Smart GEO Expo 2022
2022 스마트국토엑스포

2022 ICGIS | International Conference on Geospatial Information Science

Digital Twin Driven Smart City

디지털 트윈 기반 스마트시티

2022. 11. 3 (목) 13:00 ~ 17:00, 킨텍스 1전시관 206호

KRIHS
Korea Research Institute for Human Settlements

Table of Contents

Program Agenda

시간	내용
13:00–13:30	등록
13:30–13:35	개회사 | 강현수(Hyun Soo Kang), 국토연구원 원장
13:35–13:40	축사 | 강주엽(Joo-Yeop Kang), 국토교통부 국토정보정책관
	Keynote Speech 기조연설
13:40–14:10	Reinventing Cities: The Role of Smart Digital Planning Tools 도시 재창조: 스마트 디지털 계획 도구의 역할 Prof. Christopher Pettit, University of New South Wales Sydney
14:10–14:40	Smart City Based on Digital Twins 디지털 트윈 기반 스마트시티 Prof. Deren Li, Wuhan University
14:40–14:55	휴식
	Invited Talk 발표세션
14:55–15:10	Project PLATEAU: The Initiatives of Japanese Digital Twin 프로젝트 플라토 : 일본 디지털 트윈 이니셔티브 Uchiyama Yuya, 일본 국토교통성 도시정책과장보좌
15:10–15:25	Digital GARAM+(Digital Twin Water Management Platform) 디지털 트윈 물관리 플랫폼 Digital GARAM+ 권문혁(Moonhyuk Kown), 한국수자원공사 국가가뭄정보분석센터장
15:25–15:40	Implementation of Digital Virtual Seoul Using 3D Spatial Data(S-Map) 3차원 공간데이터를 활용한 디지털 가상 서울 구현 김태현(TaeHyun Kim), 서울기술연구원 선임연구위원
15:40–15:55	Next Generation of Smart City Development through Meta-Twin Transformation 메타트랜스포메이션을 통한 미래의 스마트도시 이정훈(Jung Hoon Lee), 연세대학교 정보대학원 교수
15:55–16:10	Measures for the Advancement of a Smart City Using Digital Twin 디지털 트윈 기반 스마트시티 고도화를 위한 방안 김익회(Ick Hoi Kim), 국토연구원 스마트공간연구센터 센터장
16:10–16:20	휴식
	Panel Discussion 종합토론
16:20–17:00	종합토론

Lecture Slides

Keynote Speech 기조연설

1

Reinventing Cities: The Role of Smart Digital Planning Tools

도시 재창조: 스마트 디지털 계획 도구의 역할

Prof. Christopher Pettit

Speaker Profile

Prof. Chris Pettit

Director, City Futures Research Centre, University of New South Wales

Prof. Chris Pettit is the Director of the City Futures Research Centre, inaugural professor of Urban Science, and PLuS Alliance Fellow at UNSW Sydney. He currently Chair of the Board of Directors for CUPUM (Computational Urban Planning and Urban Management) and on the International Advisory Board for the “Geo for all” initiative.

크리스토퍼 페팃

도시 미래 연구 센터장, 뉴사우스웨일스대학교 교수

크리스 페팃 교수는 도시 미래 연구 센터장이자,
시드니 뉴사우스 웨일스 대학의 도시 과학 초대교수이다.
현재 CPUM의 이사회 의장이며, “Geo for All” 이니셔티브의 국제 자문 위원회 의장이다.

Reinventing Cities: the role of smart digital planning tools

Chris Pettit
Professor of Urban Science
Director- City Futures Research Centre
c.pettit@unsw.edu.au
https://cityfutures.be.unsw.edu.au/

UNSW City Futures Research Centre

"The future cannot be predicted, but futures can be invented"
Denis Gabor:1963 Nobel prize winner

We need to reinvent our cities for sustainable, healthy, prosperous and socially just urban futures.

UNSW City Futures Research Centre

Contents

- Introducing City Futures – who we are and what we do
- Data-driven approaches for reinventing our cities.
- Smart Digital City Tools
  - Rapid Analytics Interactive Scenario Explorer
  - Australian Housing Data Analytics Platform
  - Colouring Cities
- Planning and Decision Support Theatres
- Concluding remarks

UNSW City Futures Research Centre

UNSW SYDNEY

City Futures Research Centre

We conduct independent research and provide evidence-based inputs into contemporary urban policy debates and the planning of future cities.

UNSW City Futures Research Centre

Our People

12 Professors and Associate Professors
20 Post-doctoral research fellows and assistants
30 Masters and PhD students.
12 CFRC Fellows

Our Senior Leadership Team:

Professor Chris Pettit
Director

Associate Professor
Hazel Easthope
Deputy Director

Professor Hal Pawson

Professor Simon
Pinnegar

Professor Susan
Thompson

Associate Professor
Hoon Han

UNSW City Futures Research Centre

Our Partners

UNSW City Futures Research Centre

CFRC and the SDGs

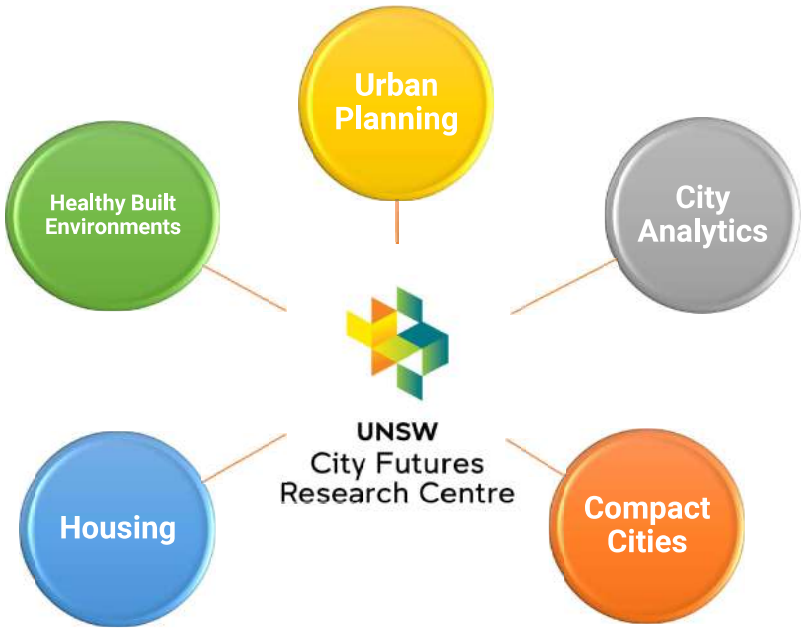
84% of projects relate to at least one Sustainable Development Goal

82 projects total

https://cityfutures.ada.unsw.edu.au/city-futures-and-sustainable-development-goals/

UNSW City Futures Research Centre

Our Research



UNSW City Futures Research Centre

Our Facilities

City Analytics Lab

The City Analytics Lab is a hybrid space with smart equipment including:

- 6 Mobile touch screen workstations
- Augmented Reality Sandbox
- Streaming and conference capabilities
- Virtual Reality Equipment

https://www.be.unsw.edu.au/content/city-analytics-lab

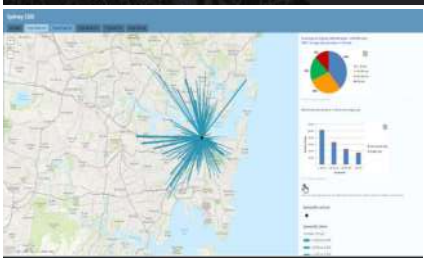
UNSW City Futures Research Centre

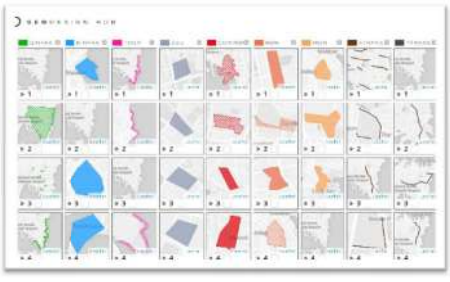
City Analytics Lab

Smart City Digital tools

- Digital Planning
- Decision Support
- Scenario planning
- Geodesign
- Big Data
- Open data
- Dashboards
- Rapid analytics
- Value uplift
- Data analytics
- Modelling
- Simulation
- Usability
- Visualisation
- Virtual Reality
- Automated valuation

"Geodesign, is a design and planning method which tightly couples the creation of design proposals with impact simulations informed by geographic contexts." (Flaxman 2010)





Pettit, C.J. Zarpelon Leao, S. Lock, O. Ng, M. & Reades, J. (2022) Big Data: The Engine to Future Cities—A Reflective Case Study in Urban Transport. Sustainability 2022, 14, 1727. https://doi.org/10.3390/ su14031727

UNSW City Futures Research Centre

Smart City Flagship projects

Rapid Analytics Interactive Scenario Planning

- Funded by CRC SI
- RAISE Toolkit II
- Drag and drop train station- value Uplift
- Sydney
- Brisbane

Australian Housing Data Analytics Platform

- National housing data Exchange
- Redevelopment potential tool
- What if? Planning tool
- Housing Affordability tool

Colouring Cities

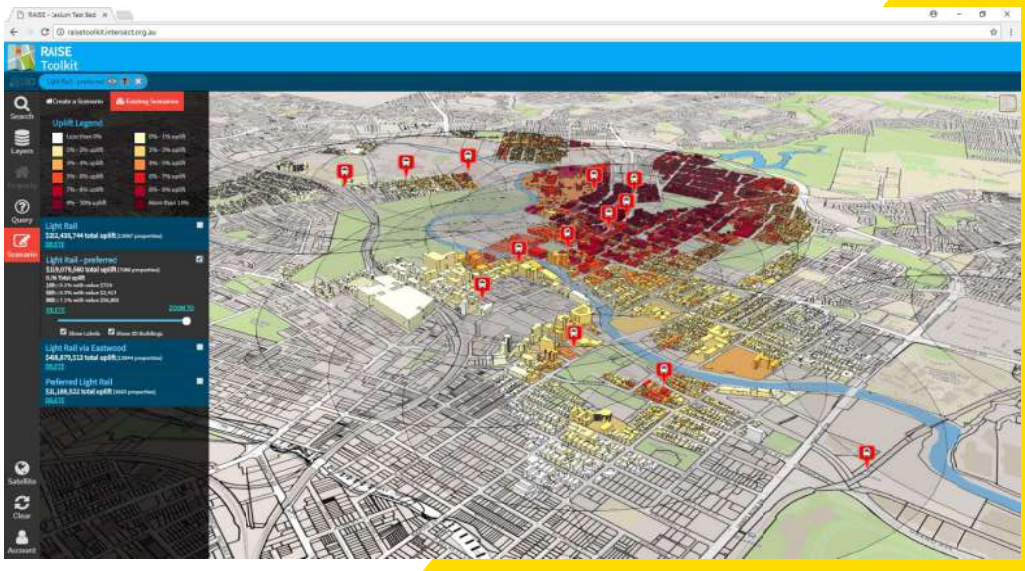
- Funded by CRC-P
- Property valuation models
- Machine learning & Big data
- RAISE toolkit II
- Covid Dashboard

Pettit, C., Bakelmun, A., Lieske, S.N., Glackin, S., Thomson, G., Shearer, H., Dia, H. and Newman, P., (2018). Planning support systems for smart cities. City, Culture and Society., pp 13-24.

UNSW City Futures Research Centre

UNSW SYDNEY

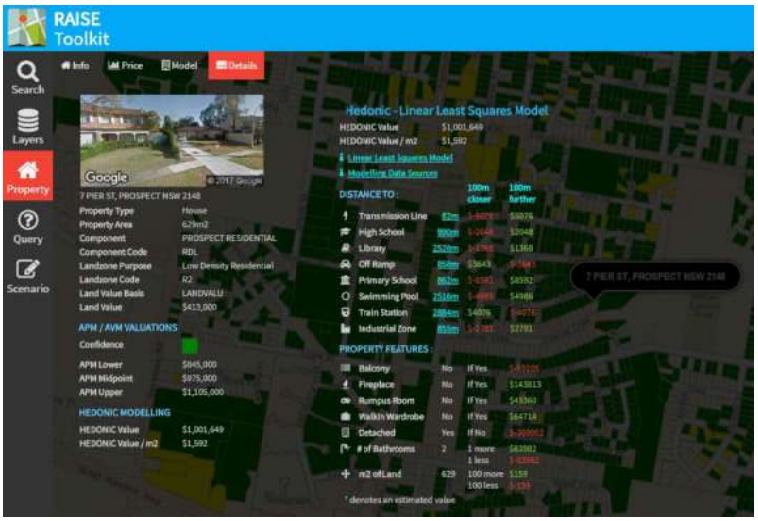
Rapid Analytics – Digital Twin Approach



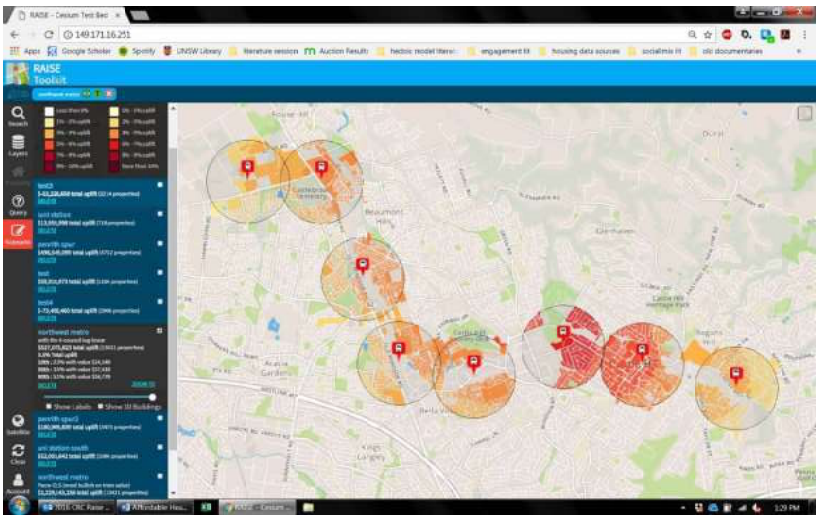
UNSW City Futures Research Centre

Rapid Analytics Interactive Scenario Explorer (RAISE)

Property valuation & value uplift modelling



Lieske, S. van den Nouwelant, R, Han,H.J, Pettit, C.J. (2019) A novel hedonic price modelling approach for estimating the impact of transportation infrastructure on property prices, Urban Studies. https://doi.org/10.1177/0042098019879382



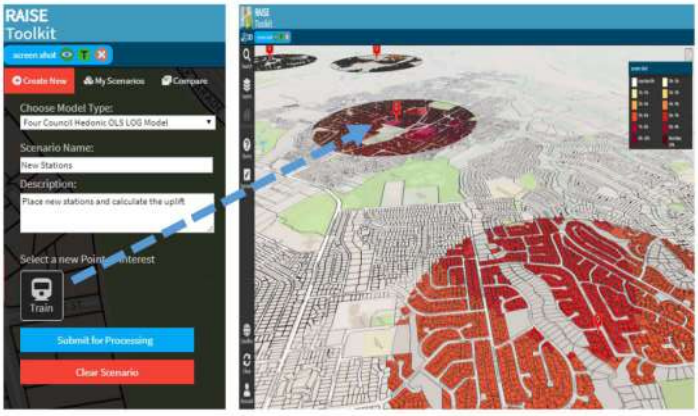
Sydney Metro North West

Leao, S. Z., van den Nouwelant, R., Shi, V., Han, H., Praharaj, S., & Pettit, C. J. (2021). A rapid analytics tool to map the effect of rezoning on property values. Computers, Environment and Urban Systems, 86, 101572

UNSW City Futures Research Centre

Towards a Property Valuation Digital Twin

Providing transparency for marginal effect for each attribute



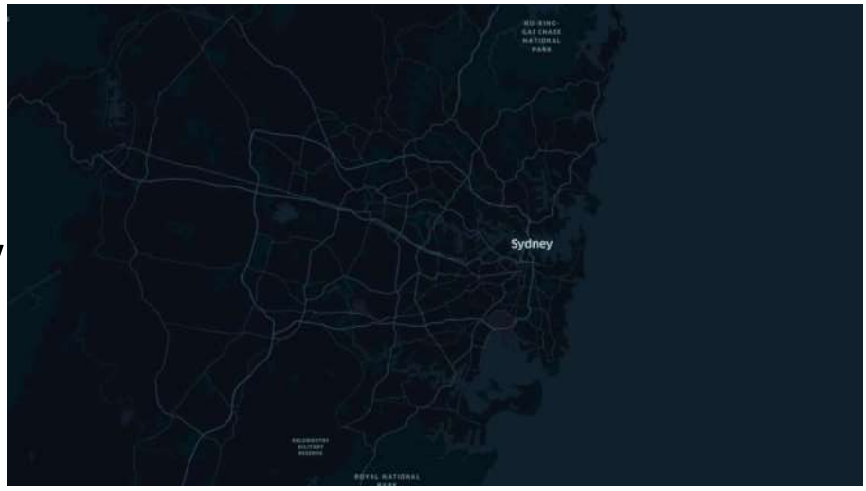
Future scenarios – valuation creation from new train station

Pettit, C. J. Shi, Y, Han, H. Ritternbruch, M. Foth, M. Lieske, S. van de Nouwelant, R, Leao, S. Christensen, B. Jamal, M. (2020) A new toolkit for land value analysis and scenario planning, Environment and Planning B: Urban Analytics and City Science, https://dx.doi.org/10.1177/2399808320924678

UNSW City Futures Research Centre

valueaustralia

Sharpening our land and property decisions with Artificial Intelligence



NSW Property NSW | Liverpool City Council | Frontier SI | UNSW Sydney | CommonwealthBank | OMNILINK Linking People and Information | UNSW City Futures Research Centre

Project Vision

Empowering individuals, government and society to make educated, data-driven decision underpinned by a transparent and ethical digital platform

Project Mission

To create a world class automated valuation model, the best in Australia

Objectives

Integrate significant data assets from public and private organisations

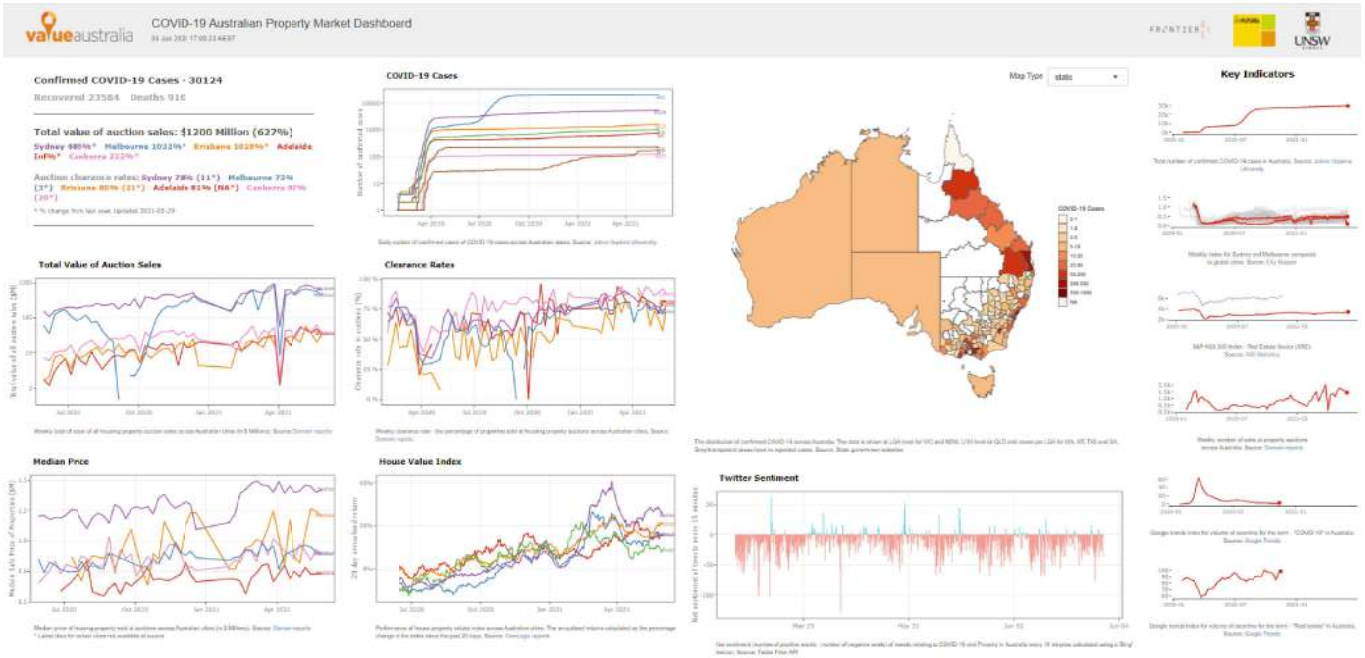
Cyber secure land and property valuation models including machine learning driven mass appraisal valuations for urban, peri-urban and regional Australia

Predictive Infrastructure sequencing and integrated city growth models

Value creation models for critical infrastructure projects with a focus on proximity benefits attributed to transformational public infrastructure and land rezoning

Infrastructure value capture financial models including: incremental financing, betterment taxes & land taxes

Economic feasibility models to calculate the likely returns on property development.

