2025 Digital Columbus Project
Development of digital innovation technologies for rapid prediction of potential complex disasters and continuous disaster prevention

Complex Disaster Management System – JAVIS(Joint Autonomous Resilience Virtual Intelligent System)

Development of a hierarchical agentic AI–based digital twin platform for complex disaster prediction and response

2025.03

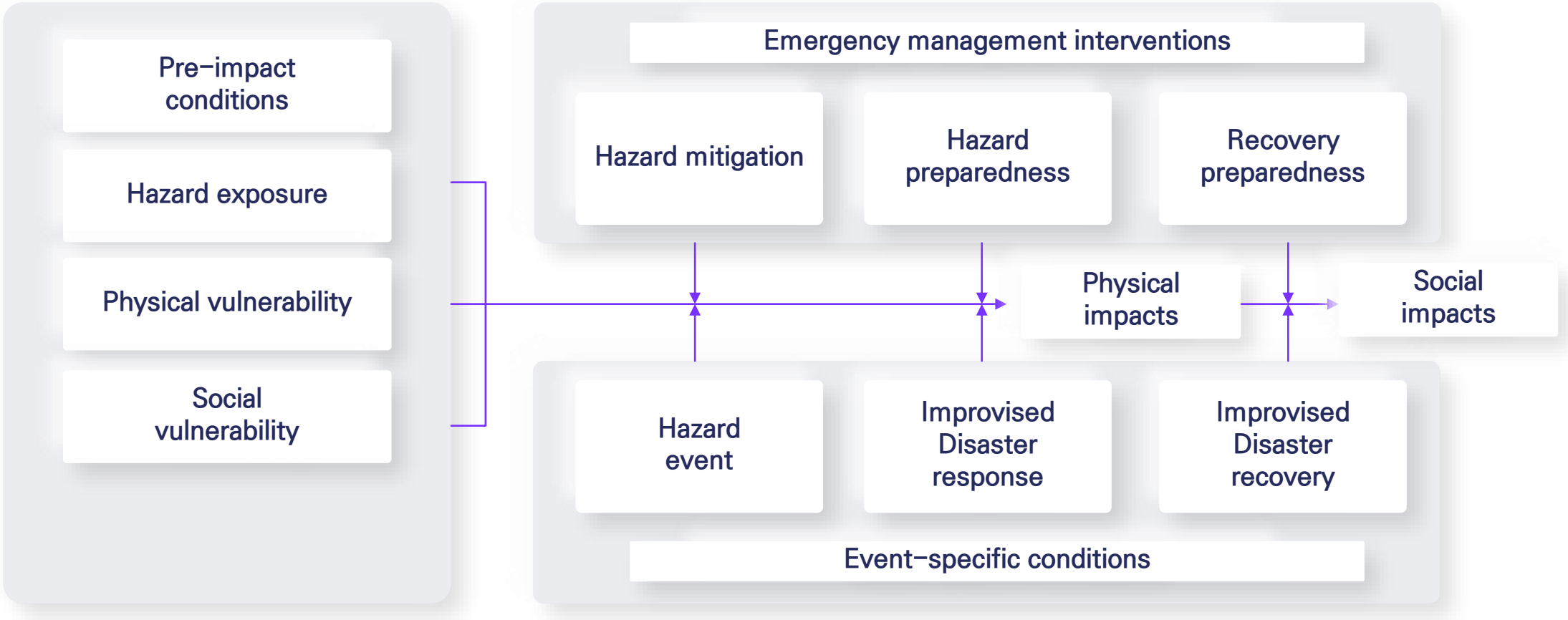
AI · Digital Twin Research Center

Dong-A University

Key

Complex Disaster

Disaster Impacts Model*



* source: Disaster studies, Michael K Lindell(2013), Sage Journals

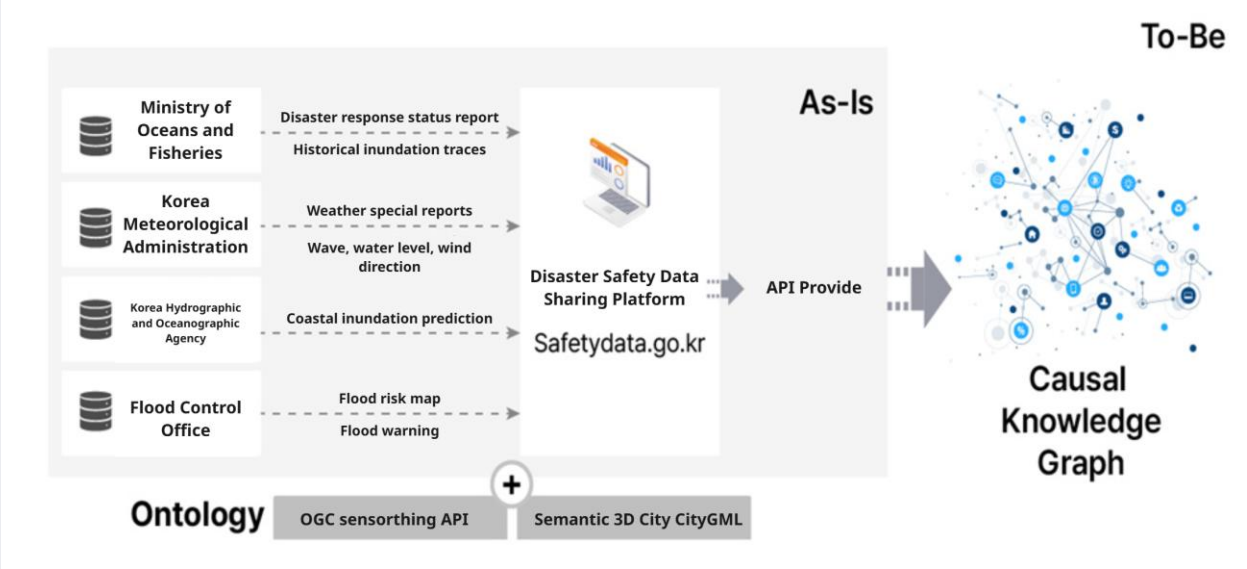
01 Project Necessity

Complex disaster response platform for knowledgeable, trusted, autonomous, intelligent digital twins for federated data, real-time forecasting, and rapid operations.

1-1 The demand for R&D challenges

[The demand for R&D challenges]

Complex disasters require knowledgeable, trusted, autonomous, intelligent digital twin complex disaster response platforms for fused data, real-time predictions and rapid operations



❶ Knowledgeable complex disaster data

- It is essential to effectively integrate various data for human-level disaster understanding and decision-making.
- Multi-source information, such as weather, satellite, and traffic data. Knowledgeization with Fusion Data by Disaster Type (Ontology – Knowledge Graph)Technology

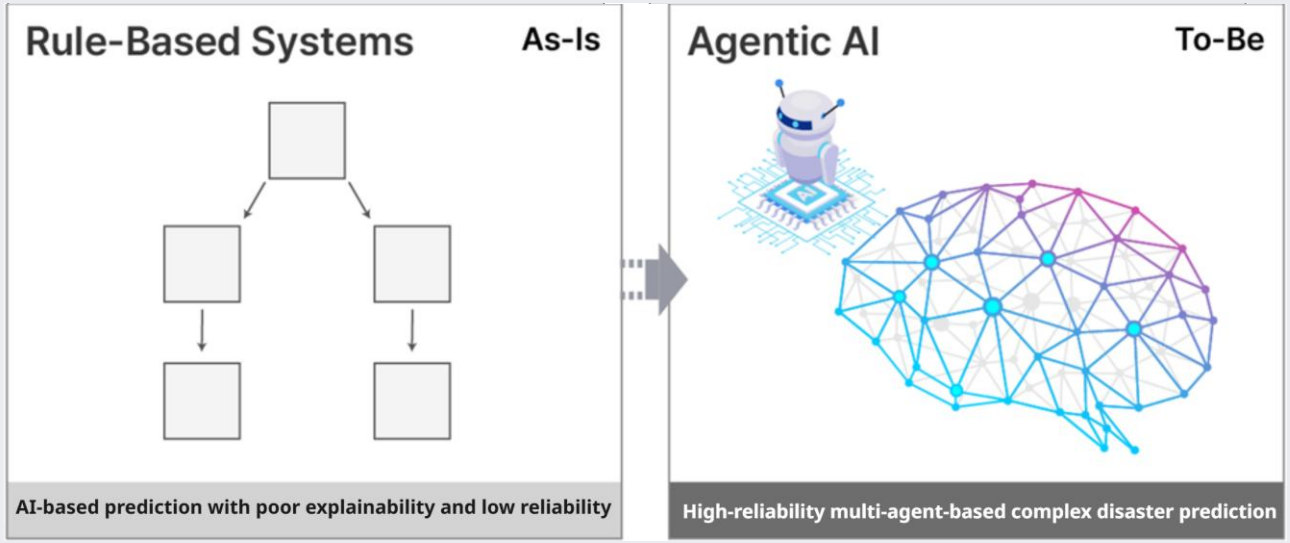
1-1 The demand for R&D challenges

[The demand for R&D challenges]

Complex disasters require knowledgeable, trusted, autonomous, intelligent digital twin complex disaster response platforms for fused data, real-time predictions and rapid operations

❷ High-confidence multi-agent-based complex disaster prediction

- Predicting future based on the likelihood of complex disasters and simulating various scenarios.
- Ensuing high reliability through extensive simulation and modeling based on digital twin technology.



