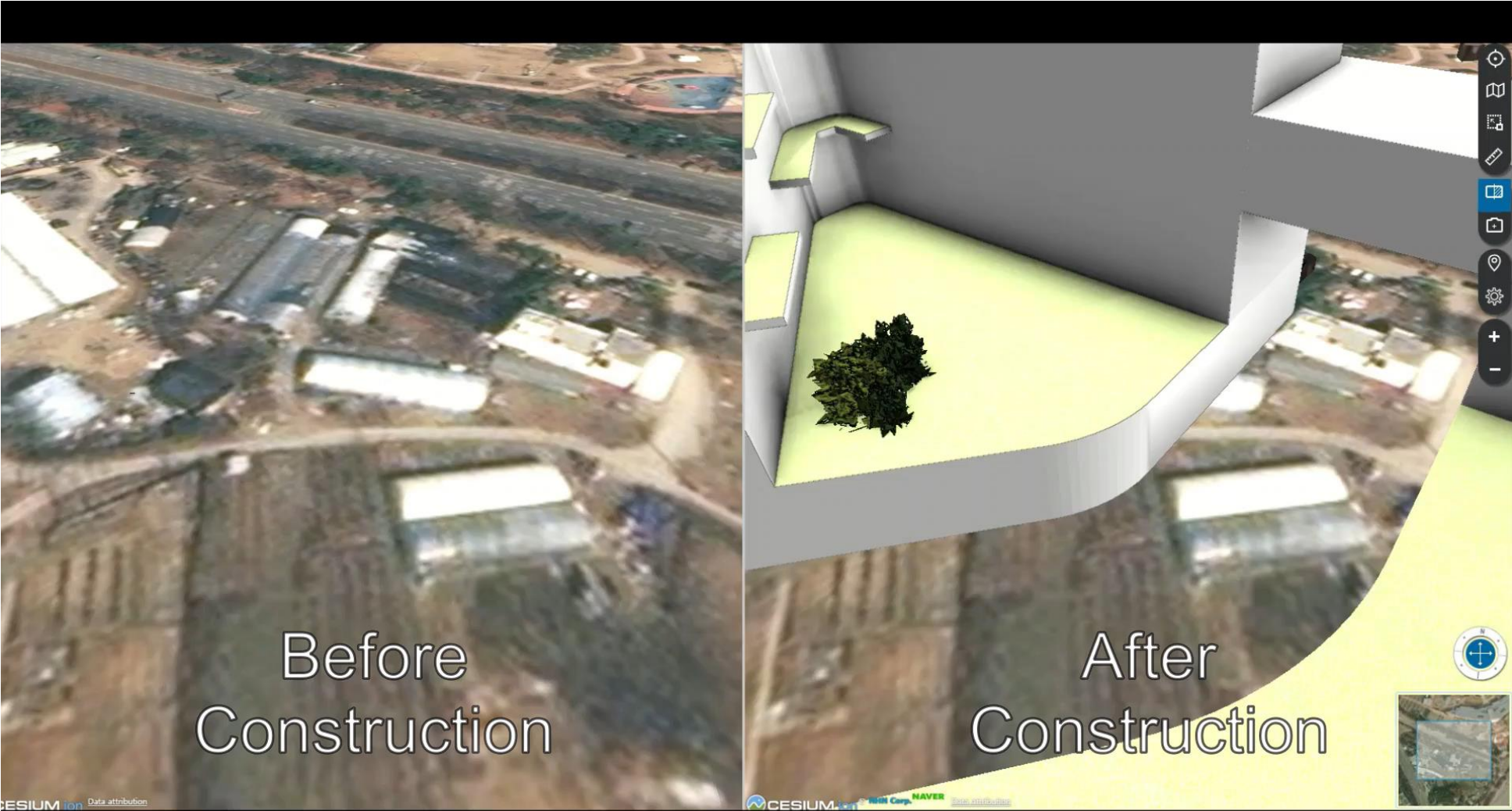


LH Digital Twin

LH 디지털트윈 플랫폼

네번째 스토리 - 일조분석 시뮬레이션

Real Cases - Wind Simulation



Real Cases - Wind Field



Real Cases - Fine Dust

Building

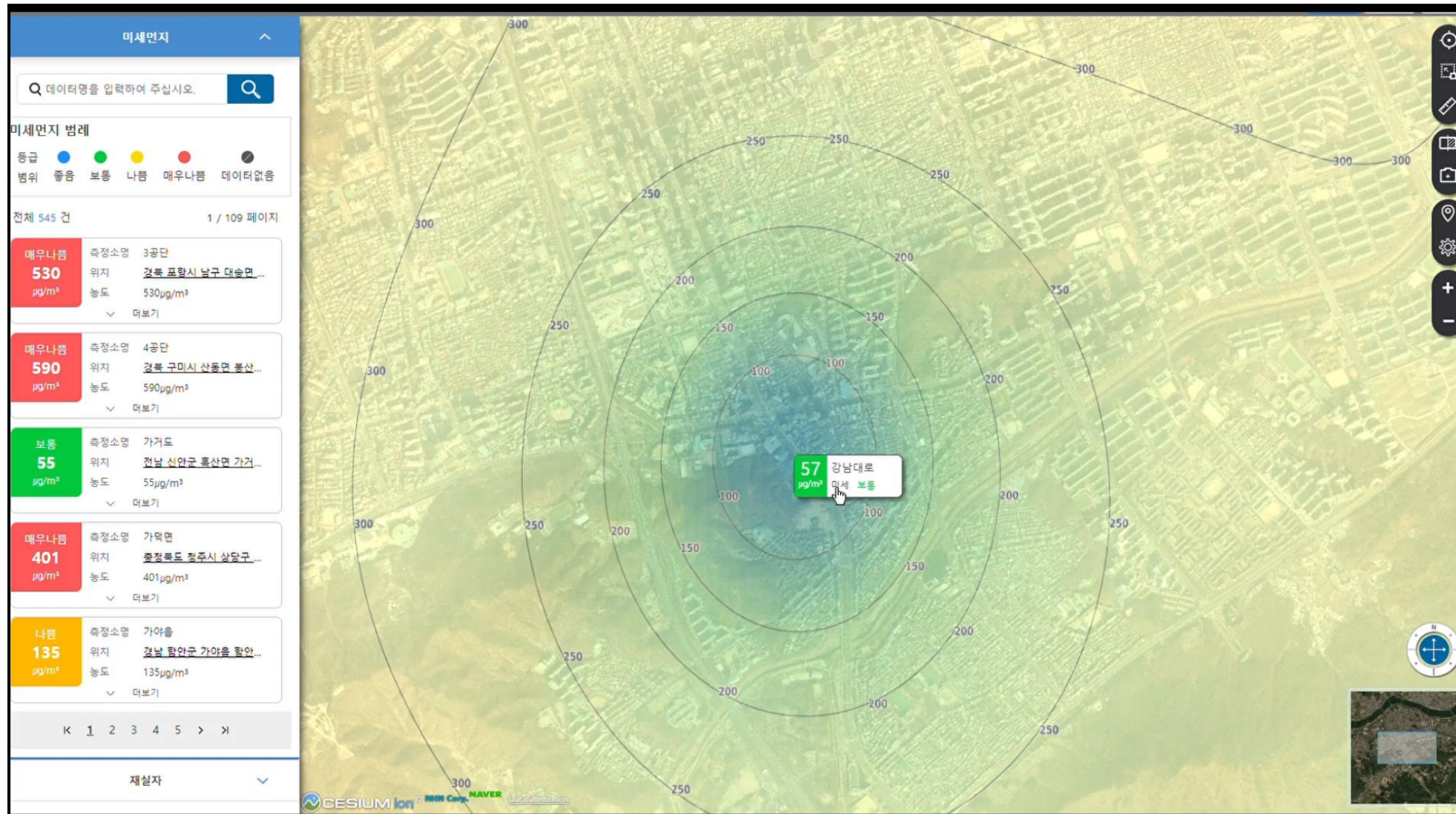
Locale

Neighborhood

City

Region

Nation



Real Cases - Global Weather



3DS Project IFC(Cultural Assets) IFC IFC(MEP) Sea Port Collada Project IFC(Japan) Sejong City CCTV Mipo Points Cloud

Issue 4
Search
API
Regist
Tree
Chart
Log
Attribute
Settings

iLUM Data attribution

- Increased visibility in the Korean market
- Successful large-scale projects
- Reference sites
- Improved rendering speed and quality
- Expanded to enterprise solution
- Many experiences about data and other systems
- ...

- Almost isolated only in Korea
- Small number of core programmers with little community
- Hard to deploy due to much dependencies on other projects
- Getting more complicated, complex, and huge
- Lack of manuals, guides
- Lack of clear roadmap
- ...



For more information, please visit <http://mago3d.net>

All the source codes are here:

<https://github.com/Gaia3D/mago3d>

Thank you!

신상희 shshin@gaia3d.com