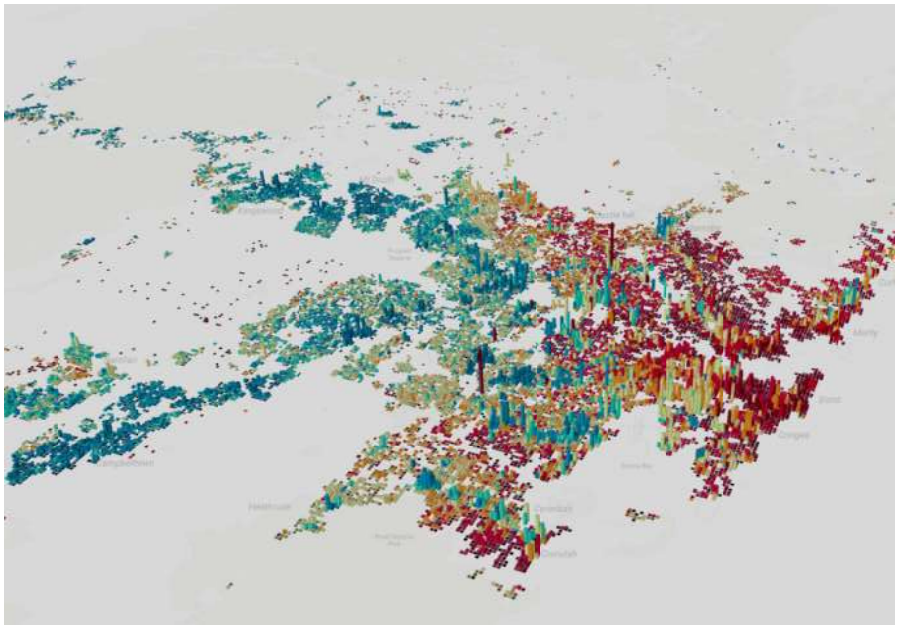


https://covid19dashboard.be.unsw.edu.au/

Soundararaj, B., Pettit, C., & Lock, O. (2022). Using Real-Time Dashboards to Monitor the Impact of Disruptive Events on Real Estate Market. Case of COVID-19 Pandemic in Australia. *Computational Urban Science*, *2*(1), 1-13.

UNSW City Futures Research Centre

Machine Learning in Value Australia: AVM Development



Lock, O., Bain, M., & Pettit, C. (2021). Towards the collaborative development of machine learning techniques in planning support systems–a Sydney example. *Environment and Planning B: Urban Analytics and City Science*, *48*(3), 484-502.

UNSW City Futures Research Centre

AVM Development

- AVM models predict the value of a property in comparison to properties transacted in the same market using historical real estate data sets

- AVM models in Value Australia
  - Linear Regression Models
  - Geographically Weighted Regression (GWR)
  - Machine Learning Models
    - Random Forest
    - Gradient Boosting, XGBoost
    - Multi-Layer Perceptron (MLP)
    - Support Vector Regression (SVR)

UNSW City Futures Research Centre

Model Comparison

Model	Strength in AVM	Weakness in AVM
OLS	Easy to understand and implement Fast to run Easily interpretable (can visualize the coefficients of variables)	Sensitive to outliers Suffer from nonlinear systems Too many features can cause serious difficulties Poor performance with correlated independent variables
Non-regression	Also easy to understand and implement Suitabile for quick estimation	Not as accurate as other advanced models Sensitive to statistical areas
GWR	GWR can reveal the local patterns of the influences of particular impact factors. Differentiate the effects spatially and to take into account variables non stationarities Easily interpretable (can visualize the coefficients of variables)	Based on linear regression, nonlinear relationships between housing price and characteristics may cause bias Time-consuming on large geographical area Too many features can cause serious difficulties
Random Forest	Runs efficiently on large datasets. Easily handle large set of input variables without variable selection.	RF is fast to train but time-consuming for predictions.
Gradient Boosting	GB often provides predictive accuracy that cannot beat. Lots of flexibility with different loss functions and various hyperparameter tuning options. Works great with categorical and numerical values.	GB is likely to be overfitted compared to RF Time-consuming for training on large datasets.
Deep Learning	DL shows excellent performance when a sufficient amount of training data is given comparing to other approaches DL has an ability to learn and model nonlinear and complex relationships	Computationally intensive to train As with regression, deep neural networks require large amounts of data for training Time-consuming for training on large datasets.

AVM Performance with different ML Models: House

Method	R^2(%)	FSD(%)	PPE5 (%)	PPE10 (%)	PPE20 (%)	MAPE (%)	MDAPE (%)
GWR	84.99	17.43	23.53	43.98	74.71	14.73	11.69
Lasso	60.93	25.08	17.82	35.1	60.67	20.15	16.37
Ridge	76.61	18.18	25.5	41.34	70.3	15.65	12.51
ElasticNet	61.23	25.08	16.82	32.37	58.71	20.13	16.3
OLS	74.54	18.21	25.1	40.23	70.68	14.26	11.25
SVR	58.95	24.42	16.95	32.93	59.89	20.37	14.35
Decision Tree	80.14	17.2	31.21	51.68	76.93	14.46	**8.98**
Random Forest	86.21	14.12	31.59	56.72	83.24	12.78	9.63
GBM	**87.90**	13.9	32.78	**57.7**	84.69	13.41	9.43
XGBoost	86.31	**13.74**	**32.88**	56.21	**85.1**	12.7	9.04
MLP	84.23	13.75	31.26	53.41	84.47	**11.86**	8.99

UNSW City Futures Research Centre

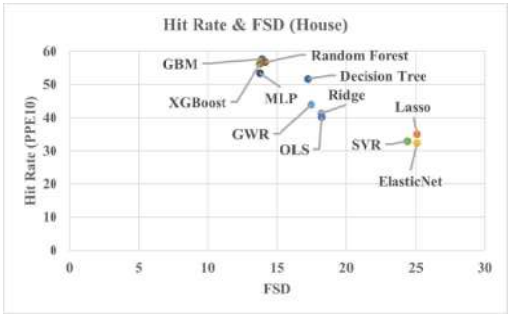
AVM Performance with different ML Models: Unit

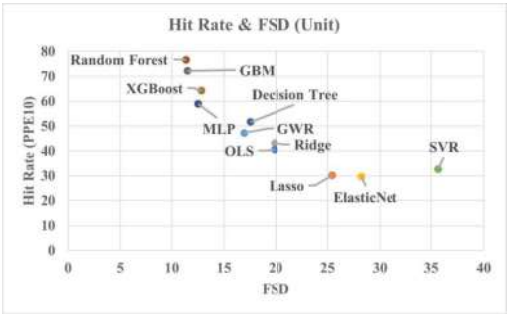
Method	R^2(%)	FSD(%)	PPE5 (%)	PPE10 (%)	PPE20 (%)	MAPE (%)	MDAPE (%)
GWR	72.94	16.95	24.75	47.25	77.50	13.85	10.75
Lasso	31.64	25.44	13.15	30.14	54.25	22.78	18.22
Ridge	61.34	19.86	22.13	43.21	74.32	15.55	12.22
ElasticNet	30.56	28.22	14.01	29.68	54.27	23.12	18.36
OLS	60.24	19.88	23.24	40.56	72.11	15.2	12.45
SVR	34.12	35.66	18.01	32.64	61.2	19.44	15.68
Decision Tree	66.32	17.55	28.63	51.67	79.22	13.52	9.97
Random Forest	**82.34**	**11.36**	**54.99**	**76.54**	**90.12**	**8.66**	**4.67**
GBM	80.17	11.51	43.56	72.15	88.98	9.13	5.46
XGBoost	81.67	12.84	35.67	64.25	88.12	9.23	7.06
MLP	78.12	12.52	31.67	58.98	84.22	11.1	8.35

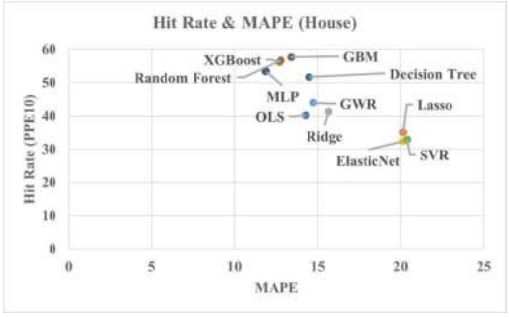
UNSW City Futures Research Centre

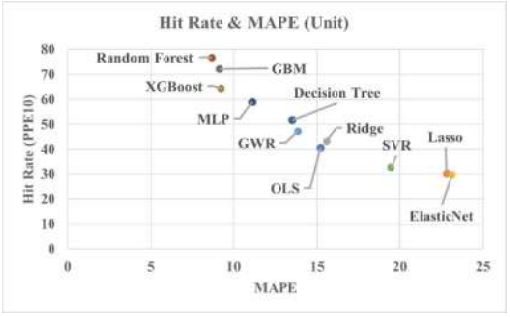
Model Comparison using Hit Rate

Hit Rate (PPEs): the larger, the better
FSD: the smaller, the better
MAPE: the smaller, the better



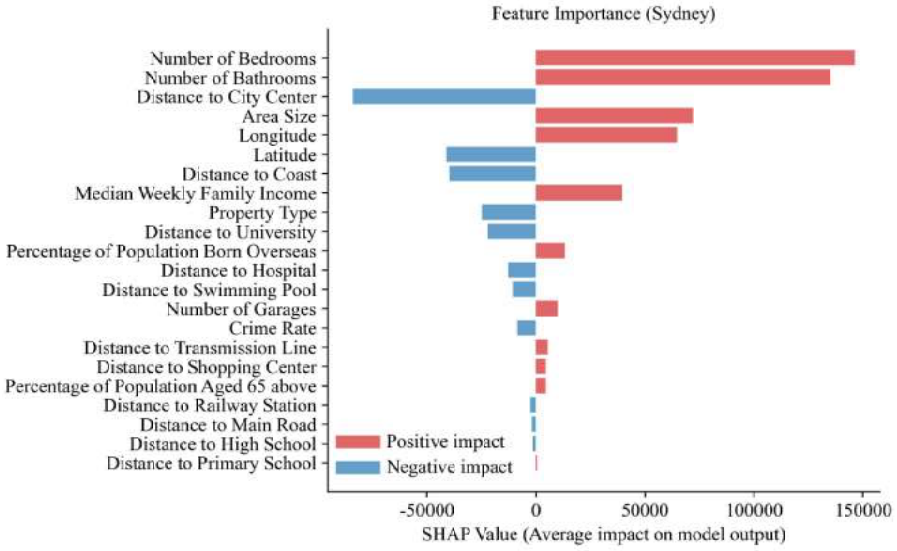






UNSW City Futures Research Centre

Feature Importance



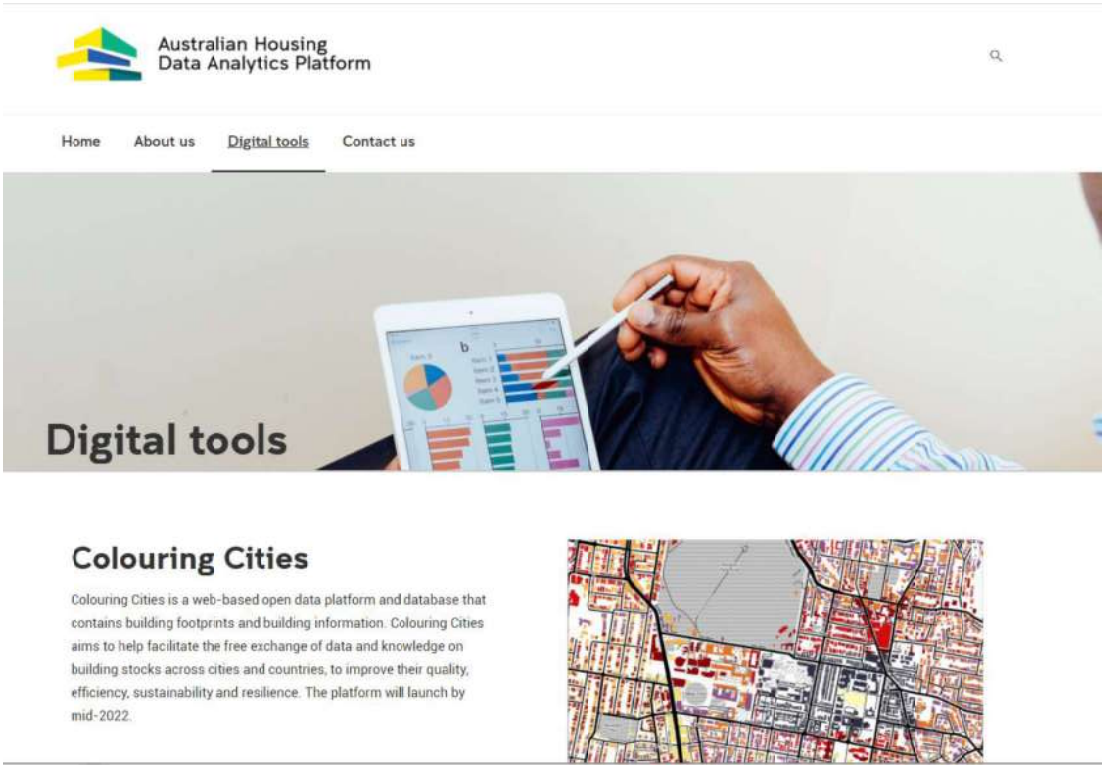
Important features:

- **Structural attributes:** Number of Bedrooms, Number of Bathrooms, Area Size, Property Type
- **Locational attributes:** coordinates, accessibility variables (to coast, train station, swimming pool…)
- **Statistical and Economical attributes**: Income, population composition

UNSW City Futures Research Centre

value australia

UNSW SYDNEY



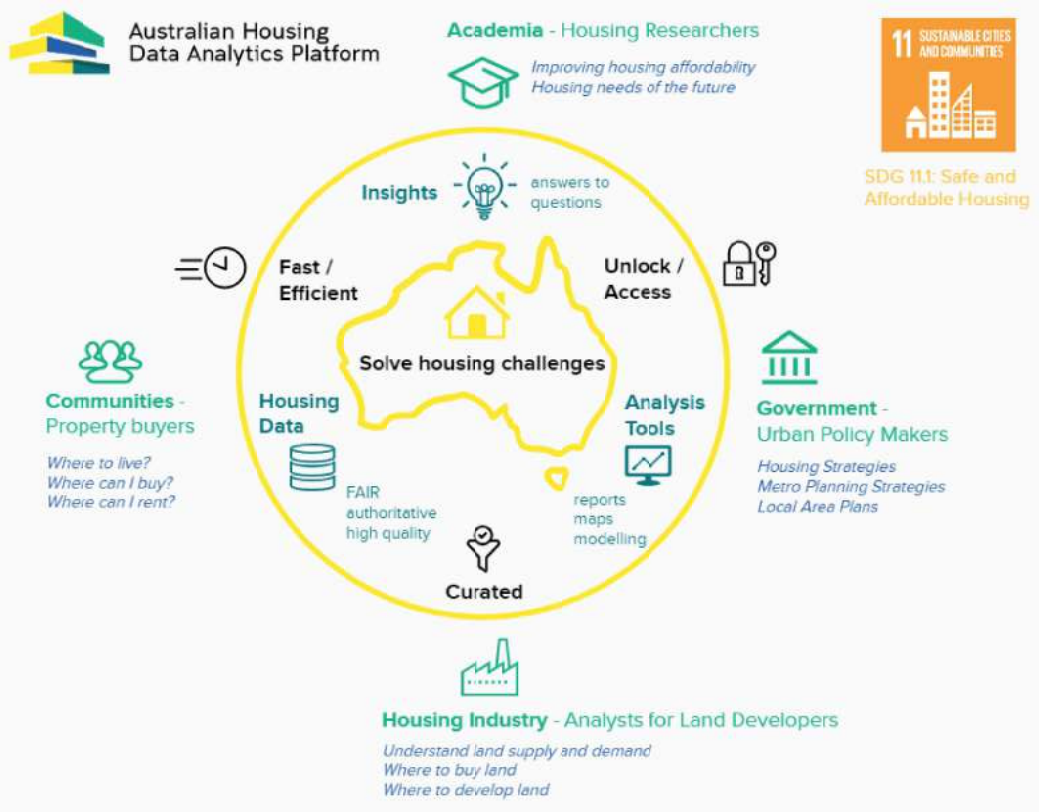
https://www.ahdap.org/

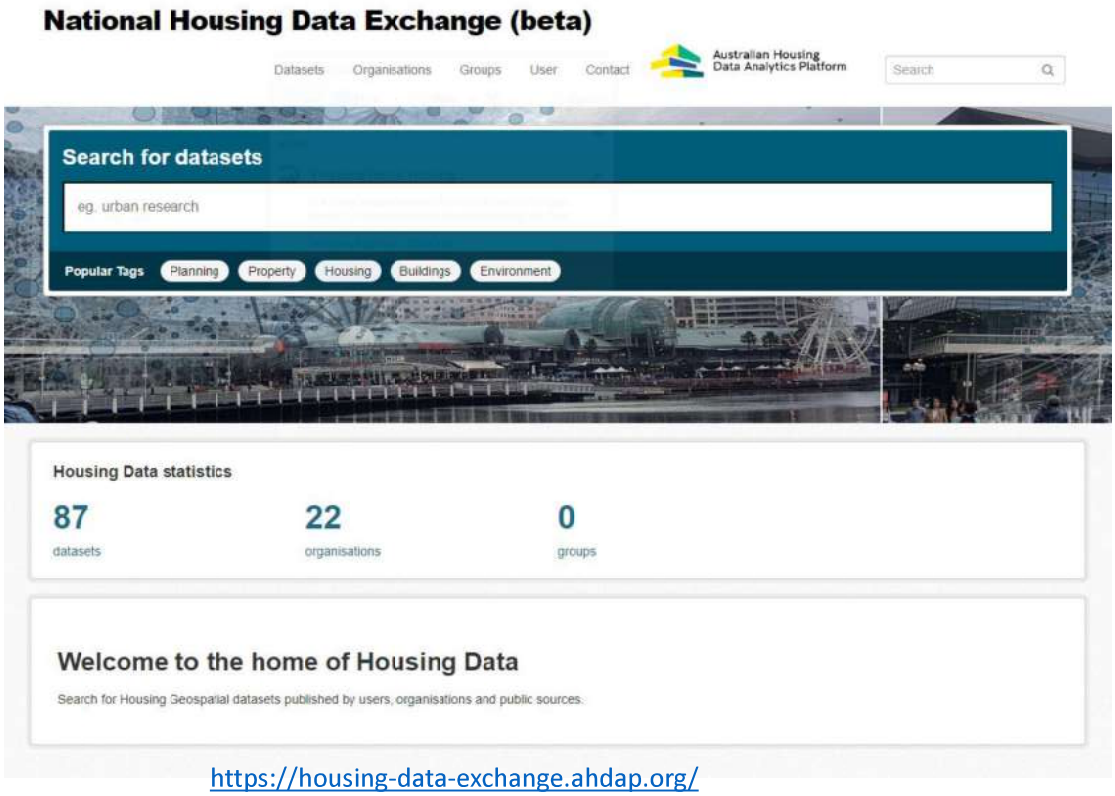
Australian Housing Data Analytics Platform