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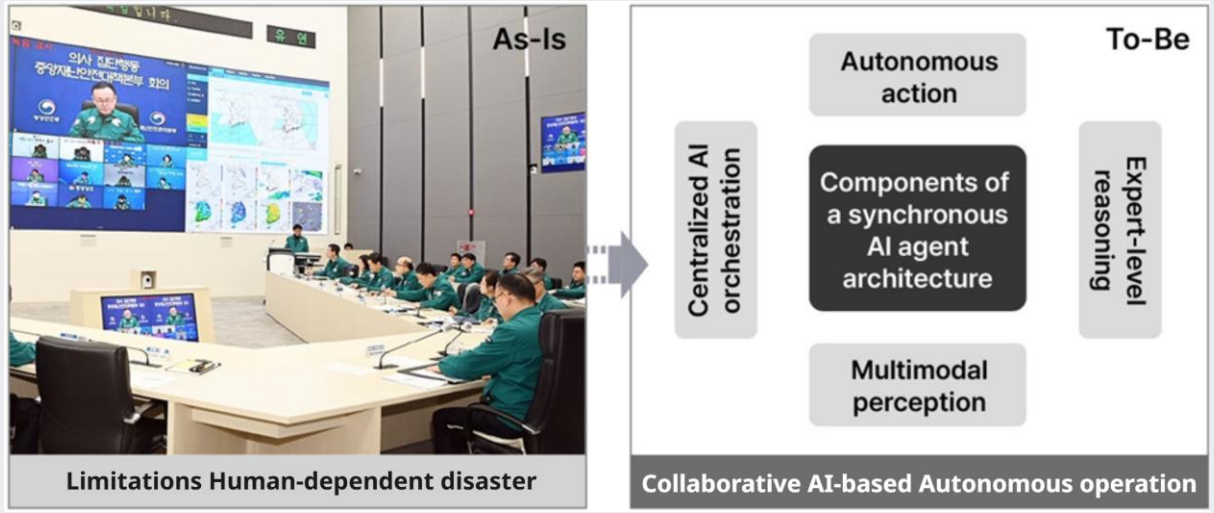
Complex disasters require knowledgeable, trusted, autonomous, intelligent digital twin complex disaster response platforms for fused data, real-time predictions and rapid operations



❸ Collaborative agentic AI-Based autonomous operation

- Limitations of fragmented and inefficient decision-makling based on human resources.
- Agentic AI-based autonomous operation technology enables rapid, accurate, and collaborative disaster risk minimization.

02 Objectives and contents of research and development projects

Development of a hierarchical agentic AI-based digital twin platform for complex disaster prediction and response

Complex Disaster Management System – JAVIS (Joint Autonomous Resilience Virtual Intelligent System)

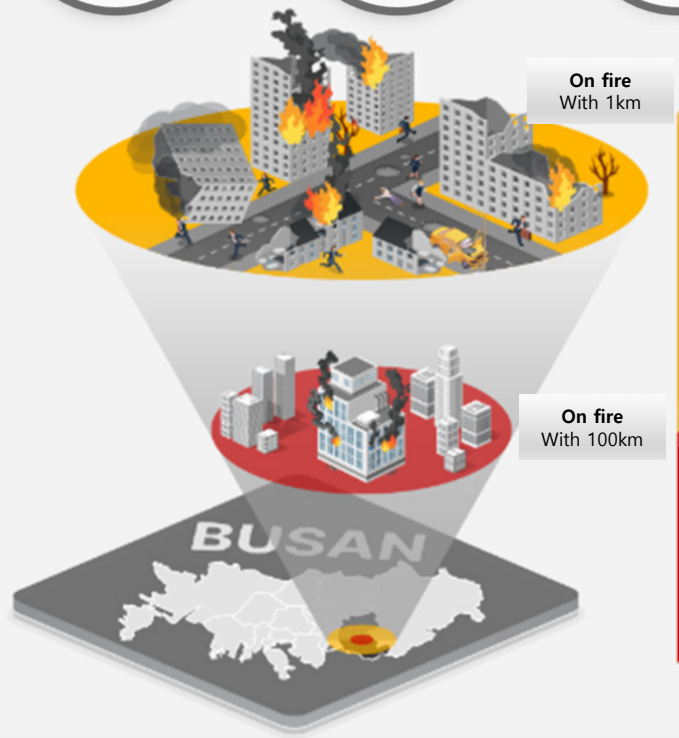
2-2 Goals, Objectives, and Outcomes of the R&D Project

Early Stage: Can't Respond

Decision Stage: Uncertain decisions

Response Stage: Fragmented response system

Integrated Response: Not possible



2nd Disaster

- **Major disaster**
- **Building collapse**
- **Explosion and blackout in nearby area**
- **Expansion of disaster-affected area**
- **Subway and traffic paralysis**

1st Disaster

Fire break out
(Haeundea building on fire)

AS-IS

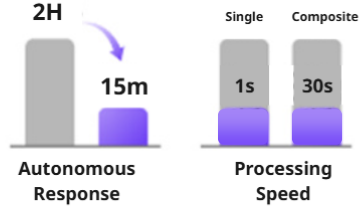
Disaster continues for 30 min to 2 hours → becomes a major disaster

Single response services:
- Fire: Fire department
- Traffic: Police department

Siloed data collection
- Fire alert information

TO-BE

JAVIS



High-leverage principle 1:29:300

Prevent complex disaster spread

2 3

· **Agentic AI:** **Integrated management and reasoning of complex disasters**

- Respond to secondary disasters via self-integrated situation management
- Prevention and minimization: Prevent spread of secondary disasters

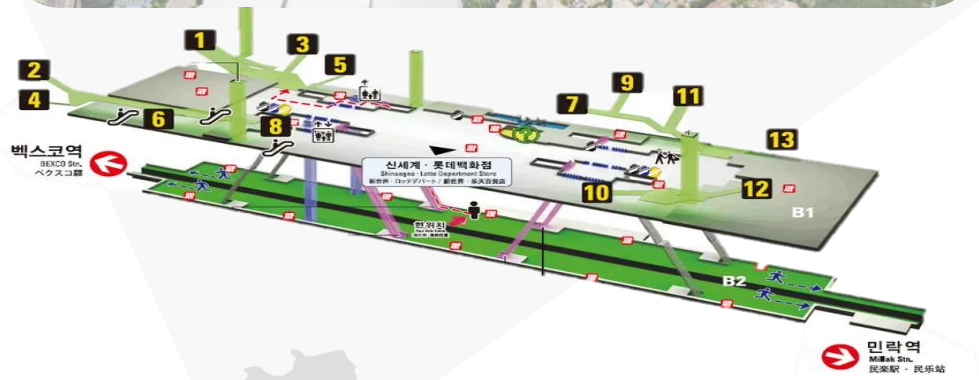
1

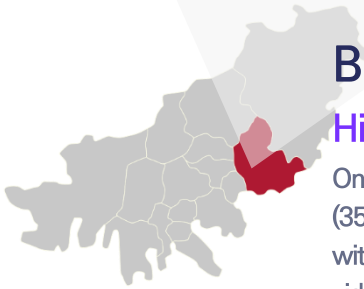
· **Knowledge Context data**

- Fire status: Building density, flammable materials, population density, risk factors, etc.

Complex Disaster Scenario
Busan Subway Fire Accident Expected Respone Strategy

SPOT | Busan Centum City





Busan Centum City

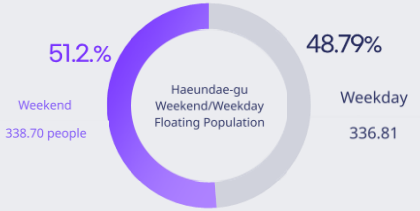
High-Tech Industrial Park

On the banks of the Suyeong River in Haeundae-gu, Busan (350,000 pyeong) a high-tech complex industrial complex with functions such as information and communication, video, entertainment, and international business.

29,585 people ('24.12)
U2Dong Population
Centum City Center Population

58,843 people('23.12)
Subway daily(3.54%)
Daily boardings and alightings at Centum City and Bexco stations

5.19 million('as of 23y)
Haeundea-gu Population
Ranked #1 in living population among all districts in Busan Metropolitan City



Major Landmarks


BEXCO


Movie Theather


Shinsegae Mall


Shinsegae Mall


KNN


Olympic Park

APEC Naru Park


Busan Museum of Art

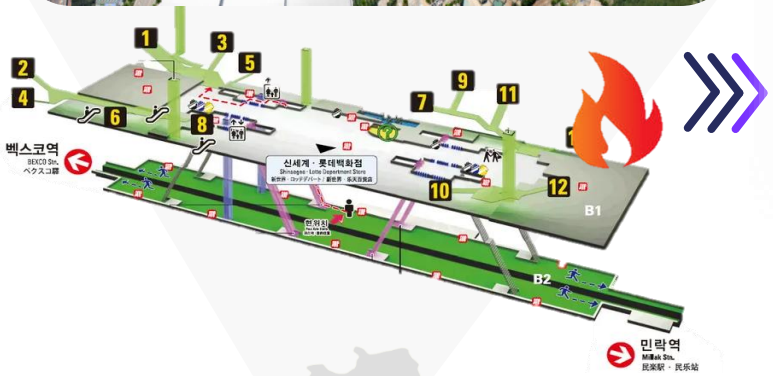
Life Work

Primary Resisdences: Centum Star, Trump World Centum I, Worldmark Centum, WBC The Palace, Forrena Centum City

Main Office: Busan Information Industry Promotion Agency, Busan Design Center, Busan Creative Economy Innovation Center, DIO Headquarters, etc

Complex Disaster Scenario
Busan Subway Fire Accident Expected Respone Strategy

Scenario — Subway Fire based Multiple Disaster



Busan Cetum City

12:00 Fire Spreads On Large Scale
- Due to building wind effect, fire spreads to high-rise buildings.
- Congestion worsens due to lunchtime crowd
- Full closure of Centum City area

12:30 High-Rise Buildings Begin to Collapse
- Fire in apartment complex leads to total building engulfment
- Traffic paralysis inside Centum City delays rescue
- Collapse begins: 2nd Disaster starts

13:30 Collapse of High Rise Building
- Collapse of aging structure
- Building leaning
- Emergency system breaks down
- Uncoordinated respone
- Compound disaster occurs

10:00 Fire Breaks Out
- Fire occurs at the platform Busan Subway Centum City Station
- Initial cause assumed to be electrical arcing
- Smoke spreads rapidly, passengers begin evacuation