UNSW City Futures Research Centre

- AHDAP is an integrated analytics platform for Australian housing data
- Implementation of an extensible data model for housing data consolidation
- Deployment of advanced analytics suite that is data-driven, including:
  - What If?: a collaborative planning support tool to experiment planning strategies
  - ENVISION: A analytical toolkit that undertakes multicriteria evaluation and strategic, map-based planning
  - AHAT: An evaluation of cost and subsidy parameters on housing affordability
  - RAISE: A rapid interactive scenario builder that allows instantaneous estimation and visualisation of property prices
  - **Colouring Sydney:** A new web-based open data platform for citizen science and visualisation of building-level information

UNSW SYDNEY

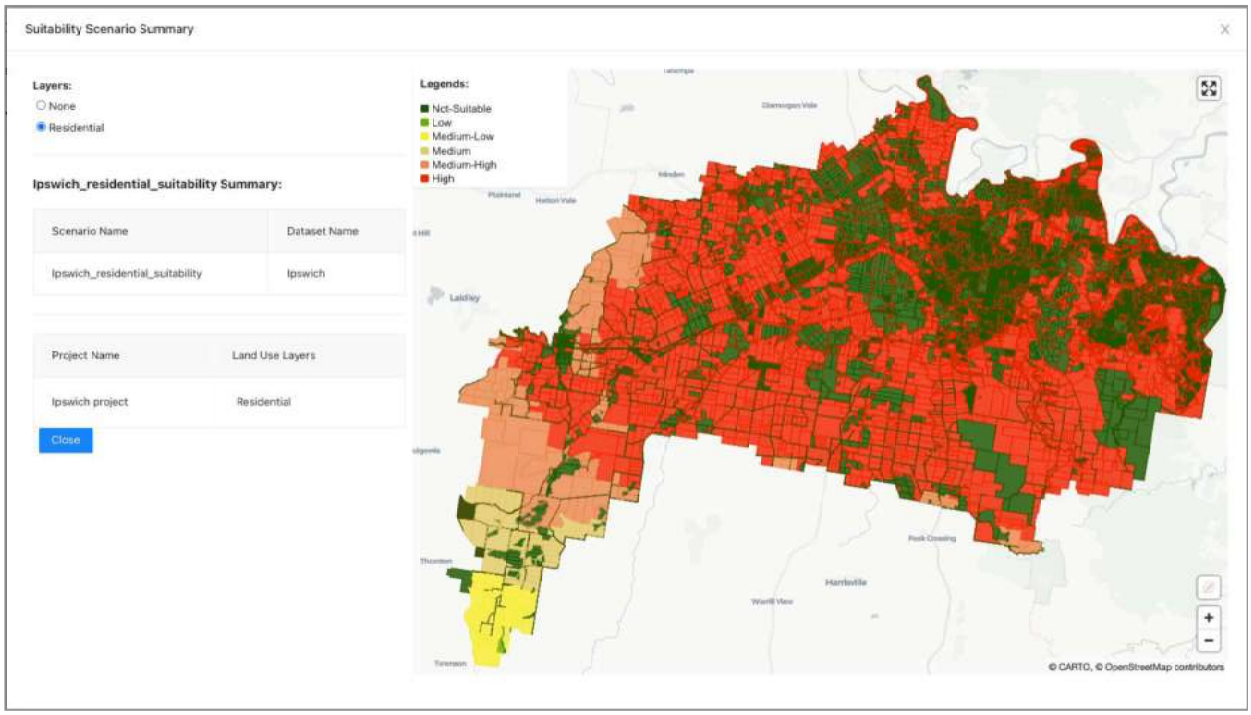




https://housing-data-exchange.ahdap.org/

What If? Scenario Planning Tool

Australian Housing Data Analytics Platform



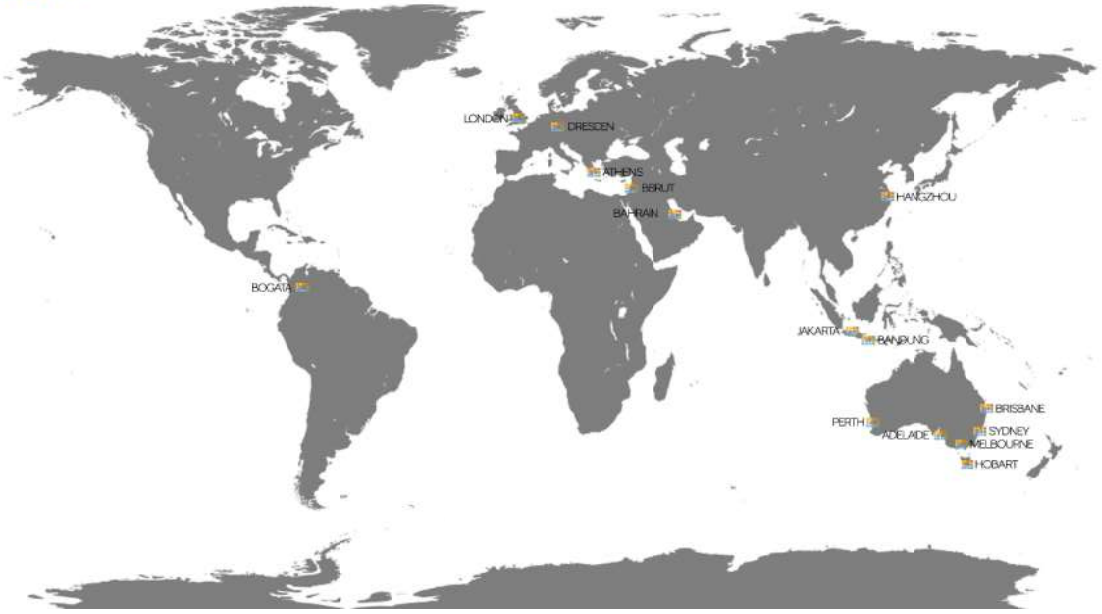
Colouring Cities Research Programme

UNSW City Futures Research Centre

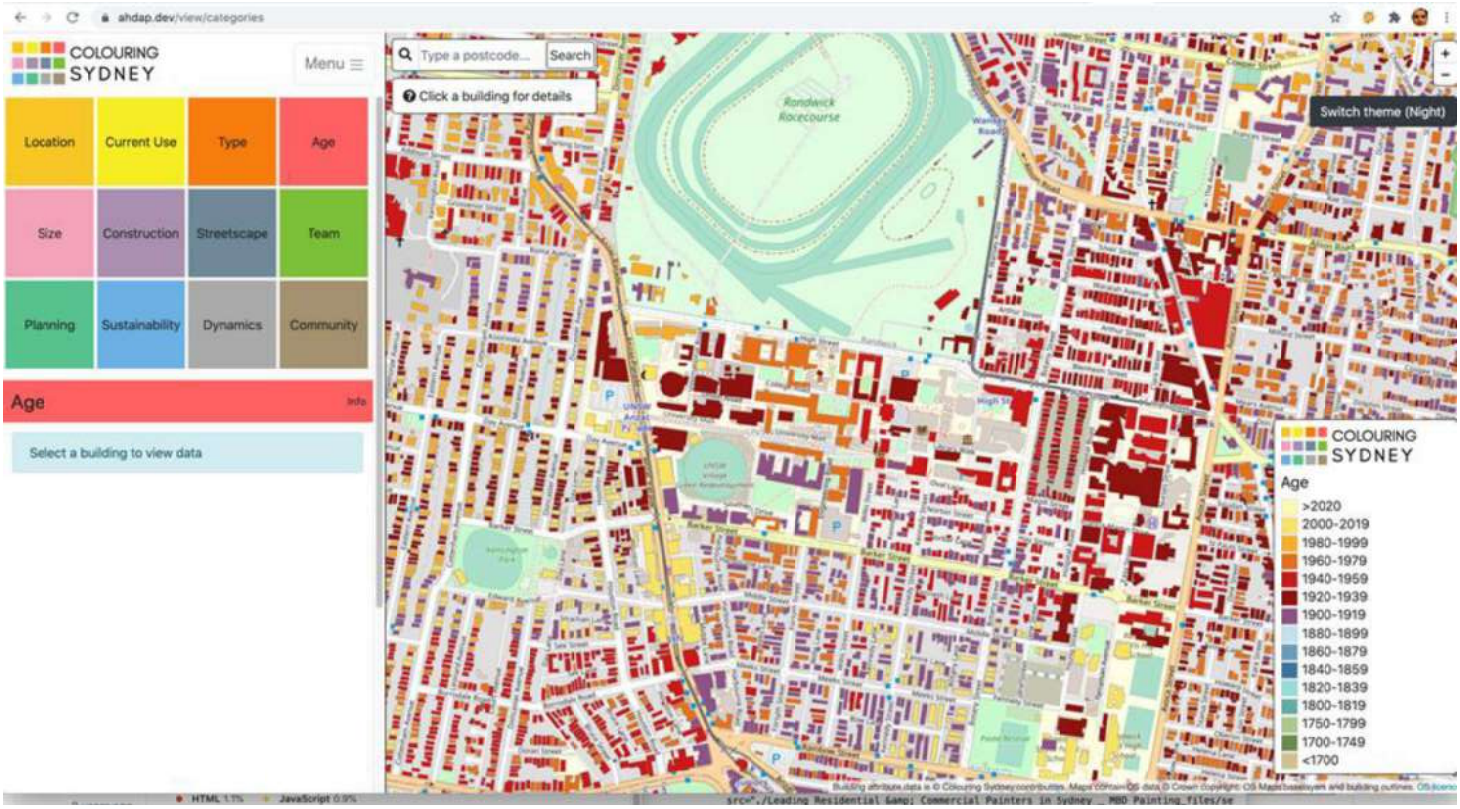
- A new digital platform focussed on VGI at the building-level (i.e., a higher spatial granularity)
- Research collaboration with leading academic institutes, international governments; and, private organisations within the Colouring Cities Research Programme
- Programmed led by the Alan Turing Institute and University College London
- Colouring Cities is deployed in the UK, Lebanon, Germany, Bahrain, Greece, China, Indonesia and Australia

UNSW SYDNEY

COLOURING CITIES
RESEARCH PROGRAMME



UNSW SYDNEY

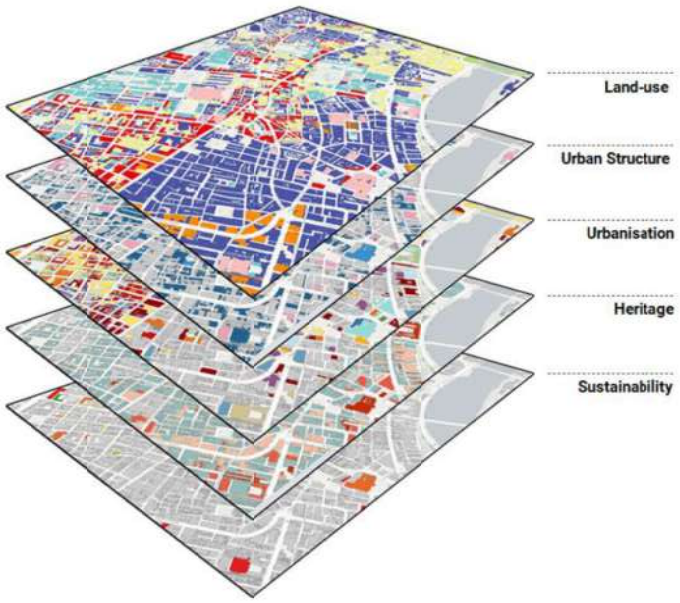


COLOURING CITIES: AUSTRALIA

- Colouring Cities is a partnership between UCL, The Turing Institute, The University of Beirut, and the Leibniz Institute of Ecological Urban and Regional Development

- A novel crowdsourcing platform for data collection for Australian cities
  Colouring Australia includes:
  Colouring Sydney, Colouring Melbourne, Colouring Brisbane, Colouring Perth, and Colouring Hobart

- Facilitating access to building-level data
  - Age
  - Land Titles and Tenure
  - Building Materials
  - Property Values: Sales and Rent Data
  - Greenspace
  - Accessibility



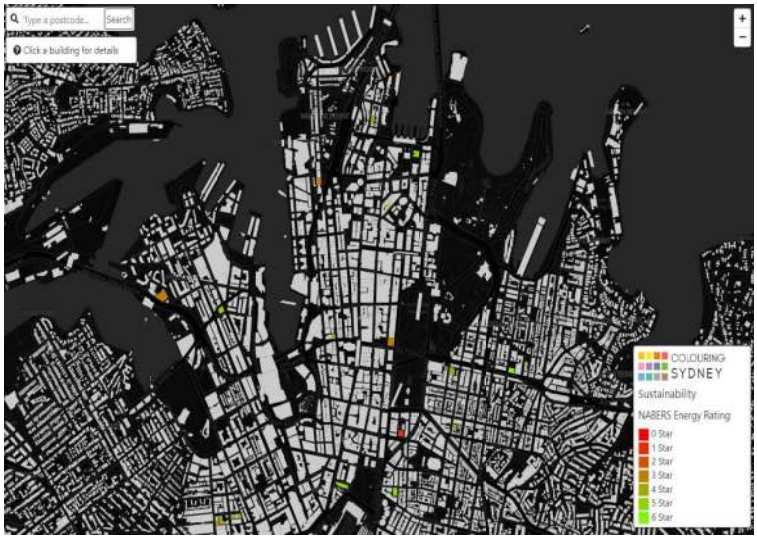
Contact Dr Matt Ng - matthew.ng@unsw.edu.au

UNSW City Futures Research Centre

Towards a net zero city

Energy Efficiency and Sustainability

- Sustainability data to address: energy, waste and water efficiencies at a high spatial resolution
- Current data includes NABERS building ratings for energy, water and waste
- Ratings can be verified/uploaded following key strategic partnerships with the NSW Department of Planning and Environment
- Sustainability ratings can be complemented by other Colouring Sydney data (i.e., building age, construction materials, façade materials) to give a holistic picture of sustainability in each building
- Integration with smart technology: platform further allows incorporation with sensor data (e.g., climate and pollution) for further evaluation

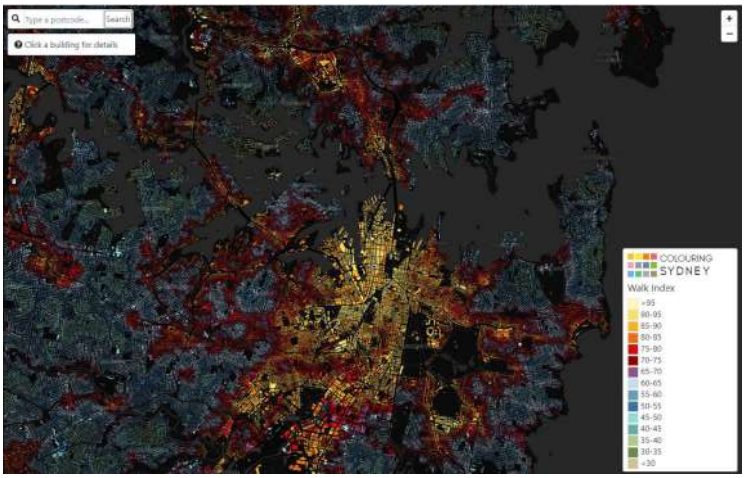


UNSW SYDNEY

UNSW City Futures Research Centre

An Active Transport centric city

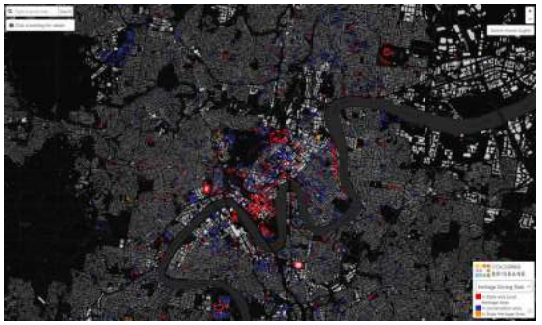
- The layer illuminates the disparities in potential for active transport across Sydney - both infrastructure and nearby destinations need to be available for people to choose active transport
- Research has shown a positive relationship between this type of walkability and property value
- An aim for walkability on Colouring Sydney is to gather data on perceived walkability and use this to inform further development of walkability indexes



UNSW SYDNEY

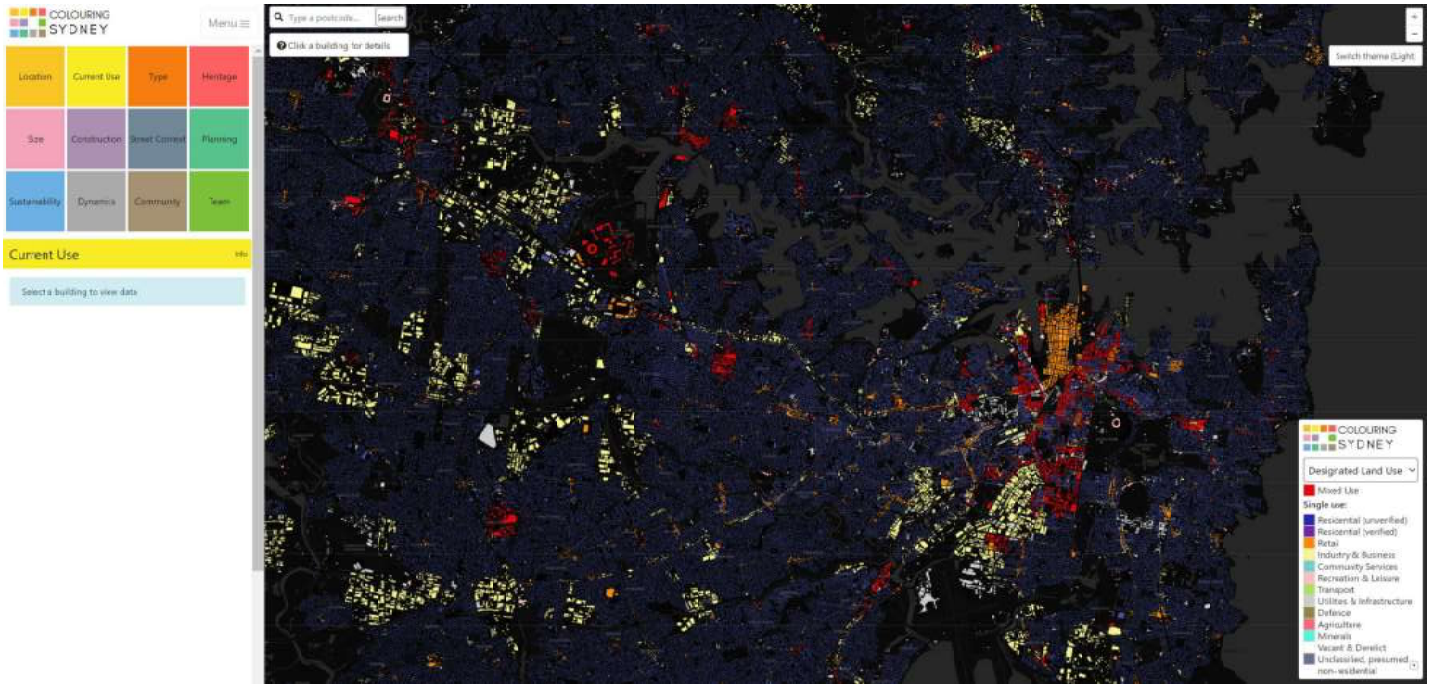
Colouring Australia

- **Open planning tool** for Australia's building stock developed by the City Futures Research Centre, UNSW
- A new way to visualise, collate, and stream multidimensional data on all buildings in Australia
- Facilitates **public participation** and **multi-sector knowledge sharing**
- **Collaboratively developed** in partnership with the Colouring Cities Research Programme (Alan Turing Institute, UK) to produce a **global database of national building stocks**
- Providing over **12 categories of open data** and over **50 subcategories** of open data
- **~11.3 million building footprint polygons across all of Australia**, derived from machine-learning and other open data sources
- Testing **novel data capture methods** and **feedback loops** to improve **quality and coverage** using **computational and crowd-sourcing approaches**
- **Applications: planning, housing, heritage, energy, transport, and resilience**



COLOURING CITIES RESEARCH PROGRAMME

UNSW City Futures Research Centre



Colouring Sydney showing open data on current land-use. Source: NSW Planning Portal, Environmental Planning Instrument Land-Use

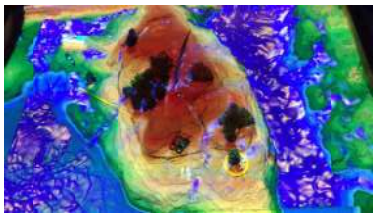
COLOURING CITIES RESEARCH PROGRAMME

UNSW City Futures Research Centre

Planning & Design Support Theatres

https://www.be.unsw.edu.au/content/city-analytics-lab



iHUB National Urban Research & Development Platform

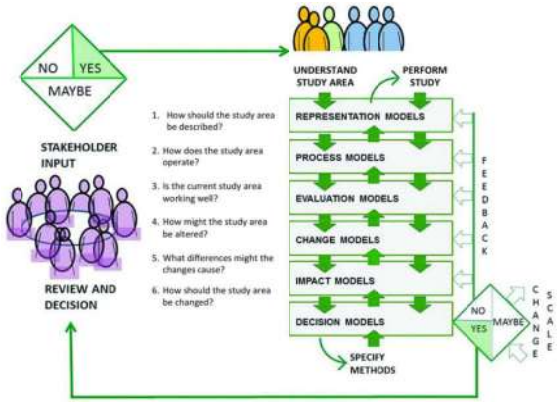
Punt E. , Geertman, S. Afrooz, A. Witteb, P. Pettit, C.J. (2020) Life is a scene and we are the actors: Assessing the usefulness of planning support theatres for smart city planning, Computers, Environment and Urban Systems, Volume 82, July 2020, 101485, https://doi.org/10.1016/j.compenvurbsys.2020.101485

City Analytics Lab

UNSW City Futures Research Centre

Geodesigning – Future Cities

Geodesign is a design and planning method which tightly couples the creation of design proposals with impact simulations informed by geographic contexts. Flaxman (2010)




Pettit, C. Hawken, S, Ticzon, C Steinitz, C, Ballal H. T. Cranfield. Leao, S. Afrooz, A, Lieske, S. (2019) Breaking down the silos through geodesign – Envisioning Sydney's urban future, Environment and Planning B: Urban Analytics and City Science. DOI: 10.1177/2399808318812887.

City Analytics Lab

UNSW City Futures Research Centre

Planning & Design Support Theatre




Cycling Infrastructure Planning: City of Penrith

Riding to school scenario (A)

Recreational cycling scenario (B)

Integrated scenario (A+B)

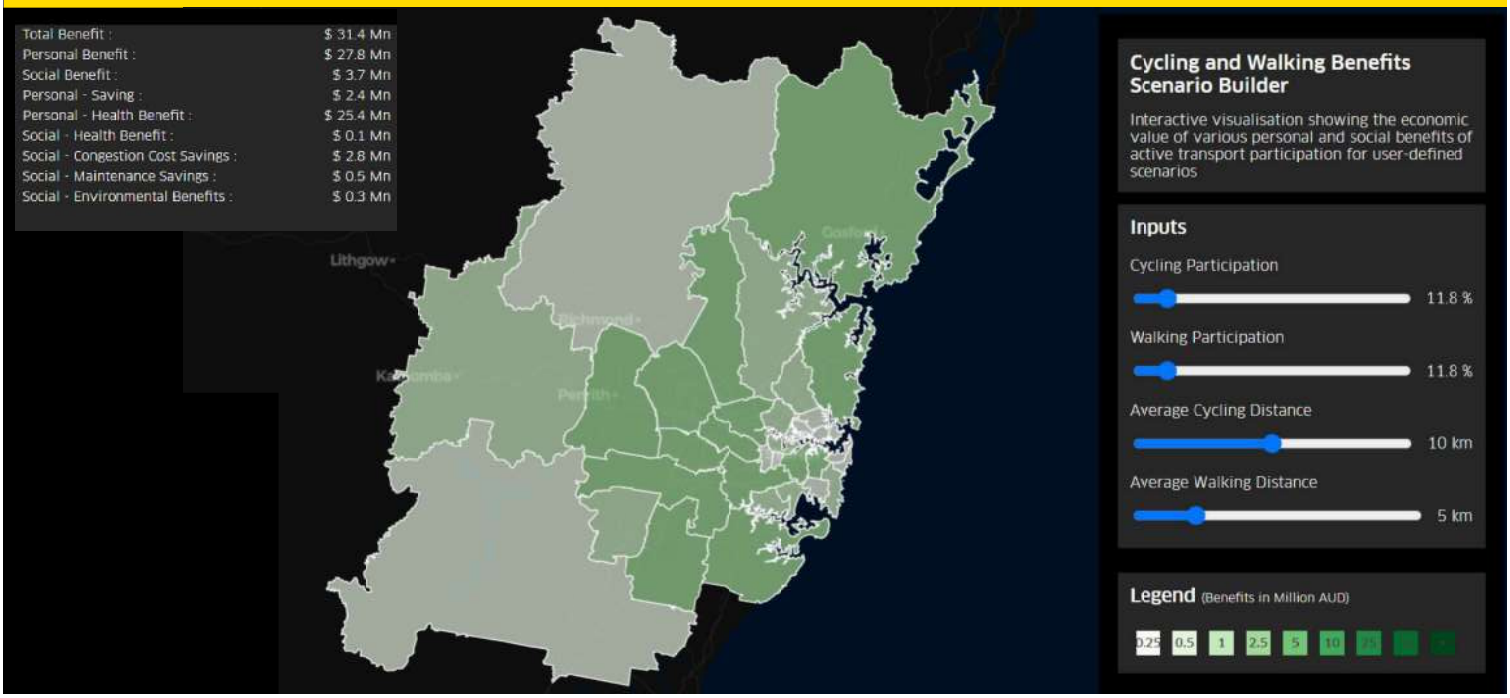
UNSW City Futures Research Centre

UNSW SYDNEY

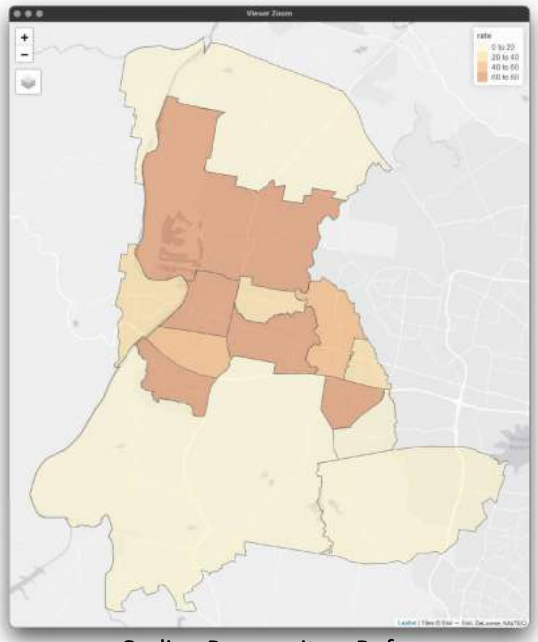
UNSW City Futures Research Centre

UNSW SYDNEY

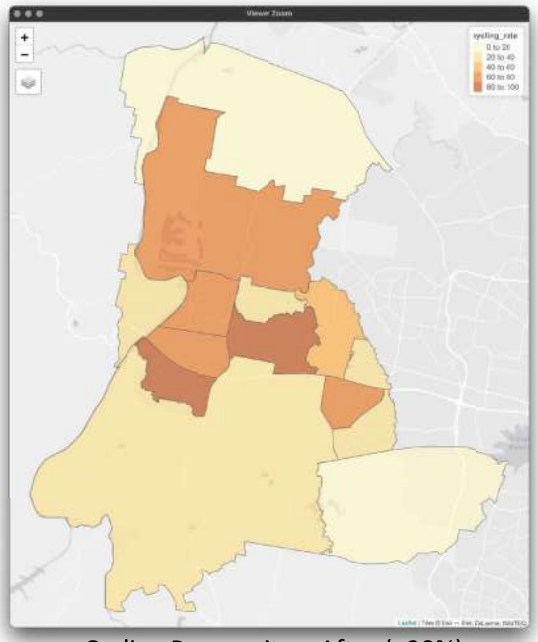
Active Transport Benefits Dashboard



Cycling Participation - Penrith

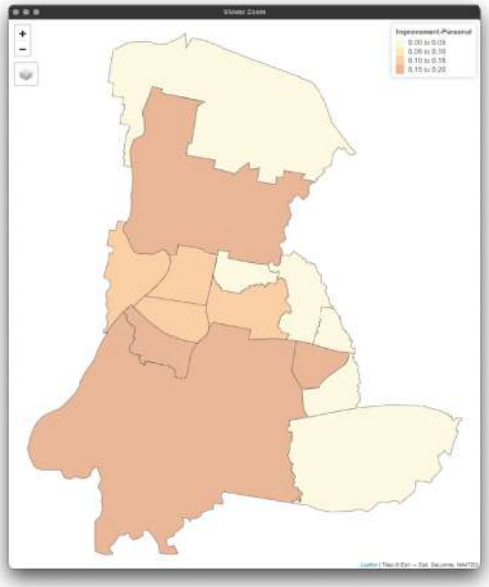


Cycling Propensity – Before

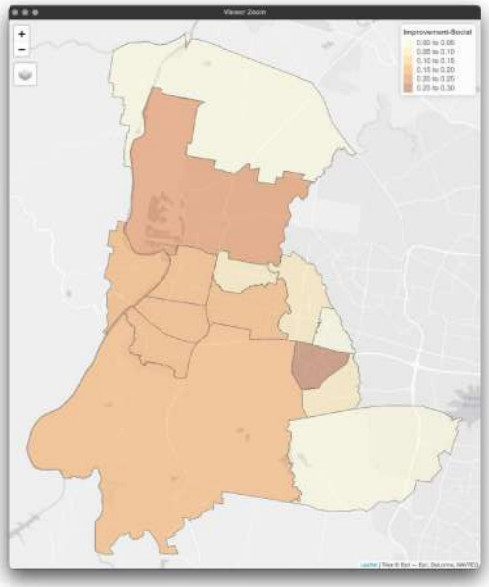


Cycling Propensity – After (+20%)

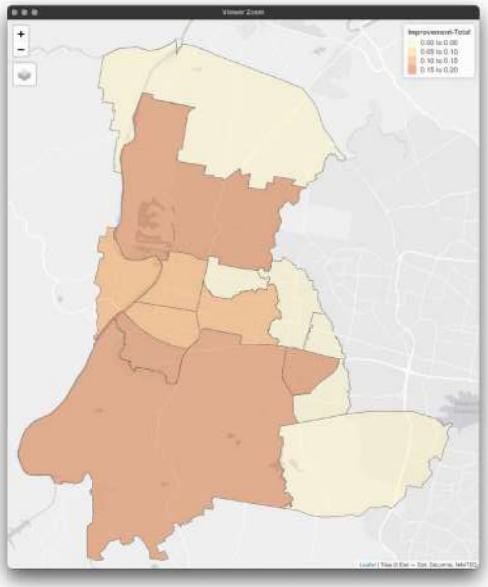
Cycling Infrastructure Benefit - Penrith



Improvement in Personal Benefit (%)
$ 3,045,123 (+14%)



Improvement in Social Benefit (%)
$ 636,346 (+20%)



Improvement in Total Benefit (%)
$ 3,681,469 (+17%)

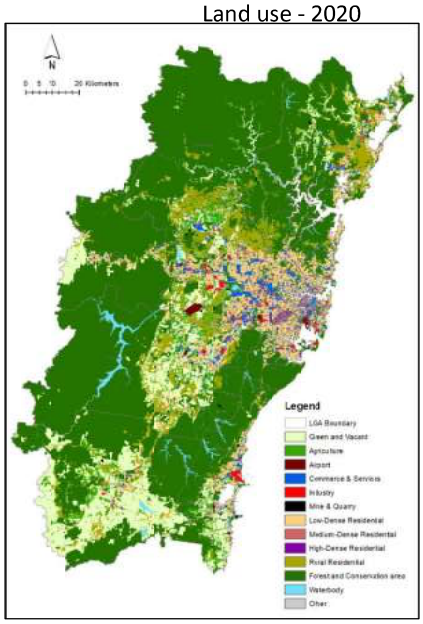
Resilient Sydney 2050 - Workshop

- The context: Greater Sydney
  - Highest total resident population among all Australian capital cities
  - Greatest risk of being affected by floods (back to back floods in 2022)
  - Penrith faces 21 very-hot days (above 35 degrees) in a year
  - Above 6% of all properties are exposed to greater bushfire risks
- City of Sydney, in 2018 with the help of 100 Resilient Cities, has formulated resilience strategies with 35 actions
- Workshop objectives (attending Action-1 of the strategy):
  - What new insights can a data-driven model provide to stakeholders during city resilience planning?
  - What are the challenges and opportunities of incorporating a data-driven model and its outcome into a collaborative city resilience planning approach?

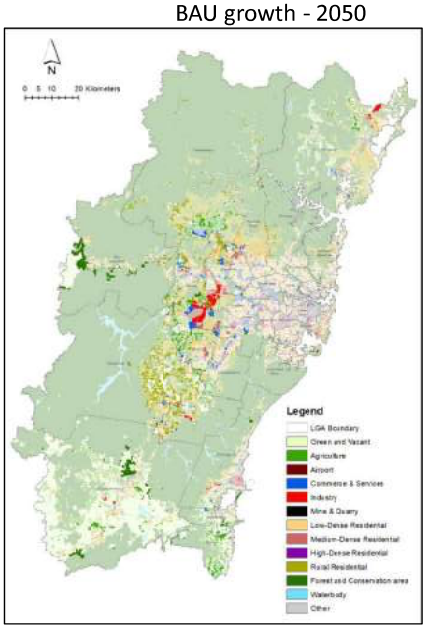
Resilient Sydney 2050 - Workshop

Resilient Sydney 2050 - Workshop

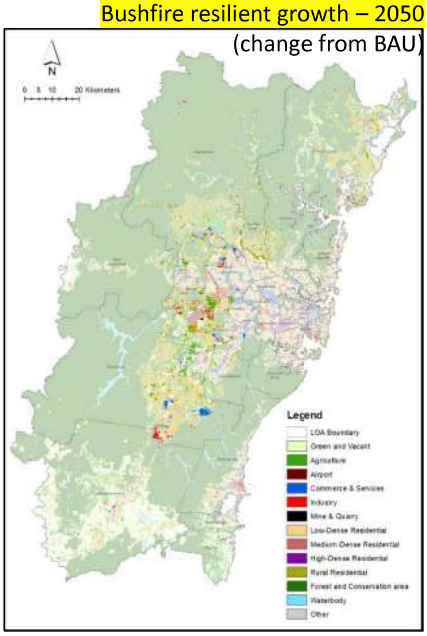
Land use - 2020



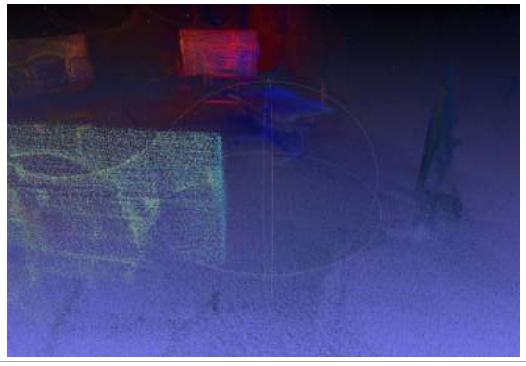
BAU growth - 2050



Bushfire resilient growth – 2050 (change from BAU)



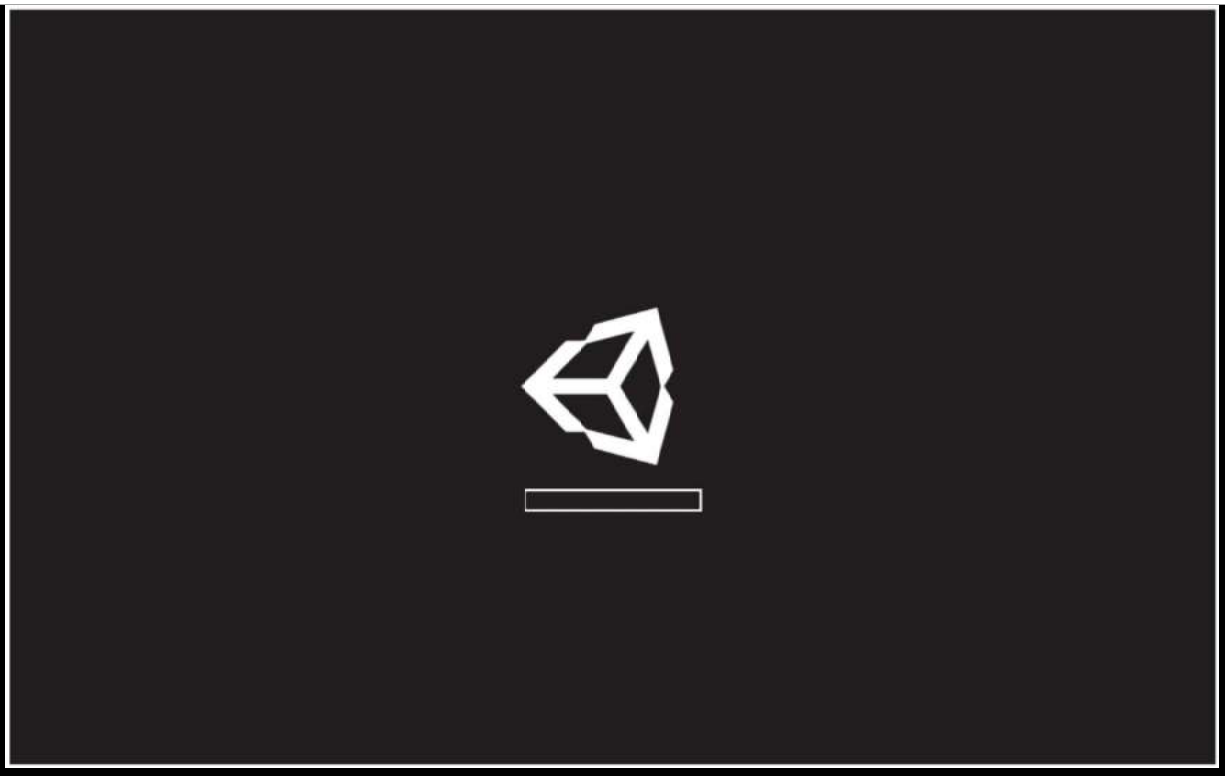
Planning & Design Support Theatres



https://bala.sh/vcal/version_15/

City Analytics Lab

UNSW City Futures Research Centre



Aleksandrov, M., Barton, J., Pettit, C., Soundararaj, B., & Zlatanova, S. (2022). Towards a Virtual Planning Support Theatre for City Planning and Design. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, X-4/W2-2022, 5–12. doi:10.5194/isprs-annals-X-4-W2-2022-5-2022

Big data, modelling for city planning

- Big data and ML can provide more accurate property modelling results.
- The property Digital Twin offer potential to further improve the understand of property and land valuation dynamics.
- Spatial data, urban models, and ML offer much promise for understanding city dynamics.
- Planning support systems such as RAISE, What if? and colouring Cities can assist strategic planning

UNSW City Futures Research Centre

Bridging the gap – Planning and technology

- The technology is there but we need to harness it better
- Need for guiding principles –Plan Tech principles - https://www.planning.org.au/planningresourcesnew/plantech-pages/pia-plantech-principles
- More work is required on the data - quality, sharing, ethics……
- Establish communities of practices and capability building with planners
- Critically reflect and design frameworks for digital planning tools to be embedded in urban governance, planning and policy making processes.