11:00 Fire Enters Critical Phase
- Partial closure of Centum City Station
- Damage begins at the department store
- Fire spreads through **underground connections between department stores**

10:30 Department Store as Risk
- Fire spread via underground passage to Shinsegae Department Store basement
- Evacuation broadcasts and guidance begin

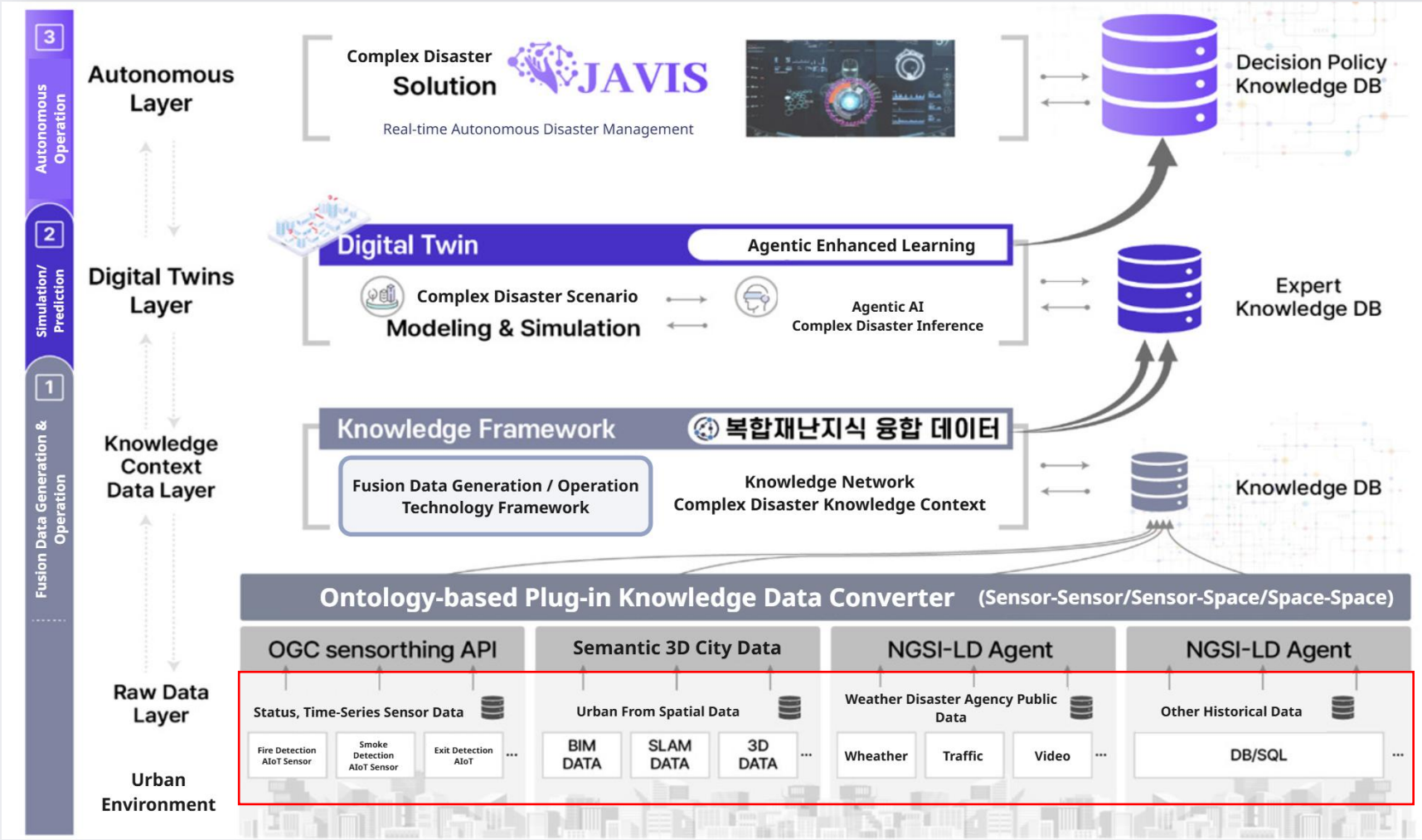
10:10 Fire Spreads
- Fire spread through station entrances and ventilation ducts
- Spreads to facilities and shops inside station
- Cititzens begin emergency evacuation and call the fire departments

10:20 Fire Department Dispathced
- Busan Fire Department dispatched urgently
- Dififcult to access underground due to smoke and heat
- Surrounding roads closed off

02 Goals and Content of R&D Project

Objectives

Development of a hierarchical agentic AI – digital twin platform for complex disaster prediction and response
Complex Disaster Management System –JAVIS(Joint Autonomous Resilience Virtual Intelligent System)



Creativity

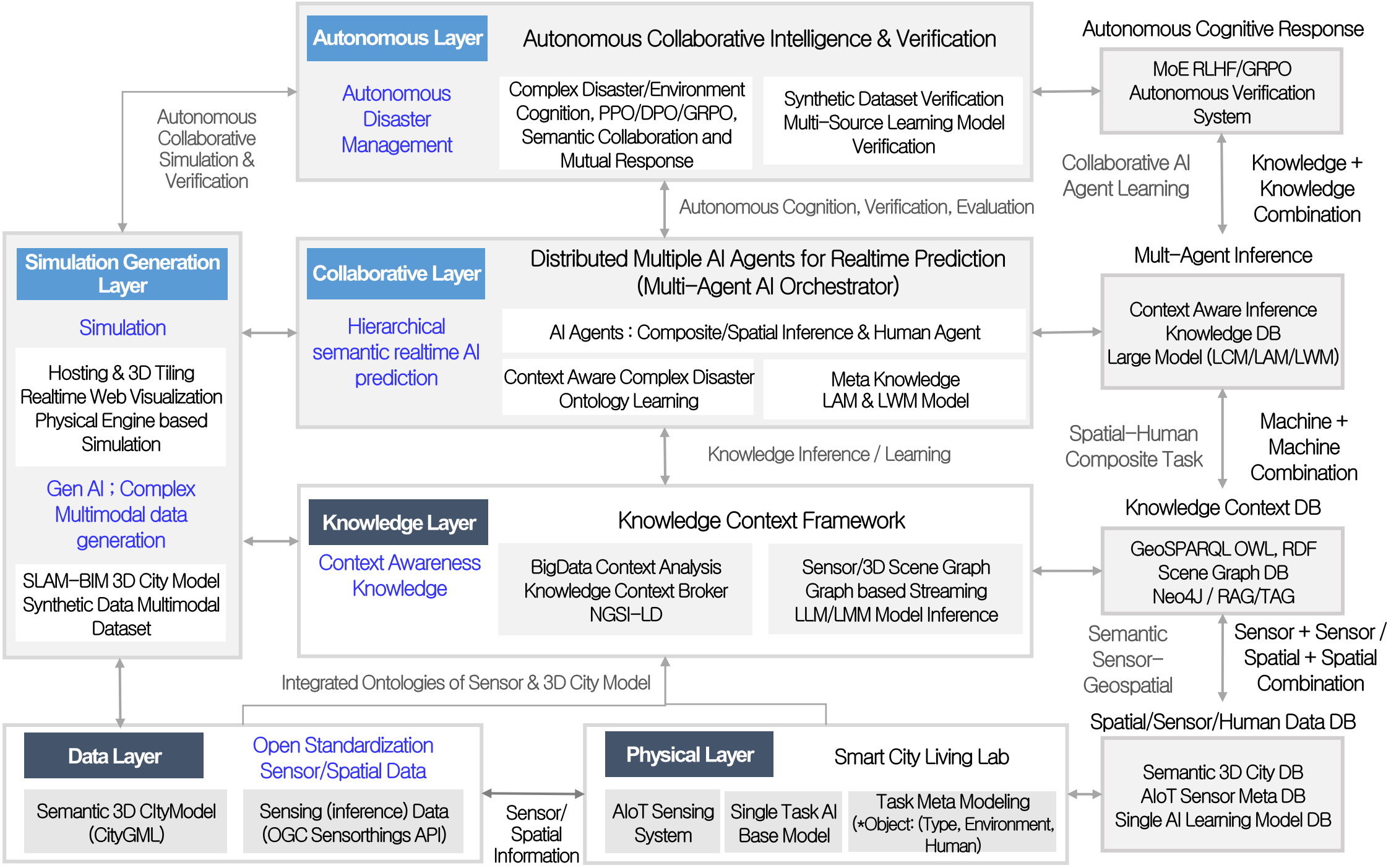
- Integration and transformation of Plug-in type knowledge data
- Agentic AI - Digital Twin integration for real-world analysis
- Optimal decision-making based on cognitive judgment in complex situations

Innovation

- Complex disaster response
- Agentic AI - Digital Twin simulation
- Generation of Expert Knowledge data
- Optimal disaster response policy and cross-verification through RLHF-based multi-layered knowledge

Challenges

- Expert group-level situational awareness
- Fast and accurate complex disaster prediction and response
- Through optimal decision-making