Thank-you

Chris Pettit
Professor of Urban Science
Director- City Futures Research Centre
c.pettit@unsw.edu.au
https://cityfutures.be.unsw.edu.au/

UNSW
City Futures
Research Centre

Invitation to Smart Data and Smart Cities Conference

https://conference.unsw.edu.au/en/7th-Smart-Data-and-Smart-Cities-Conference

Lecture Slides

Keynote Speech 기조연설

2

Smart City Based on Digital Twins

디지털 트윈 기반 스마트시티

Prof. Deren Li

Speaker Profile

Prof. Deren Li

Prof. Deren Li is a scientist in surveying, mapping and remote sensing from Wuhan University, China. He enjoys dual memberships of both Chinese Academy of Sciences and Chinese Academy of Engineering. He is also the member of International Eurasia Academy of Sciences and International Academy of Astronautics. He received doctor degree from University of Stuttgart in 1985 and honorary doctorate from ETH Zürich in 2008. In 2012, International Society for Photogrammetry and Remote Sensing awarded him the Honorary Member, the number of which ISPRS limits to a maximum of ten at any time as the highest honor.
In 2020, ISPRS awarded him the Brock Gold Medal in recognition of outstanding contributions to photogrammetry.

데렌 리

중국 과학원, 우한대학교 교수

데렌 리 교수는 중국 우한 대학의 측량, 지도학, 원격탐사 관련 과학자로서,
중국 과학원과 중국 공학원의 회원이며, 국제 유라시아 아카데미 및 국제 우주 아카데미 회원이다.
2008년 ETH Zurich에서 명예박사학위를, 2012년 ISPRS에서 명예회원으로 임명되었으며,
2020년 ISPRS로부터 브록 골드 메달을 수여 받았다.

Smart City based on Digital Twins

Academician Deren Li

Wuhan University

The construction of the new smart city

"Promote the modernization of the national governance system and governance capacity with informatization, promote the construction of new smart cities by level and classification, break down information barriers, build a national information resource sharing system, and better use information means to perceive the social situation, smooth communication channels, and assist scientific decision-making."

—— Important speech of General Secretary Xi Jinping at the 19th National Congress

On April 4th, 2020, General Secretary Xi Jinping pointed out at the Hangzhou City Brain Operation Command Center: Making cities smarter and smarter is the only way to promote the modernization of urban governance systems and governance capabilities, and the prospects are broad.

Contents

1. Smart City based on Digital Twins

(1) What is "Digital Twin"?

As a key way to realize two-way mapping, dynamic interaction and real-time connection between virtual and real, digital twins can map the properties, structure, state, performance, functions and behaviors of physical entities and systems to the virtual world, forming a high-fidelity dynamic multi-dimensional/multi-scale/multi-physical quantity model, which provides an effective means for observing, understanding, understanding, controlling and transforming the physical world.

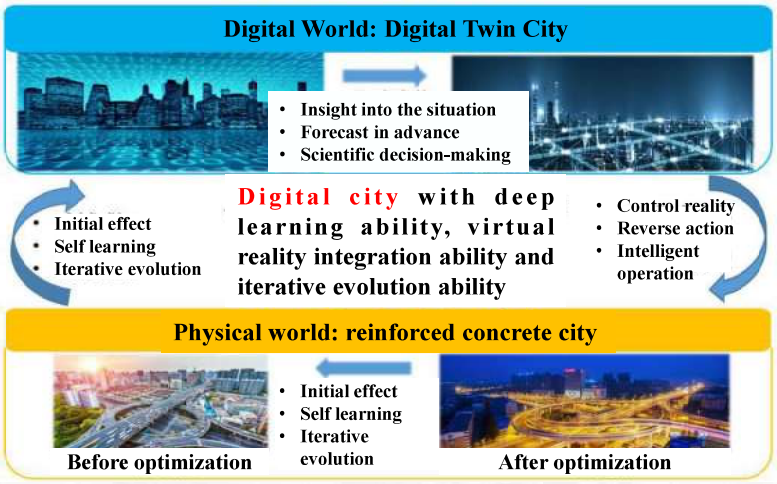
1. Smart City based on Digital Twins

(2) What is a "digital twin city"

In a digital twin city, the operation status of infrastructure (water, electricity, gas, transportation, etc.), the deployment of municipal resources (police, medical, fire protection, etc.), and the safe operation and control of people, logistics and vehicle flow will all be collected through sensors, cameras, and digital subsystems, and transmitted to the cloud and city managers through Internet of Things technologies including 5G and Beidou. Based on this data, as well as city models, digital twins can be built to manage cities more efficiently

1. Smart City based on Digital Twins

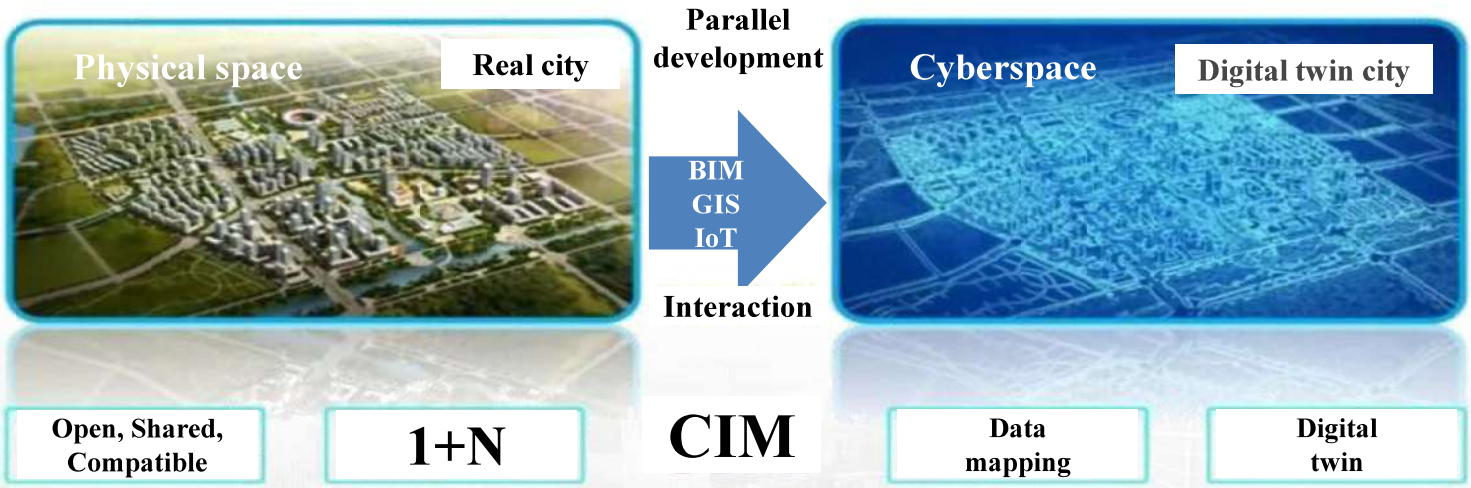
(2) What is a "digital twin city"



Compared with the "product life cycle" of industrial manufacturing, the "life cycle" of cities is longer and the benefits will be greater

1. Smart City based on Digital Twins

(2) What is a "digital twin city" (GIS+BIM+IOT)



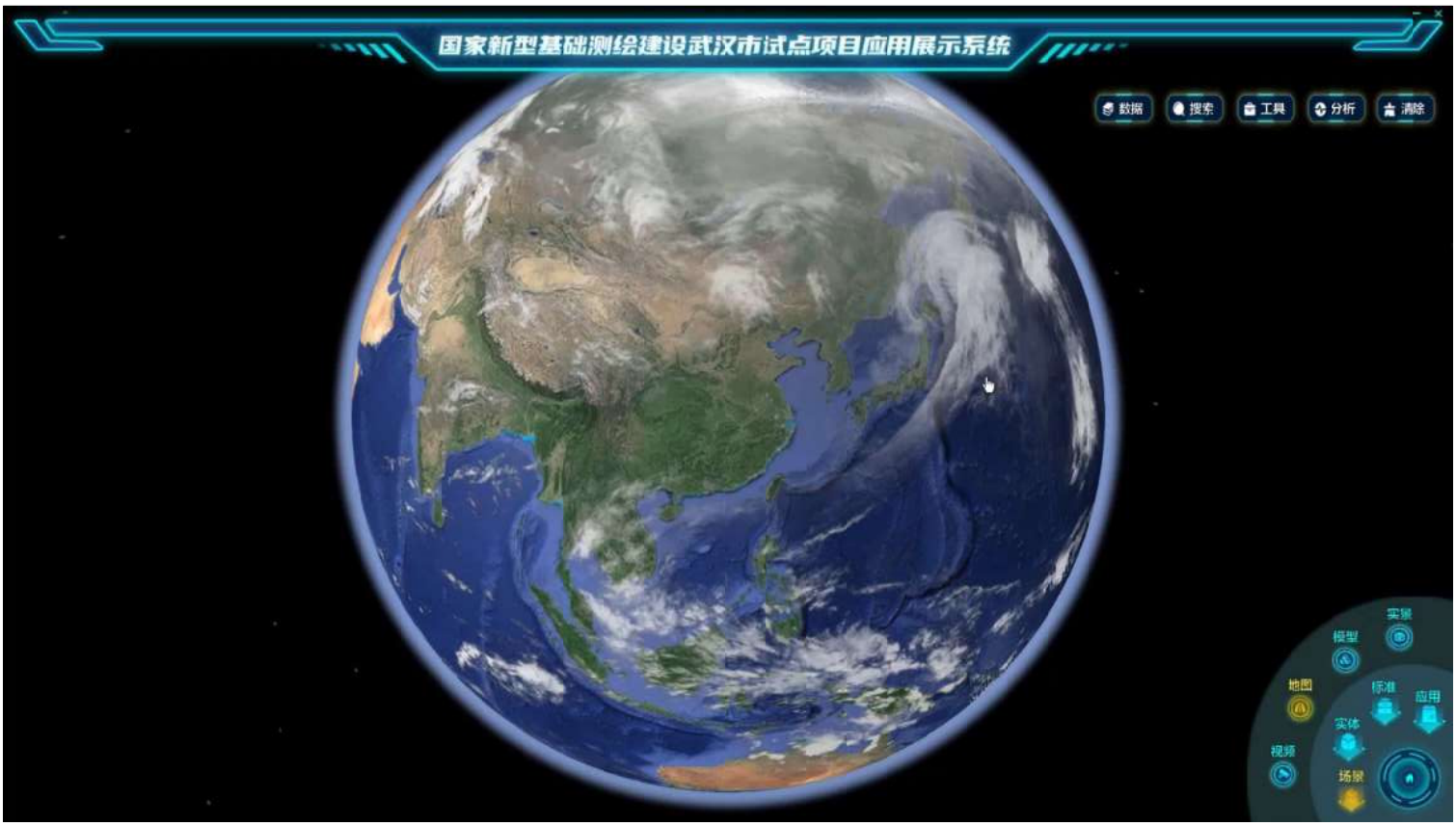
Hyderabad in India and Singapore, as well as Shenzhen and Xiongan in China, have been exploring in this aspect, and a large amount of investment is pouring into the application of "**smart city + digital twin**"

1. Smart City based on Digital Twins

(2) What is a "digital twin city"

Virtual Singapore（虚拟新加坡）计划

Smart Shenzhen based on 3D reality model



1. Smart City based on Digital Twins

(3) Digital twins and smart cities

The construction of digital twin cities will trigger disruptive innovation in urban intelligent management and services.

The result is:

✓The information is visible, the trajectory can be followed, the status can be checked, the virtual and the real operate synchronously, and the situation is blended

✓The past can be traced, the future can be predicted, the present knows the cold and warm, the small is known, and the beginning knows the end

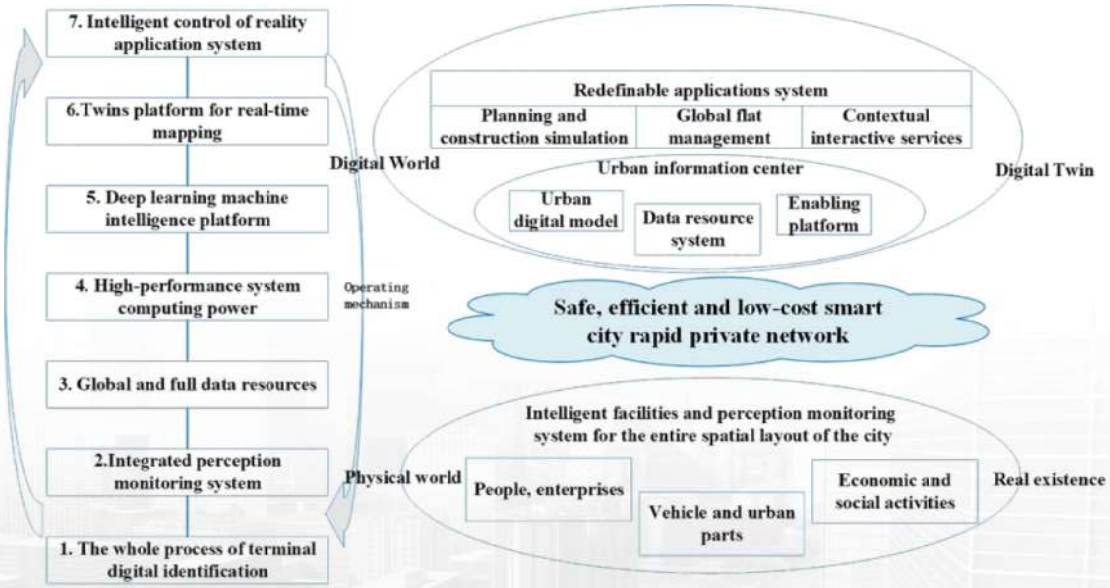
✓The whole city is in control, and everything can be managed and controlled

✓Flat management, one-stop service, more information runs, less errands for the masses

✓Virtual service reality, simulation of simulation decisions

1. Smart City based on Digital Twins

(3) Digital twins and smart cities



Above picture shows the smart city architecture of digital twins, which is a new height of smart city construction

1. Smart City based on Digital Twins

(3) Digital twins and smart cities

Digital twin city is not only the ideal goal of digital city, but also a new height of smart city construction, giving the city brain important facilities and basic capabilities to achieve intelligence.

It is a milestone in the transformation of urban informatization from quantitative change to qualitative change driven by technology, based on strong technical capabilities such as digital identification, automatic perception, network connection, intelligent control, and platform services, so that the digital city model can operate in parallel with the physical city as a twin, integrating virtual and real, and containing unlimited innovation space.

The smart city of digital twin will realize the intelligent operation control and management of the real city in the physical space in cyberspace.

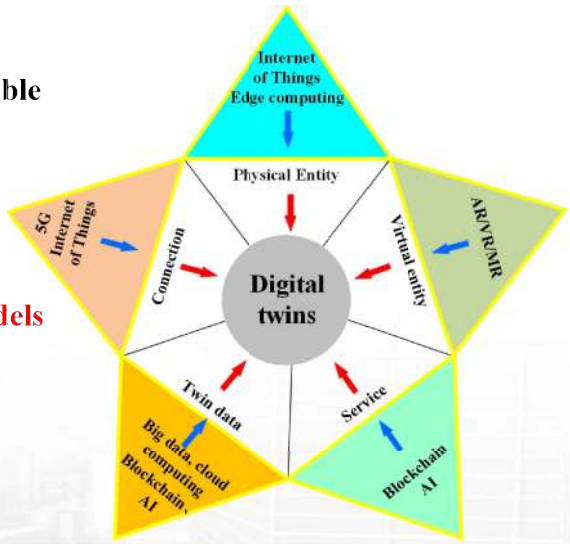
Contents

2. Characteristics of Smart City based on Digital Twins

Five key cutting-edge technologies required for digital twins

The realization and implementation of digital twins is inseparable from the support of New IT and AI:

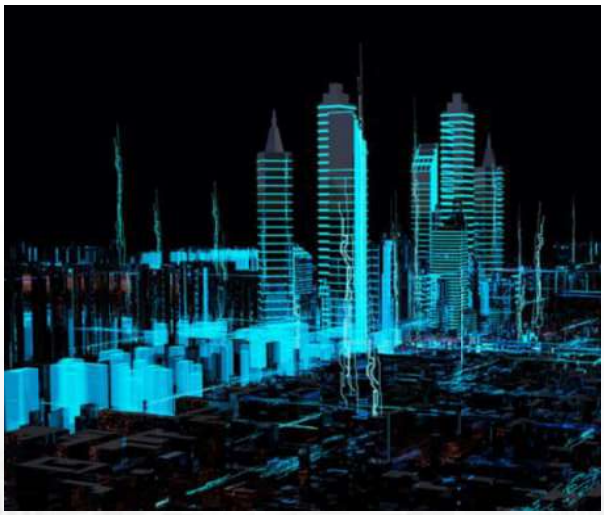
- **True and comprehensive perception of physical entities**
- **Accurate construction of multi-dimensional and multi-scale models**
- **Deep integration of all-factor/full-process/full-service data**
- **On-demand use of intelligent/humanized/personalized services**
- **Comprehensive/dynamic/real-time interaction**



The relationship of the digital twin five-dimensional model to New AI and AIT

2. Characteristics of Smart City based on Digital Twins

(1) Accurate mapping

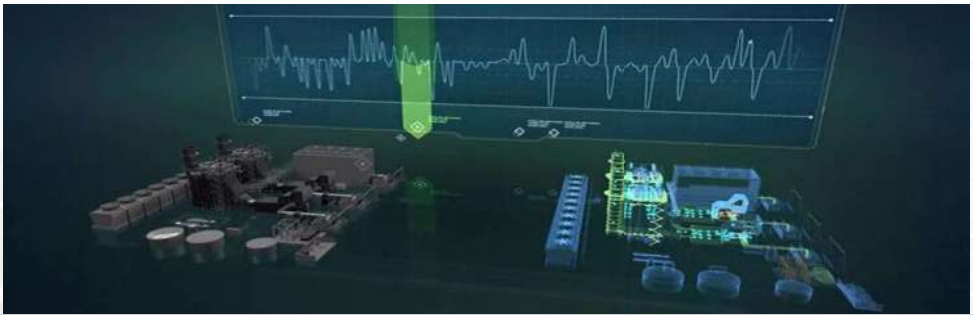


Through the deployment of sensors at various levels such as air, ground, underground, and rivers, the digital twin city realizes the comprehensive digital modeling of urban roads, bridges, manhole covers, lamp covers, buildings and other infrastructure, as well as real-time perception and dynamic monitoring of urban operation status, forming an accurate information expression and mapping of the virtual city to the physical city in the information dimension.

2. Characteristics of Smart City based on Digital Twins

(2) Virtual and real interaction

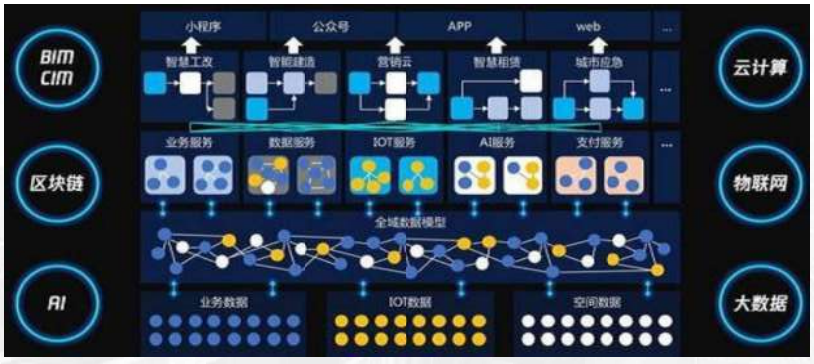
There are traces of urban infrastructure and the construction of various components, and there is information for urban residents and visitors to contact them on the Internet. In the digital twin city, all kinds of traces can be observed in the urban physical space, all kinds of information can be searched in the urban virtual space, urban planning, construction and various activities of the people, not only in the physical space, but also in the virtual space have been greatly expanded, and the integration of virtual and real and virtual and real collaboration will define a new model of urban development in the future.



2. Characteristics of Smart City based on Digital Twins

(3) Software-defined

The twin city establishes a corresponding virtual model for the physical city, and simulates the behavior of people, things and things in the real environment in the software way, and softly guides and controls the city's traffic signal control, electric and thermal energy scheduling, major project cycle management, and infrastructure site selection and construction through cloud and edge computing.



2. Characteristics of Smart City based on Digital Twins

(4) Intelligent feedback

Through the planning and design, simulation and real-time analysis on the "digital twin city", the possible adverse effects, contradictions and conflicts and potential dangers of the city are intelligently warned, and reasonable and feasible real-time feedback and countermeasure suggestions are provided, and the original development trajectory and operation of the city are intelligently intervened from a scientific perspective, so as to guide and optimize the planning, management and improvement of citizen service supply of the physical city, and give more "wisdom" to the urban operation management and life services.

Contents

3. Application of Smart City based on Digital Twins

(1) Smart city operation brain

(2) Smart grid digital twin services

(3) Smart city traffic brain

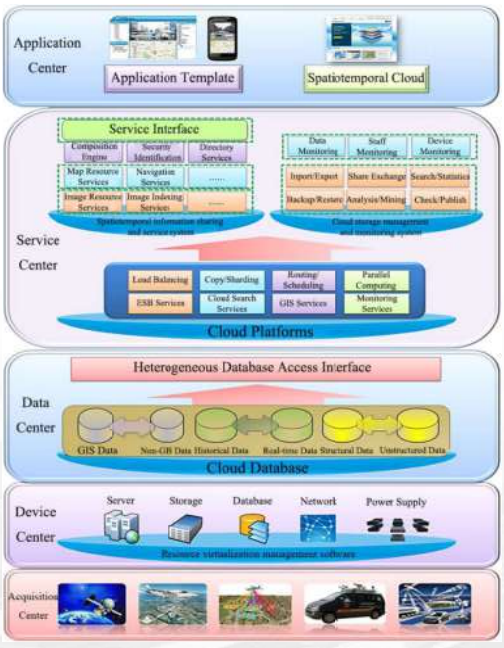
(4) Smart city public epidemic services

(5) Intelligent management of ecological environment and disasters in the YRB

3. Application of Smart City based on Digital Twins

(1) Smart city operation brain

Core: Public information cloud service platform



Application layer

Smart city management

Public information platform

Smart public security

Smart tourism

.....

Software development and running platform layer

IaaS | DaaS | PaaS | SaaS

Infrastructure layer

Server

Internet

Storage device

Computer room

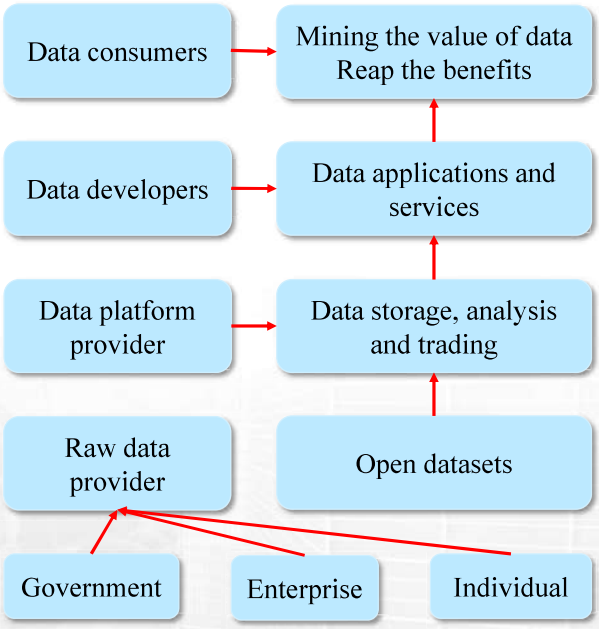
Sensing devices

3. Application of Smart City based on Digital Twins

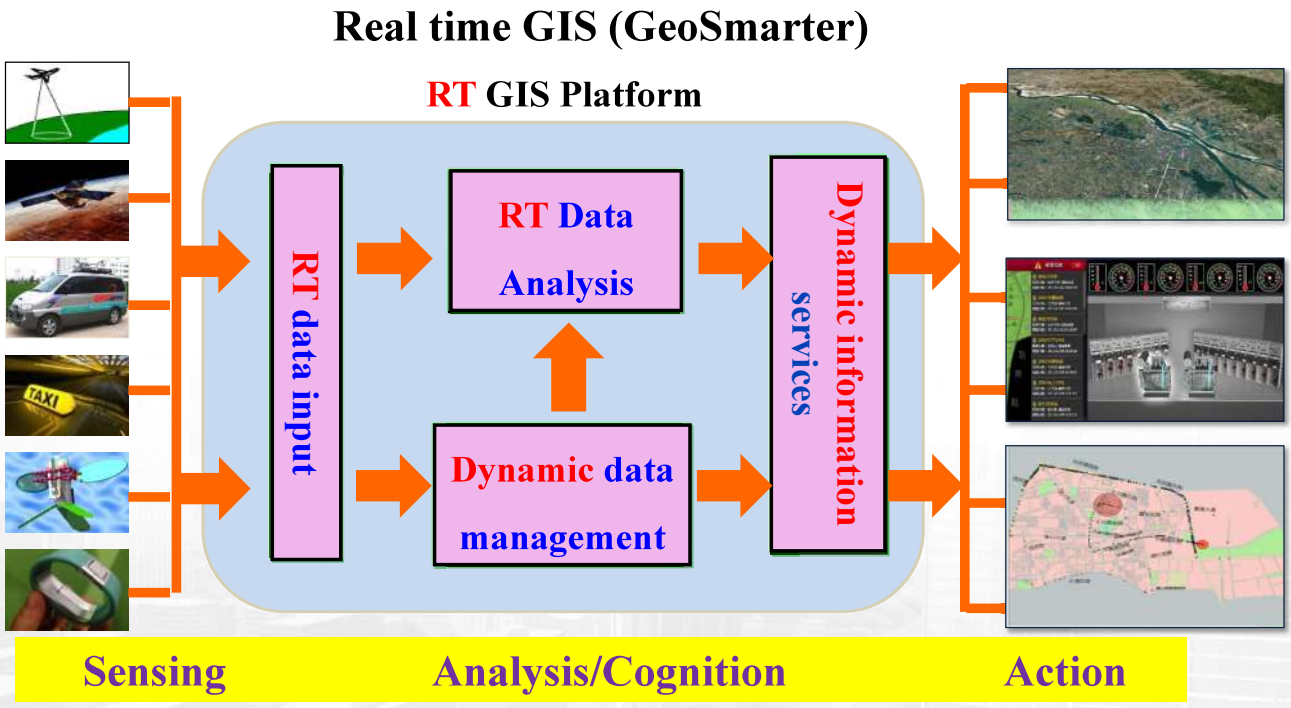
(1) Smart city operation brain

Form a big data ecosystem in smart cities

IT cooperation in the era of smart city is around the cooperation of big data: data collection, processing, storage, cleaning, mining, decision-making, control and utilization services



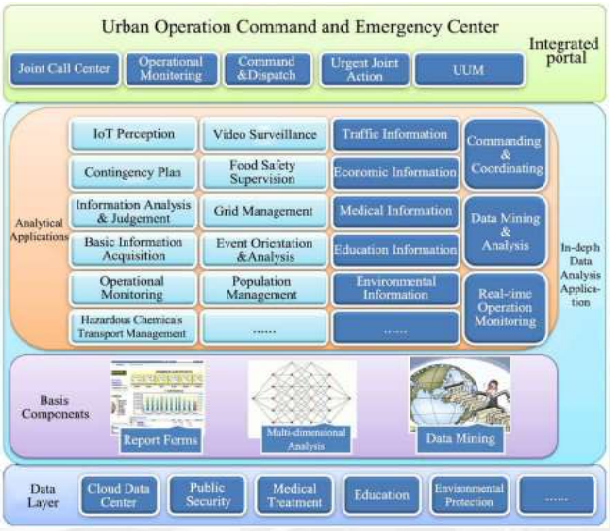
3. Application of Smart City based on Digital Twins

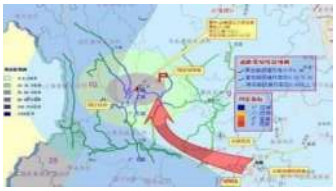


3. Application of Smart City based on Digital Twins

(1) Smart city operation brain

Based on big data, we jointly realize urban operation monitoring and command and dispatch.





3. Application of Smart City based on Digital Twins

(1) Smart city operation brain (perception, cognition and action)

3. Application of Smart City based on Digital Twins

(2) Smart grid digital twin services

Smart grid digital twin: make full use of the physical model of the power system, the online measurement data of advanced metering infrastructure, the historical operation data of the power system, and integrate electrical, computer, communication, climate, economy and other multidisciplinary knowledge, the simulation process of multi-physical quantity, multi-temporal and spatial scale, and multi-probability is carried out, and the mapping of the smart grid is completed in the virtual space, reflecting the whole life cycle process of the smart grid.

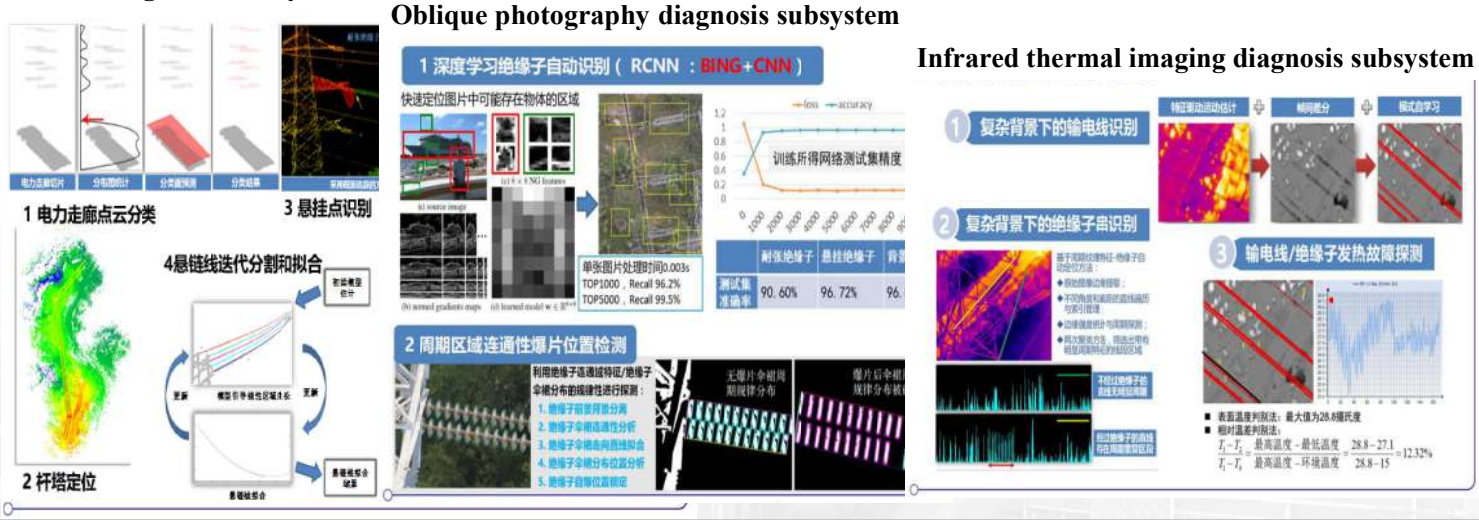
3. Application of Smart City based on Digital Twins

A software and hardware system integrating the precise positioning, identification and modeling of multiple elements of power corridors and the 3D spatial relationship calculation model is established, which solves the positioning and early warning of safety risks in power corridors.

LiDAR diagnostic subsystem

Oblique photography diagnosis subsystem

Infrared thermal imaging diagnosis subsystem



Power inspection robot for smart grid

The power inspection robot can realize all-day, all-round and fully autonomous intelligent inspection and safety protection of power transformation, transmission and distribution equipment, including automatic patrol, intelligent meter reading, image recognition, infrared temperature measurement, real-time video backhaul and other functions, replacing the traditional manual inspection and equipment identification work with artificial intelligence advanced means, reducing personnel safety risks, ensuring the intrinsic safety of the power grid, and improving the technical level of intelligent inspection of the power grid.

Substation inspection robot (big scene)

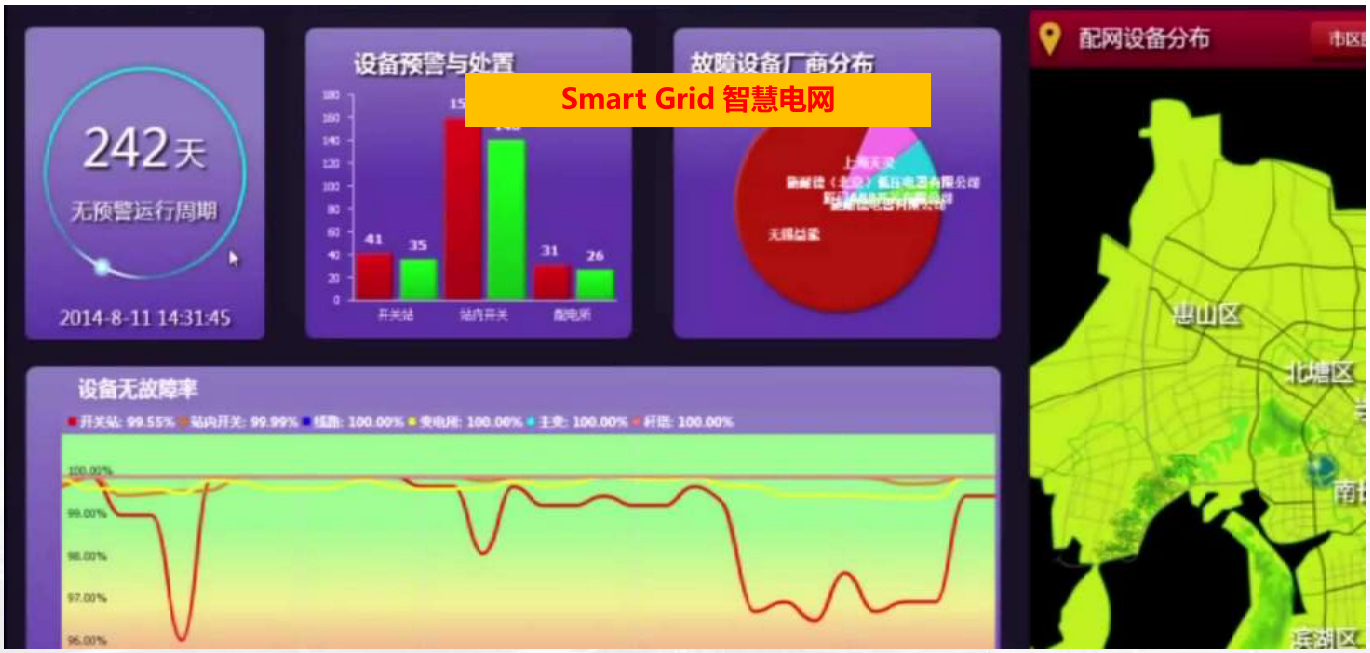
3. Application of Smart City based on Digital Twins

UAV inspection and intelligent monitoring system for power corridors

The first large-scale UAV power inspection application at home and abroad

- **15 Provinces**
- **Economic Benefit Exceed 200 M RMB**
- **Inspected power grid mileage : 20,000km**
- **Flight mileage: 50,000km**

Smart grid operation brain



3. Application of Smart City based on Digital Twins

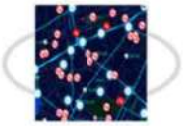
(3) Smart city traffic brain

Wuhan traffic police data brain - smart emergency application

Relying on holographic perception, spatio-temporal analysis, and data mining technology to build a road traffic intelligent emergency response system

Access to emergency resources

- Congestion, accidents, 122 police reports, police, emergency rescue, video, signal lights, etc.



Dynamic display in one diagram

- Emergency holograms
- Flexible layer configuration
- Dynamic visual display

One-click video check

- One click to automatically call peripheral video

Real-time scheduling & navigation

- Associate various police resources around
- Dynamic path planning

Security for major events

- Preset activity route
- Dynamic police deployment
- Target location tracking

Comprehensive analysis

- Congestion degree index analysis
- Traffic accident section analysis

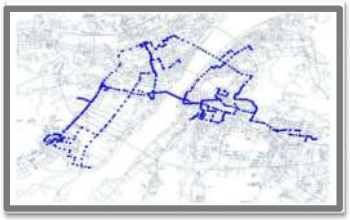
3. Application of Smart City based on Digital Twins

(3) Smart city traffic brain

City's Travel Track Big Data

Phone track data

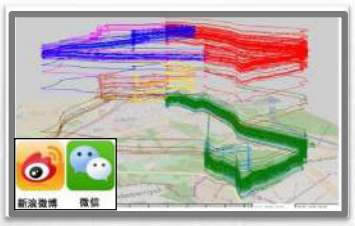
Video track data



Taxi trajectory data

Indoor positioning trajectory

Bus and subway card data



Spatiotemporal trajectory data

-- some pictures are from Baidu

3. Application of Smart City based on Digital Twins

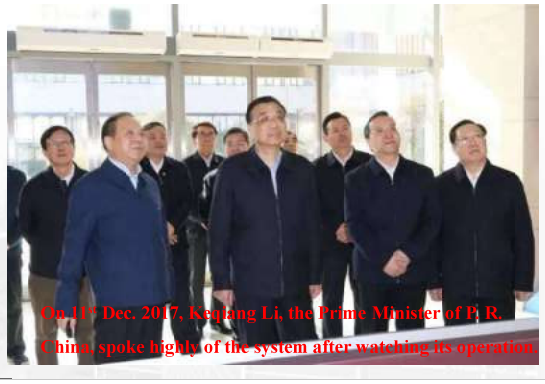
(3) Smart city traffic brain

3. Application of Smart City based on Digital Twins

(3) Smart city traffic brain

Congestion alleviation has achieved remarkable results

- In 2018, in the national ranking of traffic congestion, the system improved Wuhan from 23 to 53, the traffic congestion delay index dropped from 2.34 to 1.676, a decrease of up to 30%, and the congestion situation was greatly alleviated (data from AutoNavi map statistics).
- In Oct. 2017, using "7 quick model", the system minimized traffic congestion accident handling time from 7 minutes to 90 seconds.