Autonomous Layer
Autonomous Collaborative Intelligence & Verification
Autonomous Disaster Management
Complex Disaster/Environment Cognition, PPO/DPO/GRPO, Semantic Collaboration and Mutual Response
Synthetic Dataset Verification Multi-Source Learning Model Verification
Autonomous Cognitive Response
MoE RLHF/GRPO Autonomous Verification System
Autonomous Collaborative Simulation & Verification
Collaborative AI Agent Learning
Knowledge + Knowledge Combination
Autonomous Cognition, Verification, Evaluation
Simulation Generation Layer
Simulation
Hosting & 3D Tiling Realtime Web Visualization Physical Engine based Simulation
Gen AI ; Complex Multimodal data generation
SLAM-BIM 3D City Model Synthetic Data Multimodal Dataset
Collaborative Layer
Distributed Multiple AI Agents for Realtime Prediction (Multi-Agent AI Orchestrator)
Hierarchical semantic realtime AI prediction
AI Agents : Composite/Spatial Inference & Human Agent
Context Aware Complex Disaster Ontology Learning
Meta Knowledge LAM & LWM Model
Mult-Agent Inference
Context Aware Inference Knowledge DB Large Model (LCM/LAM/LWM)
Spatial-Human Composite Task
Machine + Machine Combination
Knowledge Inference / Learning
Knowledge Layer
Knowledge Context Framework
Context Awareness Knowledge
BigData Context Analysis Knowledge Context Broker NGSI-LD
Sensor/3D Scene Graph Graph based Streaming LLM/LMM Model Inference
Knowledge Context DB
GeoSPARQL OWL, RDF Scene Graph DB Neo4J / RAG/TAG
Semantic Sensor-Geospatial
Sensor + Sensor / Spatial + Spatial Combination
Integrated Ontologies of Sensor & 3D City Model
Spatial/Sensor/Human Data DB
Data Layer
Open Standardization Sensor/Spatial Data
Semantic 3D CItyModel (CityGML)
Sensing (inference) Data (OGC Sensorthings API)
Sensor/ Spatial Information
Physical Layer
Smart City Living Lab
AIoT Sensing System
Single Task AI Base Model
Task Meta Modeling (*Object: (Type, Environment, Human)
Semantic 3D City DB AIoT Sensor Meta DB Single AI Learning Model DB

02 Goals and Content of R&D Project

2-2 Goals, Objectives, and Outcomes of the R&D Project

Strategies Agentic AI-powered Digital Twin Platform

Digital Twin

Digital Twin Simulation

Pre-disaster

- Always-on Virtual Simulation
- Converged Data Generation
- Knowledgeization/AI inference learning
- Autonomous Response Validation

Always on

1st Disaster event

Subway Fire

- Fire AIoT Sensor
- Multi AIoT Sensor
- Meta-Analysis (Building, Roads, Subways, etc…)

dectection within 1s

Disaster Forecasting

Fire/Collapse/Explosion

- Knowledge Layer
  Specific Disaster/Spatial/Human Combining Contextual Knowledge
- AI Inference Layer
  Complex disaster forecasting

prediction within 30s

Autonomous Respone

Initial Respone

- Autonomous Respone Layer
  Expert-lelve respone policies
  Semantic-based collaboration
  Mutual aid and preparedness path
  Mutual respone by partner organizations

respone within 15m

2-3 Phased goads, content, and deliverable for R&D Project

Phase 1 (Year 1~2) : Knowledge-based complex disaster reference modeling and JAVIS prototype development

1

Knowledge-based

Complex disaster fusion data modeling

[Data Layer]

Modeling data type by disaster type including sensors, 3D city, public, historical information etc.

Multi-srouce fusion data reference model training

[Knowledge Context Layer]

Developing ontology-based plugin Knowledge data converters and real time data processing models based on Knowledge Graph

Disaster Interconnectivity: Semantic Spaces – Informing Sensor-based Knowledge

[Complex Disaster Space-Sensor Data Modeling]

Space-Sensor AI Models	Multi-model Generative mdoel (NIM, NeMO)	Multi-source Fusion Create synthetic data
CityGML	Sensorthings API	Disaster type Meta-definitions

[Complex Disaster Space-Sensor Knowledge Informationzation

Space-Sensor Integration Ontology and Complex Disaster Knowledge Graph	Knowledge Context Broker and Context Interpretation

Deliveriables

Digital Twin-based Complex Disaster Fusion Data reference model 2 or more

At least 2 knowledge-based multi-source complex disaster datasests

2-3 Phased goads, content, and deliverable for R&D Project

Phase 1 (Year 1~2) : Knowledge-based complex disaster reference modeling and JAVIS prototype development

2

Agentic AI-Digital Twin
Prototype Development

[Digital Twin Layer]

Development of Multi Agent Orchestrator and Expert Knowledge Prototype

3D city model/complex sensor data/visualization platform development

Complex disaster prediction and simulation prototype

[Multi AI Agent Orchestrator Prototype]

Multi AI Agents : Complex Disaster, Spatial Cognition, Human Cognition

Multi-Agent-based Complex Disaster Cognitive Reasoning

Designing Expert Knowledge Abstraction

Multi Agent Orchestrator (Magentic-One etc)

[Complex Disaster Simulation]

Data Platform (Fiware) Visualizaiton (Omniverse, Cosmos, etc.) engines

Knowledge-based Reference Simulations

Deliveriables

Agentic AI- Digital Twin Prototype

Speed of Complex Catastrophe Inference Less than 2 minutes

2-3 Phased goads, content, and deliverable for R&D Project

Phase 1 (Year 1~2) : Knowledge-based complex disaster reference modeling and JAVIS prototype development

3

JAVIS Prototype Development

[Autonomous Layer]

Development of JAVIS (Real-time Collaborative Intelligent Autonomous Digital Twin) Prototype through Expert Group Policy Model Learning Based on Smart City Complex Disaster Scenario

Collaborative Intelligent Complex Disaster Autonomous Digital Twin Prototype

[Collaboration Intelligence – Expert Group Policy]

LLM/LMM-based complex decision-making and execution strategies

Expert Group Policy model based on RLHF PPO / DPO

[Autonomous verification and response]

Complex disasters on the digital twin Establish type-specific self-validation

Field Test the Multi-Disaster Reference Model

Deliveriables

JAVIS Prototype

Field Demonstrations (Smart Cities – fire/gas, underground flooding, etc.)

40% more automated complex disaster decision-making

2-3 Phased goads, content, and deliverable for R&D Project

Phase 2 (Years 3~4) : Establish JAVIS Complex Disaster Prediction and Autonomous Response System based on Empirical Scenarios

1

Expert Knowledge Base Complex Disaster Fusion Data Creation Technology

[Data Layer]

Automated construction of SLAM-BIM-based 3D city model environments and generation of expert knowledge-based complex disaster fusion datasets

[Knowledge Context Layer]

Build an expert-level Knowledge Network framework

Expert-level complex disaster knowledge network framework

[Expert Knowledge Base Create Complex Disaster Fusion Data]

SLAM-BIM - CityGML Automatically Generate 3D Spatial Environments

Create an Environmental Cognitive Complex Disaster Multimodal Dataset

Complex Environments: Local, Spatial, and Multi-Sensor

[Expert Knowledge Network Framework]

Deploy Expert Semantic Web

Expert Knowledge Graph Model

Deliveriables

Digital Twin-based Complex Disaster Fusion Data Reference Model 2 or more

Environmental cognitive multi-source composite 2 or more disaster datasets

2-3 Phased goads, content, and deliverable for R&D Project

Phase 2 (Years 3~4) : Establish JAVIS Complex Disaster Prediction and Autonomous Response System based on Empirical Scenarios

2

Multi-Agent Based Complex disaster AI predictive technology

[Digital Twin Layer]

Development of Complex disaster mutual ontology,

Physical AI engine-based complex disaster simulation, Expert Knowledge graph model-based

Hierarchical Multi Agent Orchestrator Development and complex disaster reasoning

Multi-Agent Complex Disaster Prediction and Demonstration Scenario-Based Simulation

[Multi Agent Orchestrator Complex Catastrophe Inference]

LLM/LMM-based Complex Disasters Expert Knowledge Graph

Real-time complex disaster situational awareness reasoning with Causal Reasoning

[Complex Disaster Demonstration Simulation]

Virtual simulation of complex disasters powered by a physics AI engine

Early detection and response based on empirical scenarios

Genesis, COSMOS WFM, etc.; simulate fire/gas/flooding, etc.

Deliveriables

[Demonstration Scenario]

Initial detection within 10s FAR within 10%

Speed of Complex Catastrophe InferenceLess than 1 minute

2-3 Phased goads, content, and deliverable for R&D Project

Phase 2 (Years 3~4) : Establish JAVIS Complex Disaster Prediction and Autonomous Response System based on Empirical Scenarios

3

JAVIS Autonomous Operations Testing

[Autonomous Layer]

Industrial Park Complex Catastrophe Scenario Based Expert Group Policy Network Enforcement

JAVIS Autonomous Operations Testing and Modernization

Collaborative Intelligence Complex Disaster Autonomous Digital Twin Testing

[Collaboration Intelligence – Expert Group Policy]

Deploy Expert Group Policy based on LLM/LMM , RLHF

Understanding the complex disaster context and mutual self-regulation

[Autonomous verification and response]

Digital Twin Complex Disasters Advancing Autonomous Operations

Simulate complex disaster response and field testing

※ Complex disasters for industrial complexes or smart cities (fire/gas, flooding, etc.)