On 11th Dec. 2017, Keqiang Li, the Prime Minister of P. R. China, spoke highly of the system after watching its operation.

3. Application of Smart City based on Digital Twins

Overview of the unattended integrated depot project

Through the construction of integrated depot management system, operation control system and supporting facilities, gradually improve the internal information collection means of urban new energy three-dimensional bus depots, realize the integration of station data resources and develop related comprehensive applications, realize the sharing of data resources and the in-depth application of data resources in the city's bus terminal industry, and enhance the management and service capabilities of urban new energy three-dimensional bus depots.

Construction of weak current and intelligent hardware engineering

■Intelligent hardware: including splicing screen system, information release system, scheduling office facilities, information security equipment, and other hardware engineering and third-party basic hardware engineering;

■Weak current engineering: including vehicle guidance system and vehicle identification monitoring system. Through the transfer management of vehicles in the yard, the management of vehicles in the field is formed into a closed loop of management, and improve the efficiency of automatic and the intelligent management of parking lots

Build a new energy bus comprehensive depot operation and maintenance monitoring platform

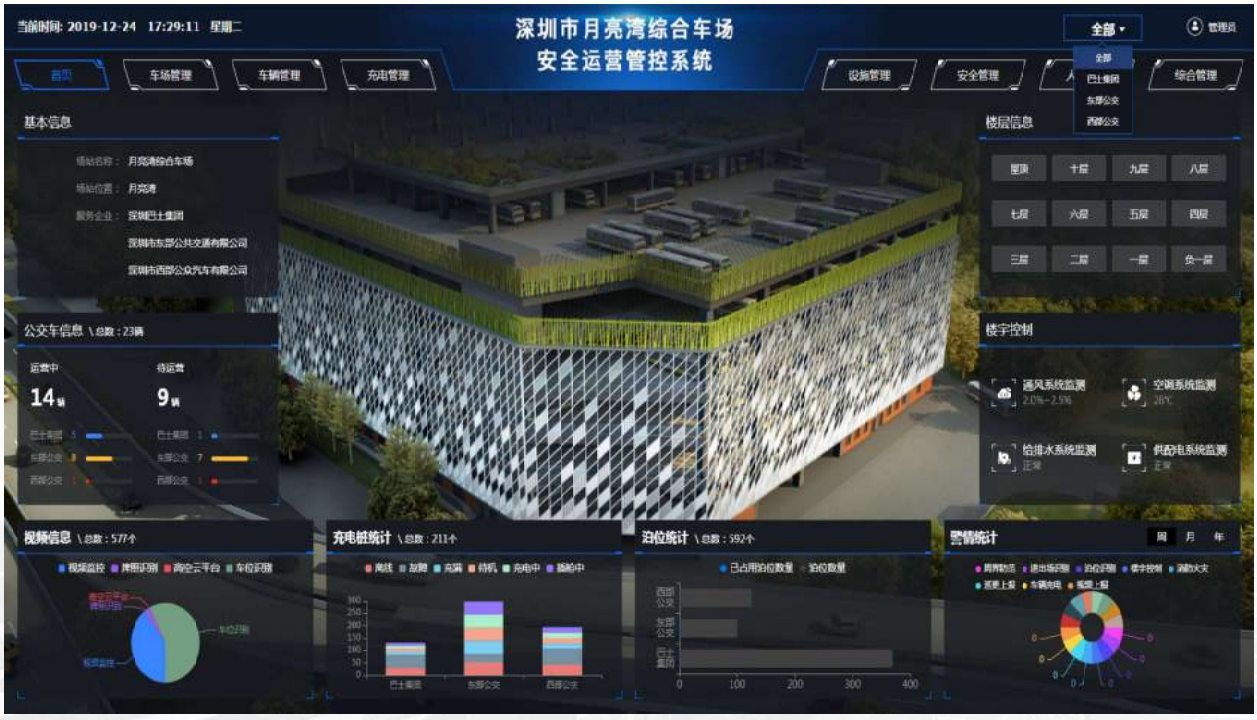
■ With the support of the new energy three-dimensional bus yard data center, it realizes the functions of station industry supervision and auxiliary decision support and station emergency disposal and coordination and scheduling, laying the foundation for the realization of digital twins

Build an intelligent software system for bus operation and station based on operation and maintenance BIM

■BIM modeling and display based on construction to operation and maintenance

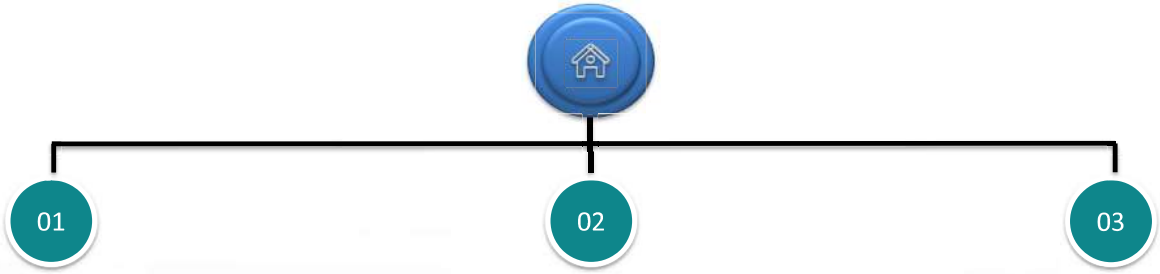
■BIM application implementation that integrates multiple data sources.

3. Application of Smart City based on Digital Twins



3. Application of Smart City based on Digital Twins

Highlight 1: Face recognition big data control



The entrance and exit cameras automatically recognize the face of the drivers entering and leaving the venue to ensure that one person corresponds to one car, and driving safety.

Personnel entering and exiting face recognition and recording statistical analysis data to control the distribution of personnel in the station in order to respond to emergency mobilization.

Through the building automation system transmission data real-time monitoring of various fans, water valves and other important components.

3. Application of Smart City based on Digital Twins

Highlight 2: Vehicle and equipment life cycle management

1. Vehicle life cycle management

After the vehicle is entered into the system, information about the part of the vehicle for each maintenance, maintenance materials, driving route, license plate number, from entering the system to scrapping will be recorded and saved by the system.

2. Equipment life cycle management

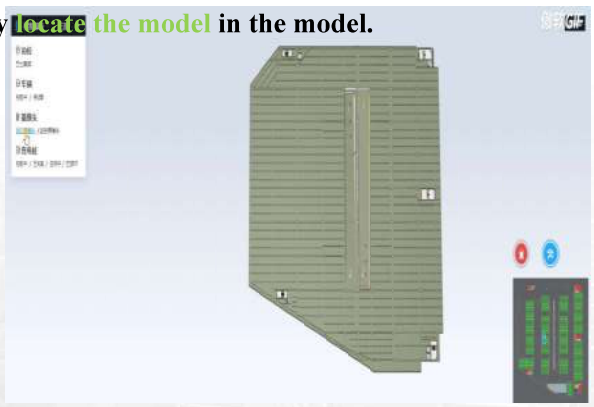
Through QR code management, the interaction between physical objects and BIM models is realized, and the whole life cycle management of the entire facility from procurement, maintenance to reimbursement is carried out.

3. Application of Smart City based on Digital Twins

Highlight 3: Using BIM technology to manage the parking lot

Parameterization: Each BIM component can be clicked, and display basic information such as length, width, height, material, production date, etc., and have relevant maintenance records entered by the system.

Visualization: In the model, you can understand the specific distribution and specific location of important equipment such as induction equipment, fire fighting equipment, ventilation equipment and some hidden components, and you can directly locate the model in the model.



3. Application of Smart City based on Digital Twins

Highlight 4: Indoor precision navigation

1 Reverse car search, Find vehicles quickly

The mobile phone, the integrated inquiry machine, and the control system can quickly query the location of the vehicle through the license plate number.

2 Indoor layer induction, Accurate to the meter

From the ground floor to the entrance to each ramp, there is a screen to navigate, and the screen to the parking floor will display the parking route accurate to the meter.

3 Improve safety efficiency

The driver quickly finds the car and stops, and can quickly reach a safe location according to the induction prompt when the accident occurs to avoid damage.

3. Application of Smart City based on Digital Twins

Highlight 5: Linkage control of emergency plans

Clear responsibilities

Allocate emergency personnel and emergency supplies into the corresponding emergency plan to ensure that safety responsibilities are implemented to individuals.

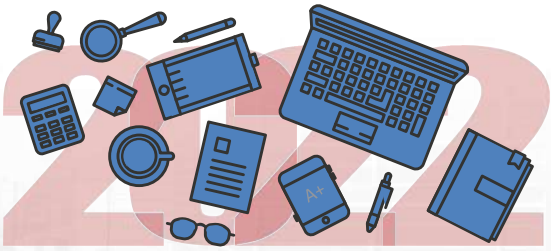
Intelligent linkage

One-click activation of the emergency plan to realize intelligent linkage such as on-site broadcasting, display screen, and mobile phone push.

Live calls

Real-time multi-party video calls between emergency personnel can respond to emergencies faster, so as to reduce their losses and improve safety efficiency.

One-click start



3. Application of Smart City based on Digital Twins

Highlight 6: Asset Management

The facility is bound to the location, the area can be freely divided, and the quick positioning and BIM model can be interacted.

The whole process of relocation management is tracked to achieve full control of assets.

According to the straight-line depreciation method, the percentage depreciation method Calculate the depreciation rate of equipment in order to better handle the depreciation of equipment.

Centrally manage equipment and office furniture information through coding for better financial alignment.

3. Application of Smart City based on Digital Twins

(4) Smart city public epidemic services

Service goal: manage the city well through the network, without locking the city

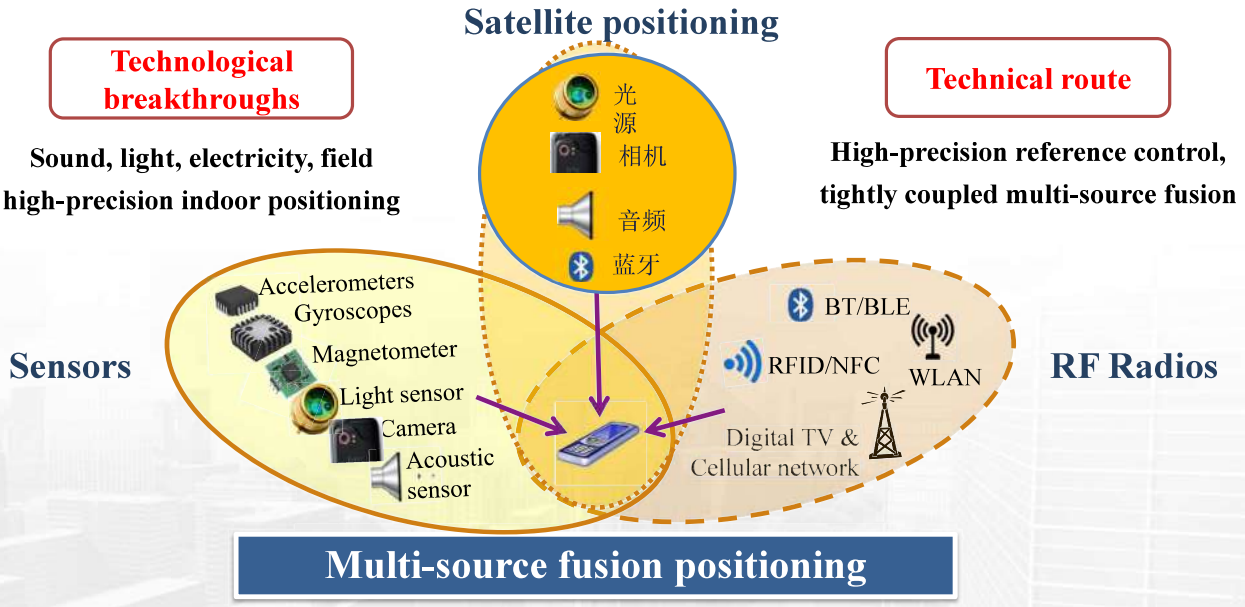
Using spatial big data and AI location intelligence technology to trace the historical trajectory, find close contact groups, predict high-risk transmission areas, and assist in virus transmission dynamic model analysis, the platform simultaneously and comprehensively covers 7,700+ places and locations in more than 200 cities in 29 provinces across the country to provide decision-making support for disease prevention and control

Epidemic traceability analysis function of Vezhi WDCIP platform

3. Application of Smart City based on Digital Twins

(4) Smart city public epidemic services

Mobile phone multi-source fusion indoor positioning

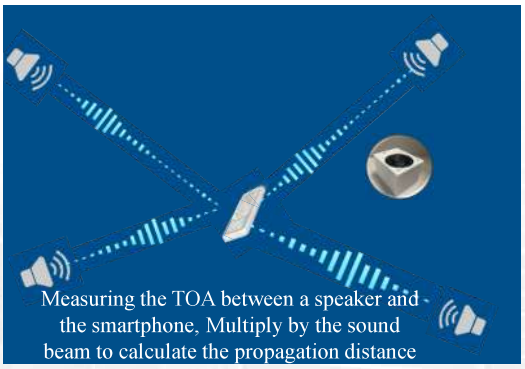


3. Application of Smart City based on Digital Twins

Audio-based high-precision smartphone ranging technology

In view of the problem that Beidou signals cannot penetrate indoor space and indoor positioning accuracy is low, the audio-based indoor positioning technology of smart phones is broken, and compared with the currently widely used Bluetooth positioning technology, signal effective range is extended from 5-10 to 50 meters, ranging accuracy increased from 2-5m to 0.12m (in LAB environment), which is currently the positioning technology with the highest accuracy that can support all public mobile phones in the world, and solves the problem of low indoor positioning accuracy.

- **Receives it with the microphone of a public mobile phone Chirp signal, operating frequency of 16-21KHz, after bandpass filtering, ordinary people can not hear, nor is it affected by ambient sound.**
- **Bluetooth synchronization of the clock of the transmitting device (1 ms)**
- **Measuring distance difference TDOA, sub-meter positioning accuracy Signal coverage capacity: 40-50 m**



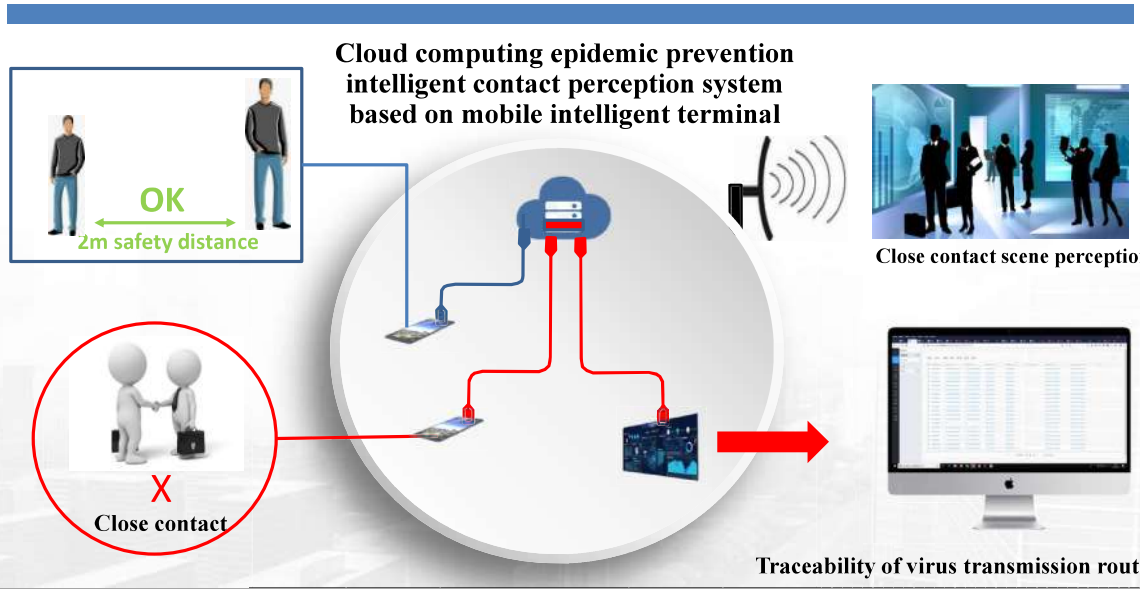
Measuring the TOA between a speaker and the smartphone. Multiply by the sound beam to calculate the propagation distance