Deliveriables

[Demonstration Scenario]

Initial disaster response time 30 minutes or less

Over 60% automation of complex disaster decision-making

2-3 Phased goads, content, and deliverable for R&D Project

Phase 3 (Years 5-8): Demonstration of complex disaster prediction and autonomous operation based on JAVIS, a complex disaster management system

1

Expert Knowledge Base Automatically Generate Complex Disaster Fusion Data

[Data Layer]

Expert Knowledge-based Complex Environments Automatically generate complex disaster fusion datasets and train spatially knowledgeable multimodal AI dictionary models

[Knowledge Context Layer]

Expert Knowledge network-based disaster correlation Automated generation of Expert Knowledge contexts

Large-scale complex disaster physical world model LWM and multimodal Gen AI

[LWM-based complex disaster generation]

Large Complex Disaster Physical World Model (LWM) and Expertise Building

Automatically Generate Complex Environment Complex Disaster Synthetic Data

※ LWM-based **multimodal inference model learning, physical simulation, and contextual adaptation**

[LCM-based Expert Knowledge Context]

Automatically generate Expert Knowledge Contexts based on large semantic models (LCMs)

Expert Knowledge Context-based disaster interconnection semantics

Deliveriables

Spatial Knowledge Multimodal AI Models 6 or more

Expert multi-source complex disaster datasets 6 or more

2-3 Phased goads, content, and deliverable for R&D Project

Phase 3 (Years 5–8): Demonstration of complex disaster prediction and autonomous operation based on JAVIS, a complex disaster management system

2

Powered by Agentic AI Reinforcement Learning Real-time complex disaster prediction

[Digital Twin Layer]

Hierarchical Multi Agent Orchestrator based disaster correlation meta-analysis, based on Agentic AI reinforcement learning Complex disaster simulation and inference model validation, real-time complex disaster early prediction

Agentic AI early detection of complex disasters

[Agentic AI Complex Catastrophe Reasoning]

Based on a large-scale behavioral model (LAM)Collaborative Complex Disaster Expertise

Distributed Multi-Agent Reinforcement Learning for Real-Time Complex Disaster Situation Cognitive Reasoning

[Agentic AI Complex Disaster Demonstration Simulation]

Response virtual simulation powered by Agentic AI and Physical AI engines

Real-time early detection and response to complex disasters based on empirical scenarios

Genesis, COSMOS WFM, and more; urban-combined-disaster-crowd-response virtual simulation

Deliveriables

Complex disaster initial detection within 1s to 10s

Within 5% of FAR

Speed of Complex Catastrophe Inference 30 seconds or less

2-3 Phased goads, content, and deliverable for R&D Project

Phase 3 (Years 5–8): Demonstration of complex disaster prediction and autonomous operation based on JAVIS, a complex disaster management system

3

JAVIS Autonomous Operations Validation

[Autonomous Layer]

Maritime Urban Complex Disaster Scenario

Expert Group Policy Knowledge

Demonstration JAVIS real-time complex disaster response operation and verification/evaluation system operation

Collaborative Intelligence Complex Disaster Autonomous Digital Twin Operations

[Collaboration Intelligence – Expert Group Policy]

Large AI Model Expert Group Policy Knowledge Verification

Autonomous Collaboration Expert Knowledge Interoperability

Large-scale AI model for complex disasters (LCM,LAM,LWM)

[Autonomous verification and response]

Digital Twin Complex Disasters Autonomous operations and response, verification/assessment

Real-Time Complex Disaster Response Field Validation

Multi-disaster (weather, building, underground) for maritime megacities

Deliveriables

Initial Complex Disaster Response Time Within 15 to 30 minutes

Over 95% automation of complex disaster decision-making

2-3 Phased goads, content, and deliverable for R&D Project

10 Multi-Source Complex Disaster Dataset ⬆
Composite Disaster (Real+Virtual) Dataset Types

95 % Complex Catastrophe Prediction Model Accuracy ⬆
Complex environment and complex disaster forecast model accuracy (FRA within 5%)

1K Number of concurrent AI agents ⬆
Concurrent processing of agents on Multi AI Agents Orchestrator

1 s /30 s Complex disaster data processing speed ⬇
AIoT single sensor (1 second) / complex data processing (30 seconds)

15 m less Complex disaster initial disaster response time ⬇
(Self-validation – disaster response) Response time

95 % Level of automation for complex disaster decision-making ⬆
Decision automation ratio (number of AI Agent decisions / total number of decisions)x100

JAVIS Complex Disaster Autonomous Response – 1:29:300law Rule of Thumb Detected within 10 seconds, initial response completed within 15 minutes

03 Strategies, methods, and implementation systems for R&D projects

JAVIS Complex Disaster Autonomous Response– 1:29:300 Rule Detected within 10 seconds, initial response completed within 15 minutes

03 Strategies, methods, and implementation systems for R&D projects

JAVIS Autonomous Complex Disaster Response 1:29:300 Rule —
Detect within 10 seconds, complete initial response within 15 minutes

Promotion Strategy	Stage 1 (Seed Research)	Stage 2 (Leader Research)	Stage 3 (Innovative Research)
Real-time Complex Disaster Respone Model Propose a model to minimize disaster occurrence based on Agentic AI-Digital Twin integrated complex disaster system	- Modeling of complex disaster scenarios - Design of the JAVIS autonomous operation framework	- Predict complex disasters based on real scenarios - Build the JAVIS autonomous response system	- Real-time complex disaster response based on JAVIS - Verify autonomous operation and response
Securing Global Leading Technology Lead the core technology of JAVIS for complex disaster response	- Knowledge network reference model for complex disasters - Plug-In type data platform technology	- Technology to generate fused data using Causal AI and knowledge grounding - Multi-Agent Orchestrator technology	- Semantic-based cooperative AI technology - Establish cognitive and response systems for autonomous agents
Presentation of Real-World Complex Disaster Case Studies Provide real-world reference models for complex disasters in marine-integrated smart cities	- Smart Village (Eco-Delta City) complex disaster reference model (e.g., heavy rain, typhoon, maritime)	- User Case: Sinpyeong-Jangrim Smart Green Industrial Complex Causal AI and knowledge grounding -Fire, smoke, gas disasters in industrial zones	- **Use Case:** Marine Integrated Smart City - Complex disasters in super-tall buildings, underground/aboveground, densely populated coastal cities

Implementation System

Lead Legacy — AI Digital Twin Software Verification Center
Develop JAVIS core technologies

Joint Partner — ESG Regional Innovation Resaerch Institute
Verification, policy research for JAVIS

Collaborators

Korea Water Resources Corporation

Korea Industrial Complex Corporation

Haeundae Marine City/Sentum Area

Organizations

- Busan Metropolitan Government
- Busan Fire Department
- Korea Meteorological Administration (Climate)
- National Disaster and Safety Headquarters
- National Maritime Research Institute
- National Police Agency
- Venture Companies

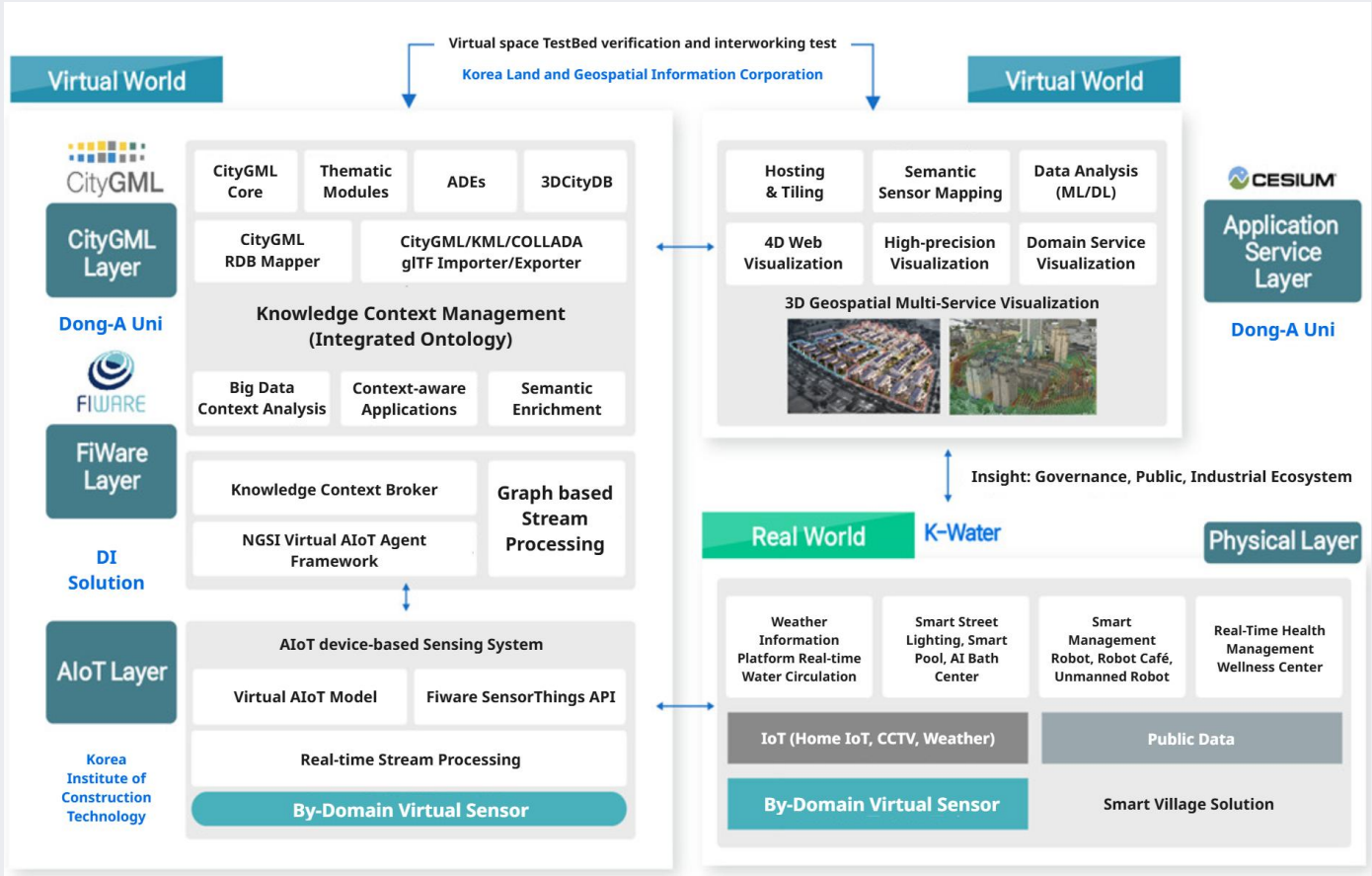
- Denmark Digital Lead
- UK MMU

03 Strategies, methods, and implementation systems for R&D projects

Organizer Competencies

❶ Establishment of the Digital Twin Testbed

- Ministry of Science and ICT, "Digital Twin-based Smart City Lab Demonstration Complex"
  Organized the second part of the project ('22~'25)
- Lead Institution (Dong-A University), Joint Institution (Korea Water Resources Corporation, Korea Institute of Construction Technology, Korea Land Information Corporation, DI Solution)
- Demonstration site: Eco Delta City Smart Village, Smart City Lab
- Development Contents
  ① Smart city data model prototype development
  ② Establishment of AIoT device-based sensing system for each smart city service
  ③ Utilizing digital twin-based computing data platform and testbed construction



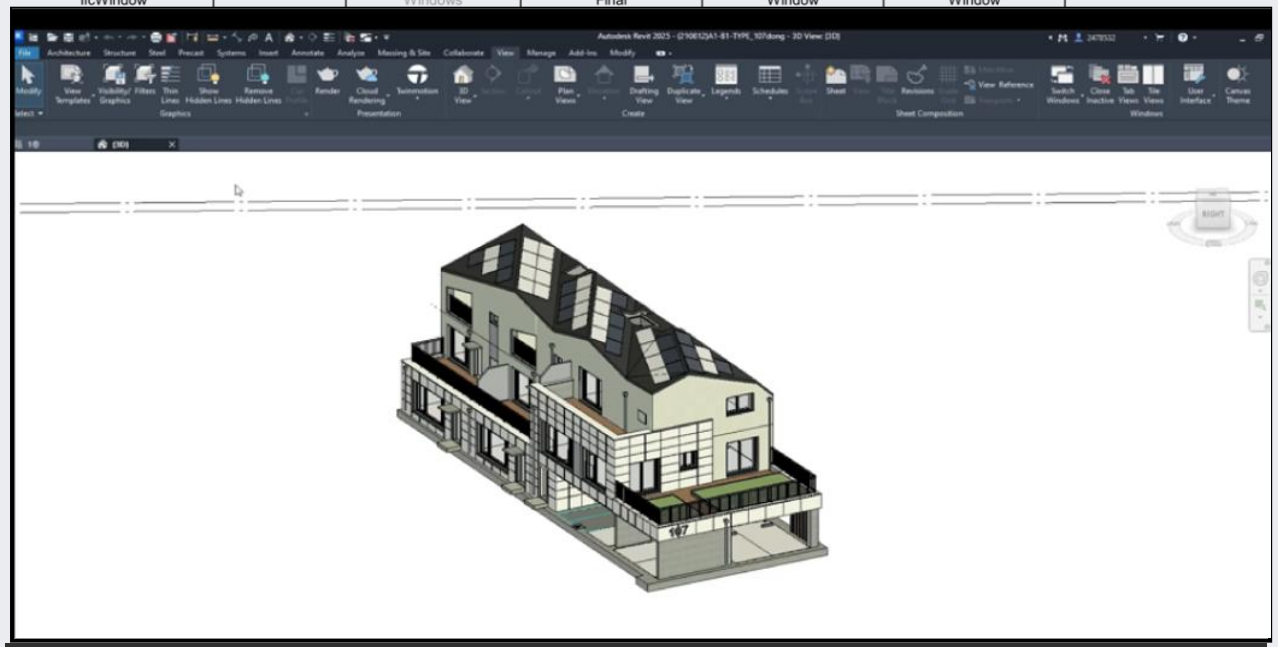
03 Strategies, methods, and implementation systems for R&D projects

복합재난 예측·대응을 위한 계층적 Agentic AI 기반 디지털 트윈 플랫폼 개발

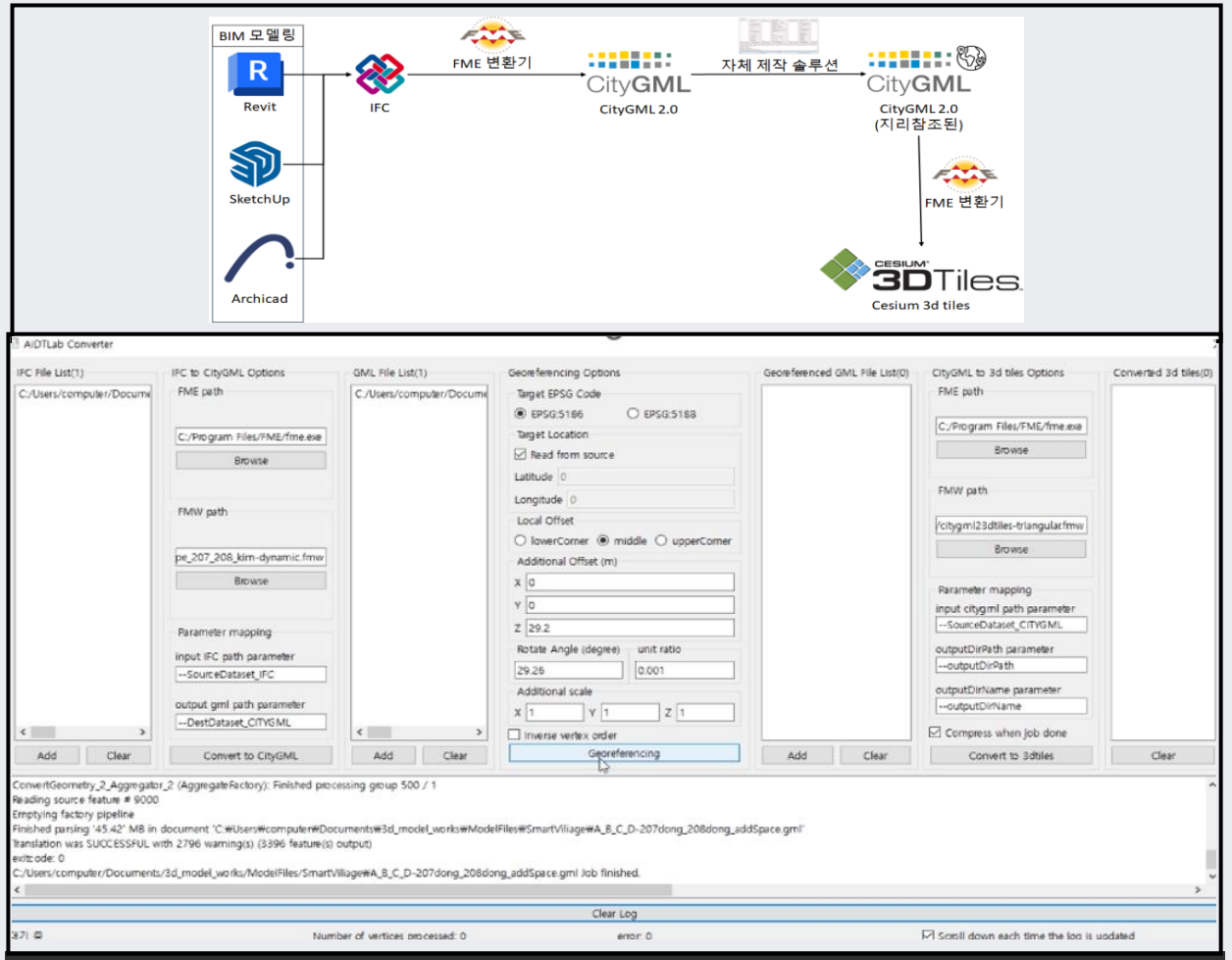
Organizer Competencies

Open standard 3D city model building and sensor integration (Smart Village)

IFC2x3			Temporary/Final	CityGML2.0		Unity3D
IfcEntity	PredefinedType	Category		Base Name	CityGML tagName	NavMeshBuildSourceTag
IfcMember	*	Curtain Wall Mullions	Temporary	Member	BuildingInstallation	
IfcWallStandardCase	*	Walls	Final	Wall	WallSurface	Not Walkable
IfcWall	*	Walls	Final			
IfcCurtainWall	*	Walls	Final			
IfcBeam	*	Structural Framing	Temporary	Beam	BuildingInstallation	
IfcWindow	*	Windows	Final	Window	Window	



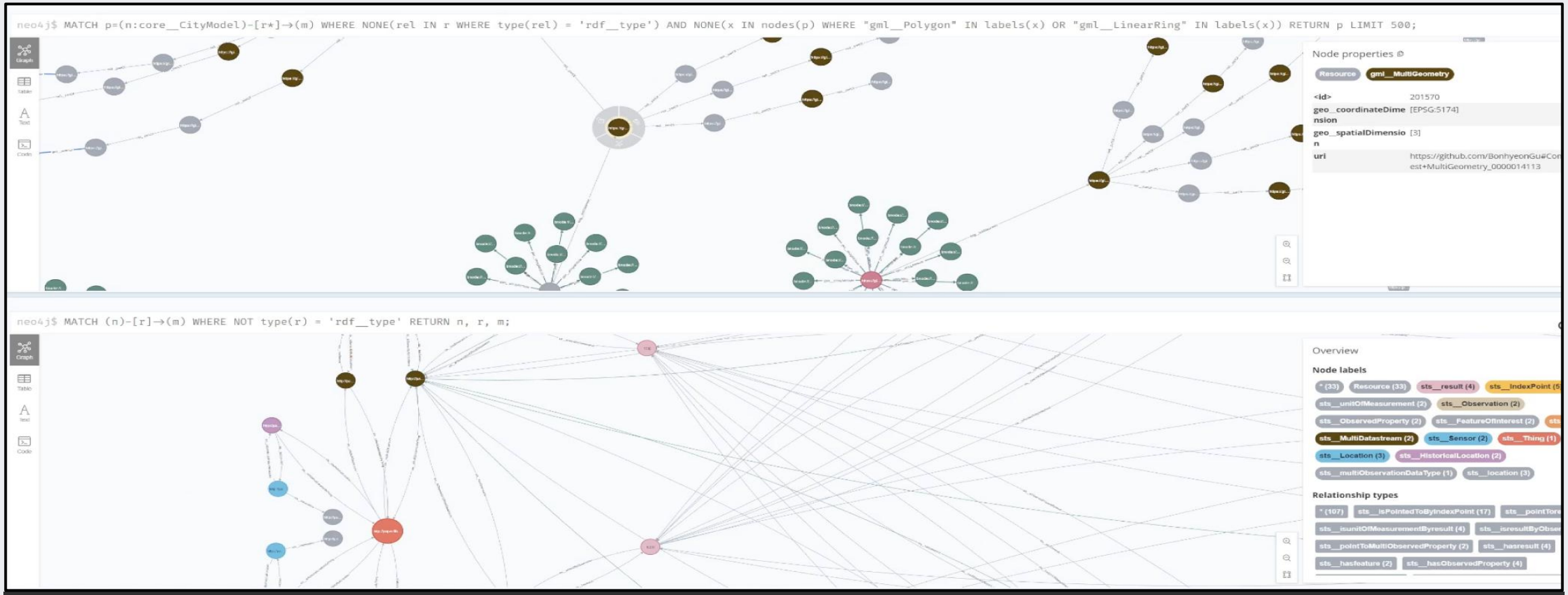
Overriding Base Room with Case-Based Mapping Rules for CityGML Inference



Implemented IFC to CityGML to 3DTiles automatic converter

Organizer Competencies

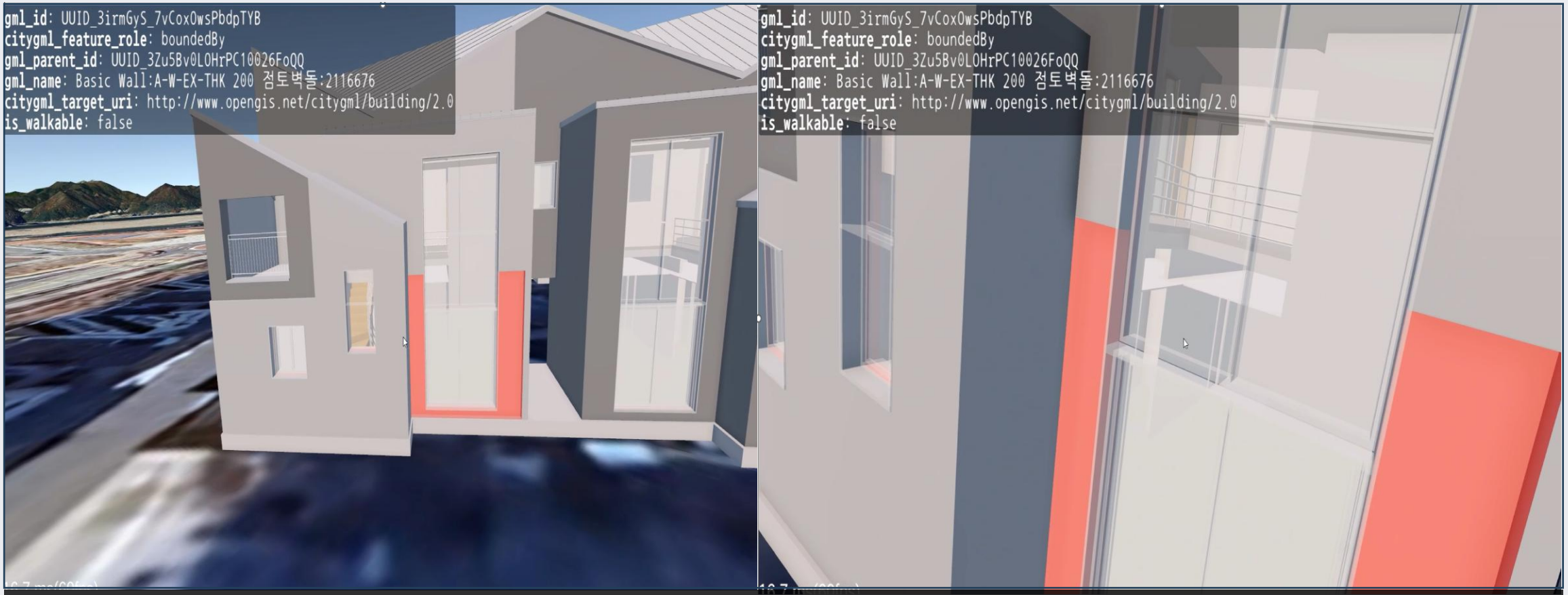
Combining spatial data (CityGML) + sensor data (OGC Sensorthing)



Developed Ontology-based (OWL) Knowledge Graph (KG) generator converter (2025)

Organizer Competencies

❹ Develop BIM data management (DB) and visualization platforms



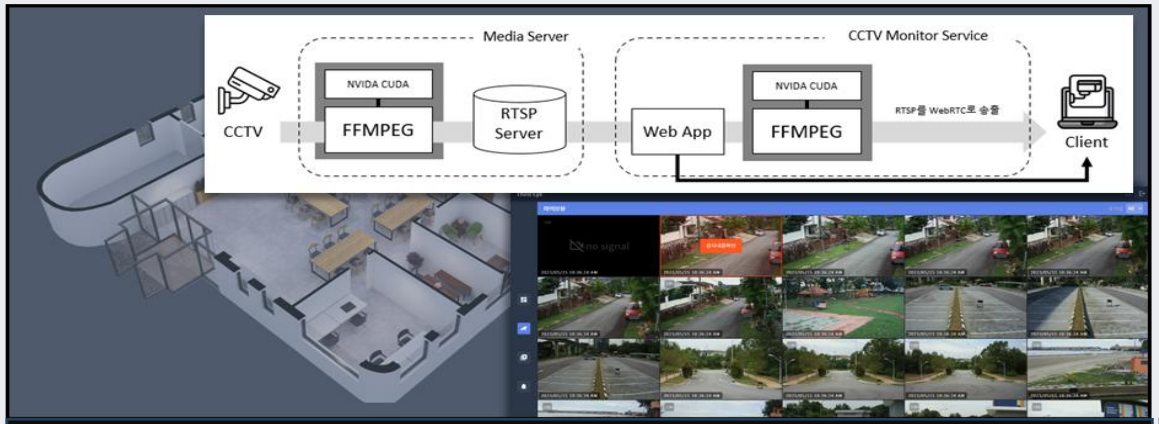
LOD4 level (highest level of detail) metadata results BIM data management (DB) and visualization platform under development (2025)

Organizer Competencies

❺ Connecting Eco Delta City Smart Village: Developing and testing various smart city innovation services based on the Digital Twin platform (Fire, water level, comfort (2025))

Visualization of proposed platform's weather condition elements (humidity, wind, temperature)

Personal Thermal Comfort:
Inference of thermal comfort based on personal characteristics (e.g., clothing)

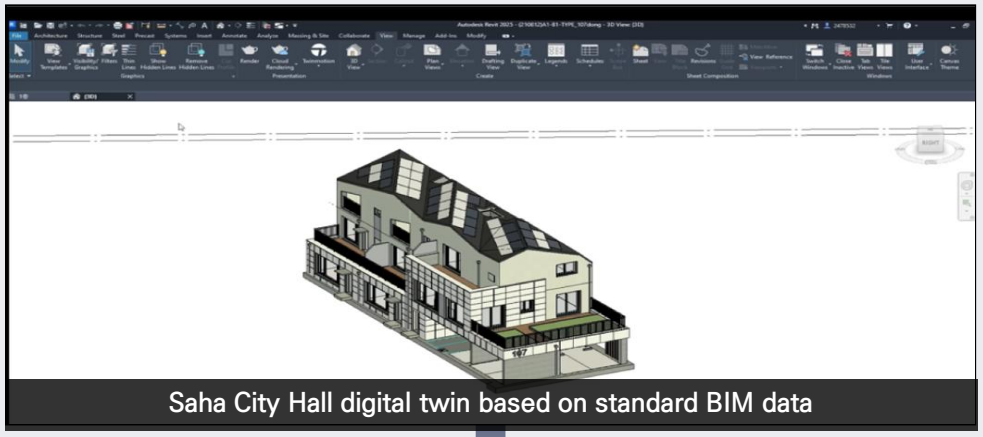


Fire detection platform UI based on digital twin

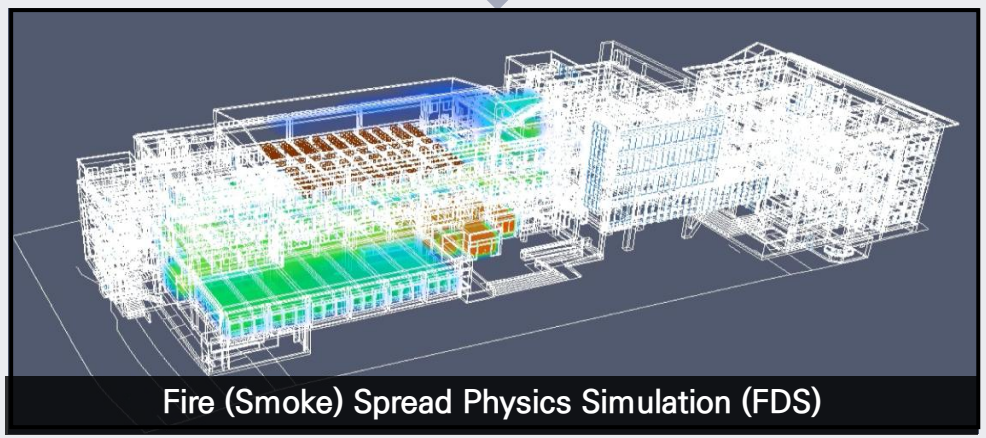
Generation and visualization of isosurface based on water level sensor

Organizer Competencies

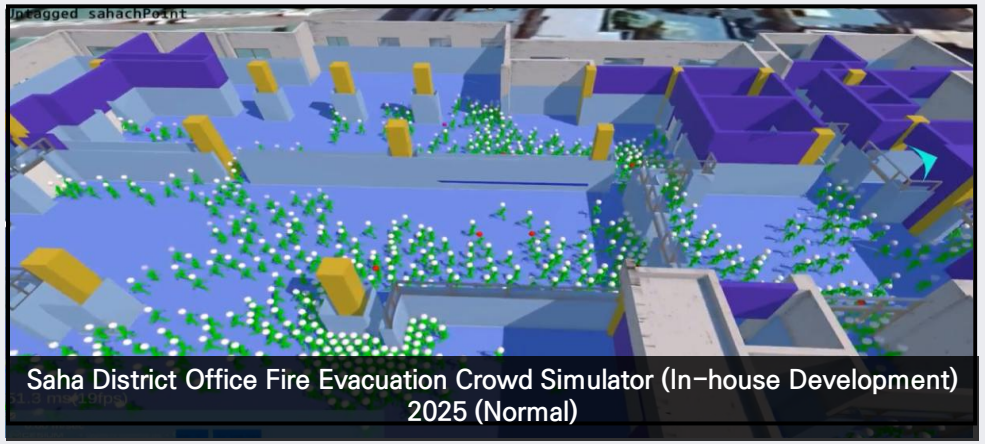
❺ Demonstration of Saha-gu Office Digital Twin



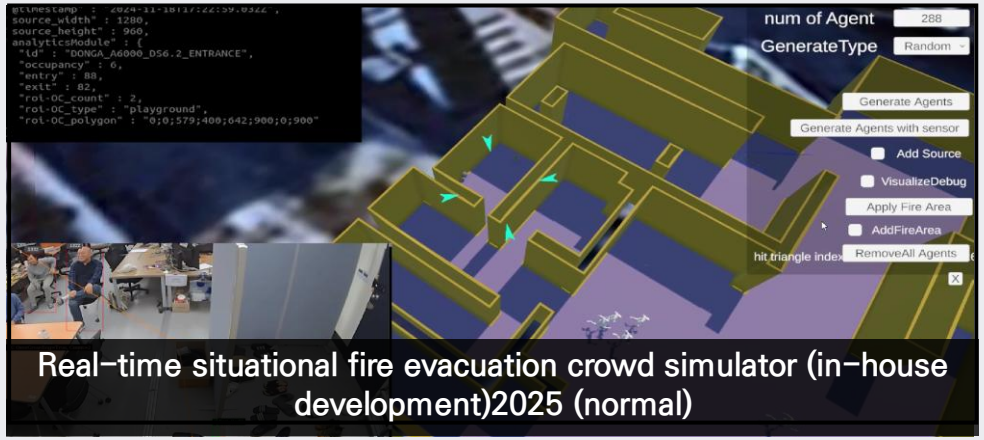
Saha City Hall digital twin based on standard BIM data



Fire (Smoke) Spread Physics Simulation (FDS)



Saha District Office Fire Evacuation Crowd Simulator (In-house Development) 2025 (Normal)

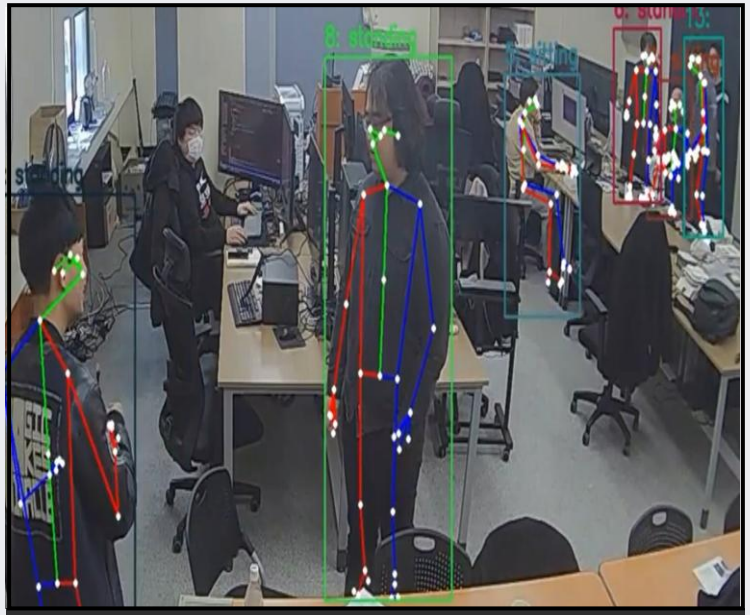


Real-time situational fire evacuation crowd simulator (in-house development)2025 (normal)

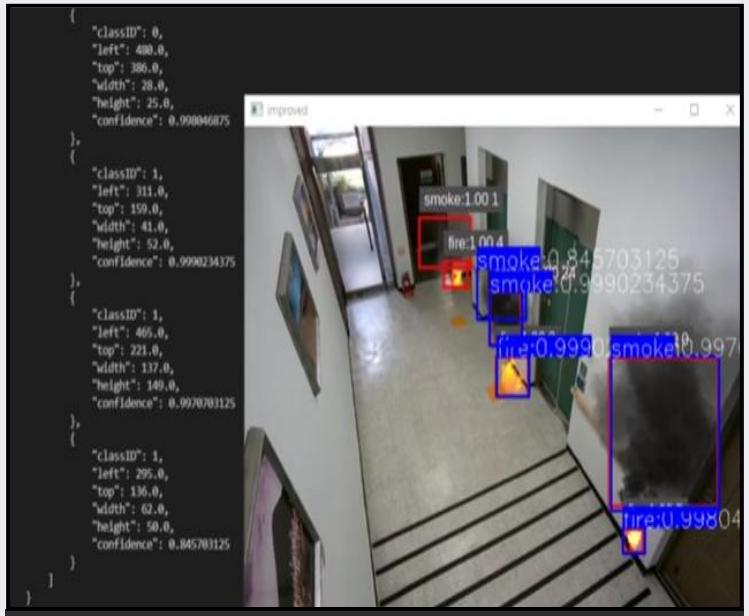
03 Strategies, methods, and implementation systems for R&D projects

Organizer Competencies

❻ Acquire high-quality (15-pixel) object detection (fire, smoke, people) AIOT inference engine (AI Sensor) technology



Get high-quality human motion state recognition technology

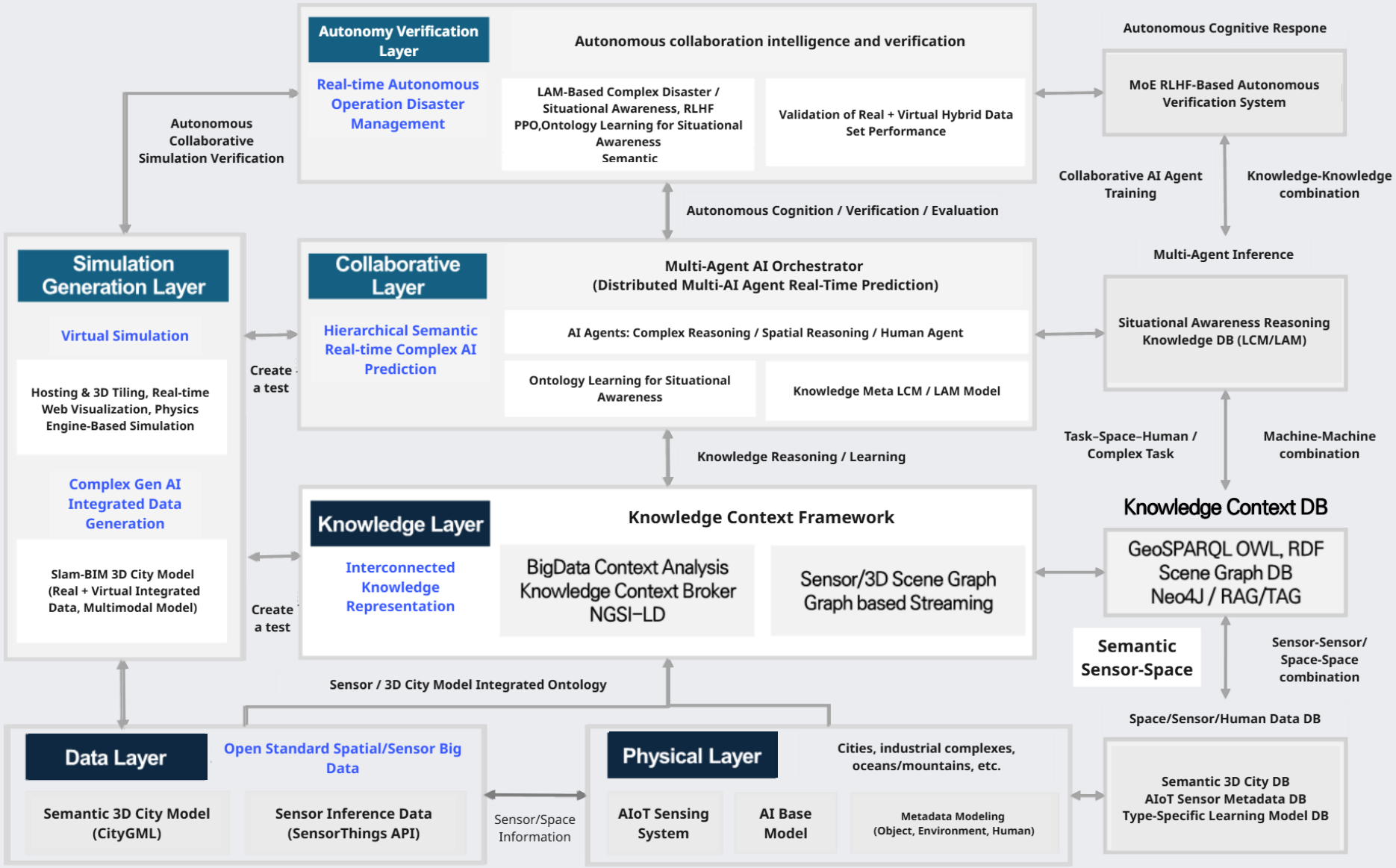


Saha-gu Office Virtual Fire Simulation (Multimodal Data Generation)

Simulate early fire detection in a factory

04 Appendices

Complex Disaster Project Resources



☞ Digital Twin Smart Village / Smart City Lab Commercial Testbed Environment Integration

감사합니다

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