Demo from Baiyun Airport, Guanzhou

3. Application of Smart City based on Digital Twins

(4) Smart city public epidemic services

Automatic awareness of epidemic safety distance

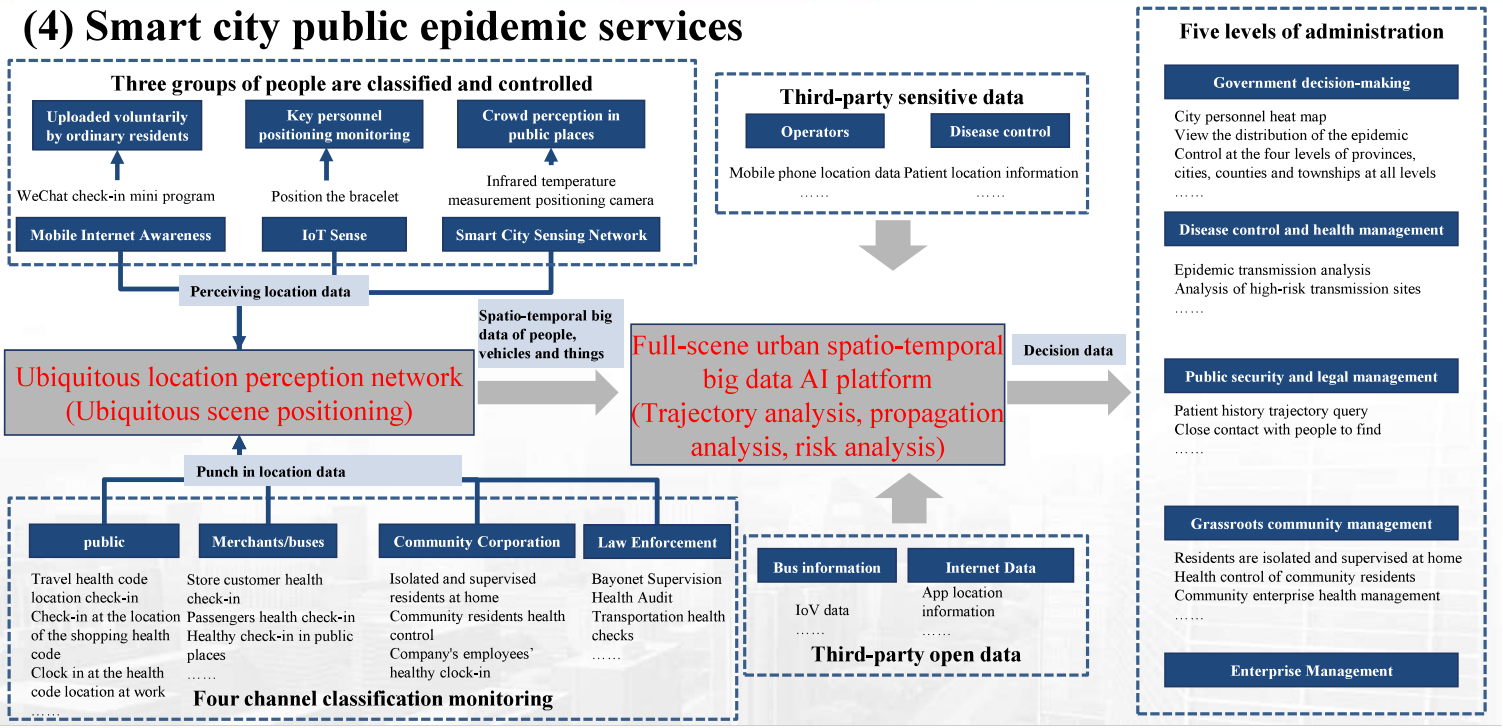


3. Application of Smart City based on Digital Twins

(4) Smart city public epidemic services

3. Application of Smart City based on Digital Twins

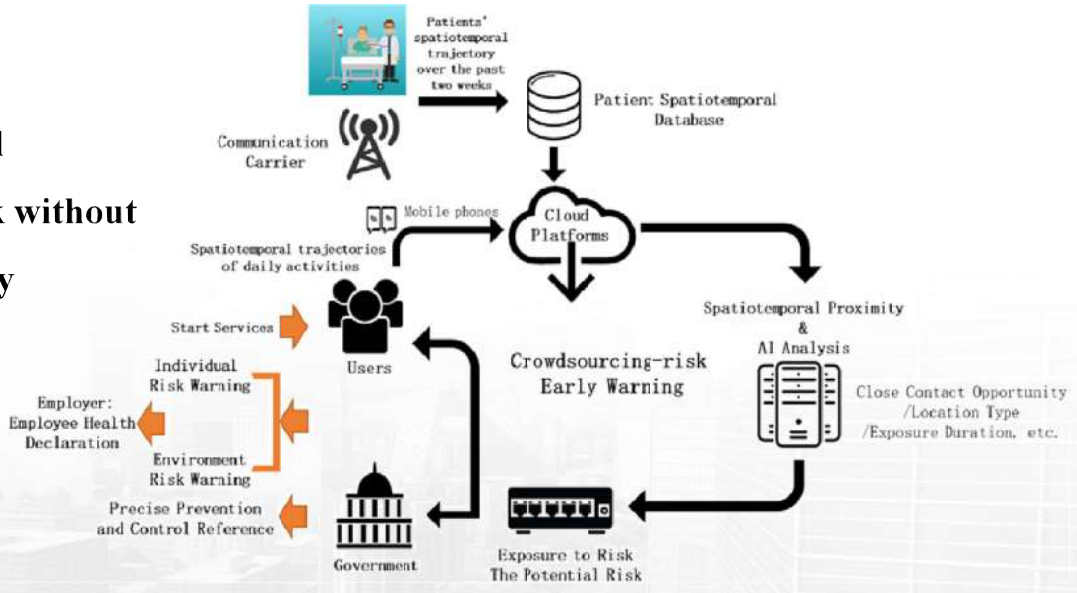
(4) Smart city public epidemic services



3. Application of Smart City based on Digital Twins

(4) Smart city public epidemic services

Manage the city well through the network without locking down the city



National epidemic prevention and control service system

3. Application of Smart City based on Digital Twins

A public epidemic prevention and control system based on accurate spatio-temporal location big data urgently needs to be established.

From 2020 to 2021, Academician Li Deren led and cooperated with 17 academicians to complete the major consulting project of the Chinese Academy of Engineering "Public epidemic prevention and control service system based on spatio-temporal location big data normalized after the pandemic", which was listed as the No. 1 recommendation of academicians of the Chinese Academy of Engineering in 2022.

Item number: 2020-ZD-16

国家高端智库

内部刊物
注意保存

中国工程院院士建议

2022年第1期（总第632期）

中国工程院咨询工作办公室　　2022年1月12日

基于精准时空位置大数据的
公共疫情防控系统亟需建立

李德仁　刘经南　宁　光　龚健雅　周成虎

习近平总书记主持召开中央全面深化改革委员会第十二次会议时强调："完善重大疫情防控体制机制，健全国家公共卫生应急管理体系。"为此，中国工程院组织18位院士，开展了"大疫情后常态化的基于时空位置大数据的公共疫情防控服务体系战略研究"，并建议建立我国基于精准时空位置大数据的公共疫情防控系统。

一、建立我国基于精准时空位置大数据的公共疫情防控系统的必要性与紧迫性

-1-

3. Application of Smart City based on Digital Twins

(5) Intelligent Management Web GIS for ecological environment of Yangtze river basin based on Geospatial Sensor Web

3. Application of Smart City based on Digital Twins

Background: National Strategy—Ecological civilization management of YRB

President Xi(2016):"We should put it to a overwhelming position to repair ecological environment of Yangtze river"

Flood control: drain water before flood

Navigate: drain off water in reservoir

VS

Generate electricity: Store water in reservoir

How to reconcile contradiction among flood-control, electricity-generation and river transportation with ecological environment of Yangtze river under protection?

Reservoir group of the upper Yangtze river flood control dispatching (Flood-control)

Channel safety monitoring and emergency response of the middle and lower reaches of the Yangtze river (Navigation)

Integrated management of cascade hydropower stations in the lower reaches of Jinsha river (Electricity-generation)

3. Application of Smart City based on Digital Twins

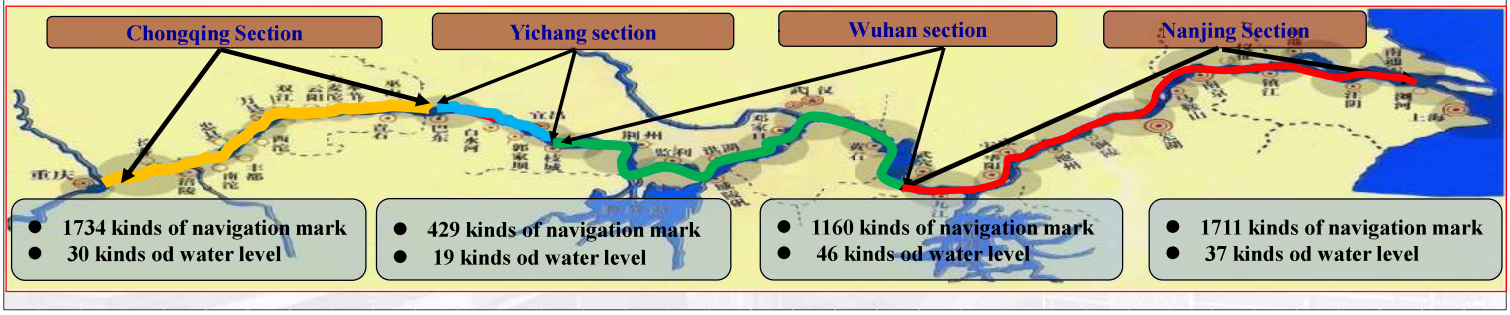
Methods: Collaborative management of air-space-ground observation platform

The ground observation platform

Satellite observation platform

32 kinds of
10 thousands of sensors
100 millions of observation records

Airborne observation platform



3. Application of Smart City based on Digital Twins

Application effect of Digital twins :Cascade hydropower stations in the lower reaches of Jinsha river store water and generate electricity

The hydrology and sediment analysis system

Effects

Generate power from Xiluodu to Xiangjiaba by scouring silt

Scour silt regularly ⇨ **Scour silt periodically**

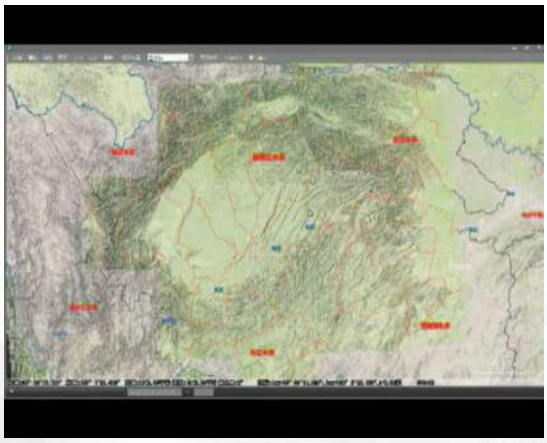
In 2013 flood season, stored 800 million cubic meters of water in advance

In 2014 flood season, stored 1.6 billion cubic meters of water in advance

In 2015 flood season, stored 1.8 billion cubic meters of water in advance

3. Application of Smart City based on Digital Twins

Application effect: 21 Yangtze river upstream reservoirs prevent flood and fight a drought



The flood routing simulation system

Effects

Real-time share of information of controlling large reservoir in upper Yangtze river, forecast and dispatching information and rainfall information within Yangtze river basin; efficiency improved a lot, 20 minutes for Yangtze river flood control center to get information,30 minutes for national flood control center.

3. Application of Smart City based on Digital Twins

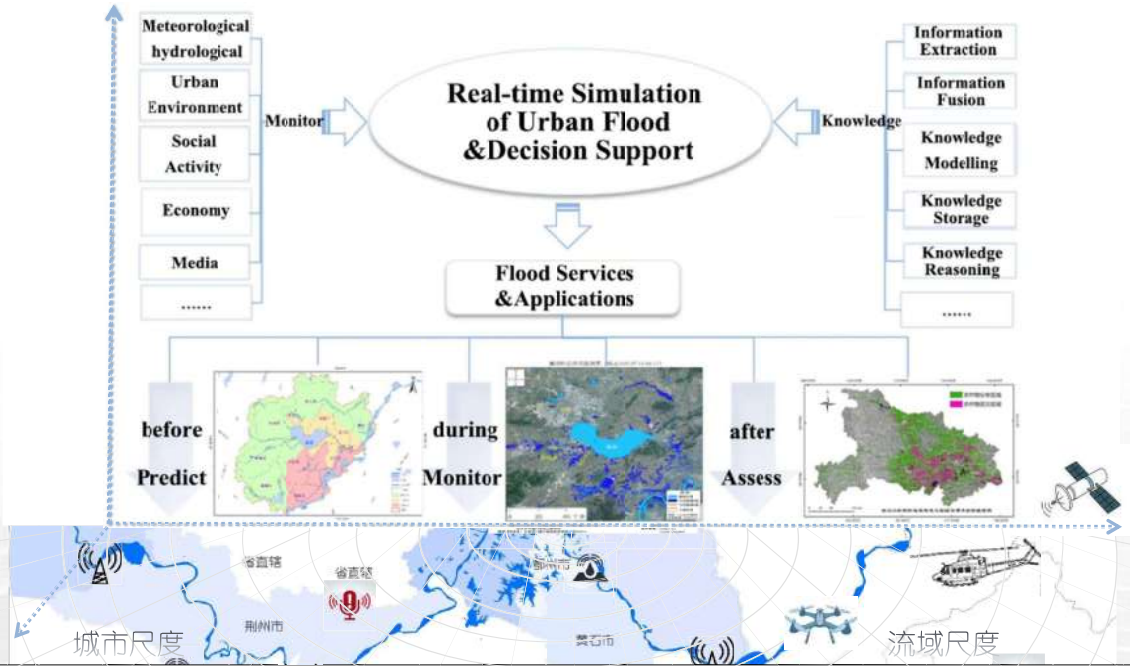
Application effect: The Yangtze river main channel management

Channel maintenance assistant analysis system

Effects

Application scenarios	Before application	After application
Model of navigation mark maintenance	Inspection	Monitoring
Release of shallow channel dimensions	Every 10 days	Every 7 days
Time of finding abnormity of navigation mark	1 day max	10 minutes max
Time to remove abnormity of navigation mark	8 hours	2 hours
Water level measurement and forecast	1 or 3 times a day Manauly measurement	Every 1 hour remote sensing remote report system

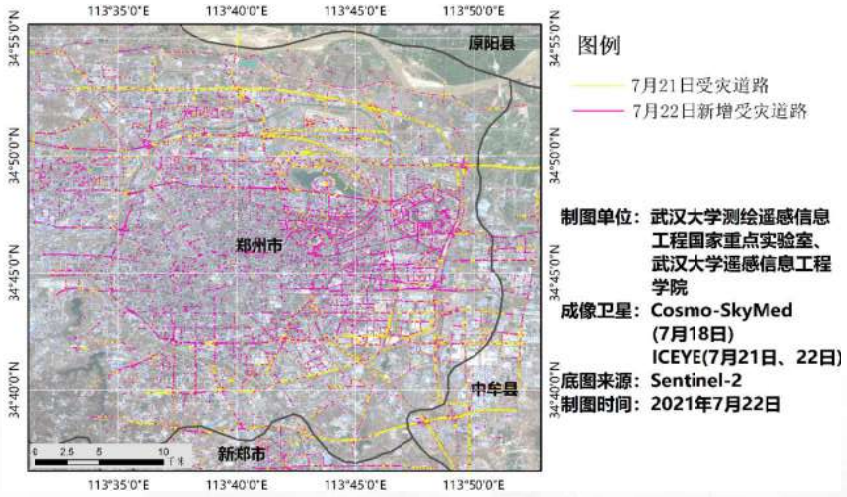
2020 Flood Monitoring and Flood Services



SAR image water change monitoring in Zhengzhou in July 2021

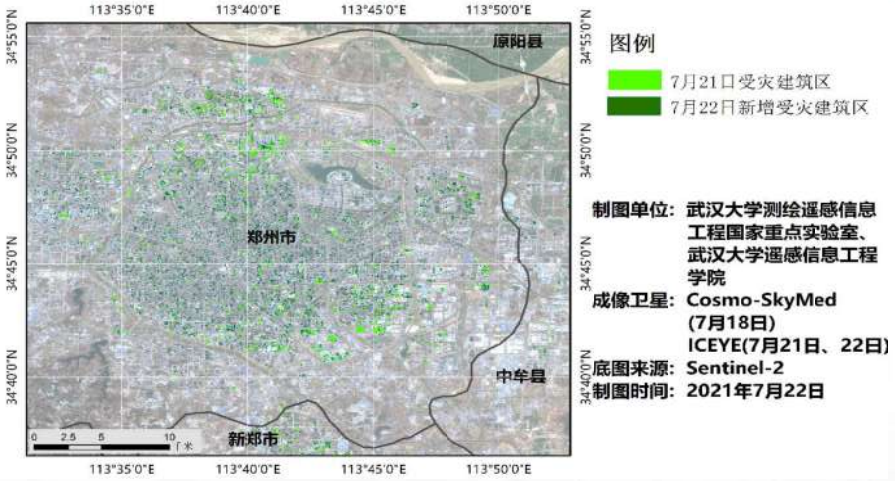
On July 18th, the normal water area of Zhengzhou City was 35.717 km², as of 13:09 on July 21st, the water body of Zhengzhou City covered an area of 101.745 square km², and as of 10:32 to 13:09 on July 22nd, the water body of Zhengzhou City covered an area of 130.535 km².

Road damage in Zhengzhou City and nearby areas



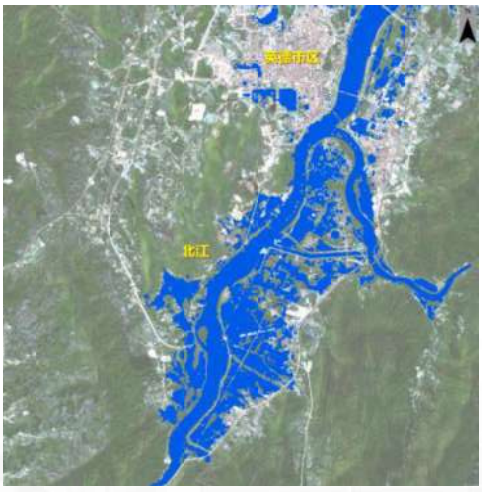
Using public map (OSM) statistics, the total length of roads within the administrative division of Zhengzhou City is 4849 km, 440 km were submerged on July 21st, accounting for 9.07%, and 819 km were submerged on the 22nd, accounting for 16.89%.

House damage in Zhengzhou and nearby areas



Combined with the information of building land elements extracted from satellite images before the disaster, the construction land area of Zhengzhou City reached 61.50 km^2, and as of July 21st, the total area affected by flooding reached 7.07 square kilometers, and the affected proportion reached 11.50%; As of July 22nd, the total area affected by flooding reached 22.71 km^2, and the proportion affected reached 36.93%.

Time series flood monitoring based on GF-3 data in June 2022



Optical image of Yingde city on June 23th GF-3 Yingde City radar image flood monitoring on June 23th

Flood disasters are usually accompanied by clouds and rains, and SAR images have all-weather imaging characteristics, which can effectively support flood disaster monitoring.

Time-series flood monitoring based on GF-3 data

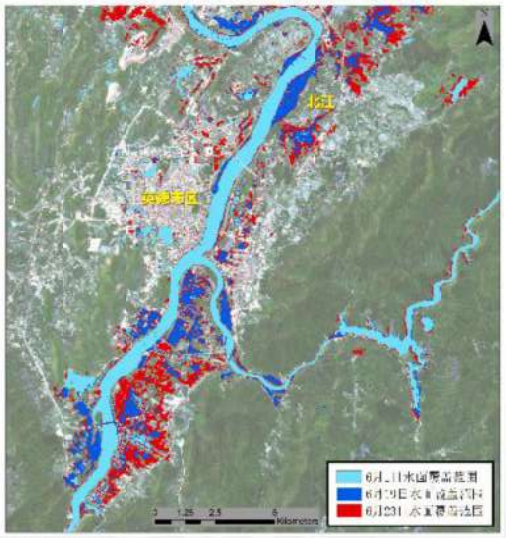
2022年6月01日广东省英德市洪涝范围

Dynamic monitoring of floods on June 1st, 19th, 23rd and 24th

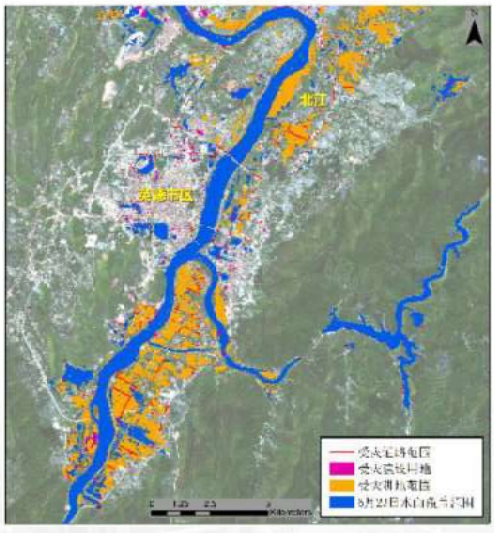
Jiangnan Village, Dazhan Town, Yingde City, at the confluence of the Beijiang and Huangjiang Rivers, is one of the villages most affected by the disaster.

Time series flood monitoring based on GF-3 data

2022年6月广东省英德市洪涝受灾要素分布图



2022年6月广东省英德市洪涝受灾要素分布图



In Yingde City, Guangdong Province, flash floods, road collapses, farmland flooding, urban waterlogging and other disasters occurred, and 24 towns (streets) were affected to varying degrees.

Contents

4. Realistic cities should keep up with the Smart City

Common issues in China's urban development

--- Subsidence of the ground;

--- Impervious aquifers on the surface of cities and heavy rainfall;

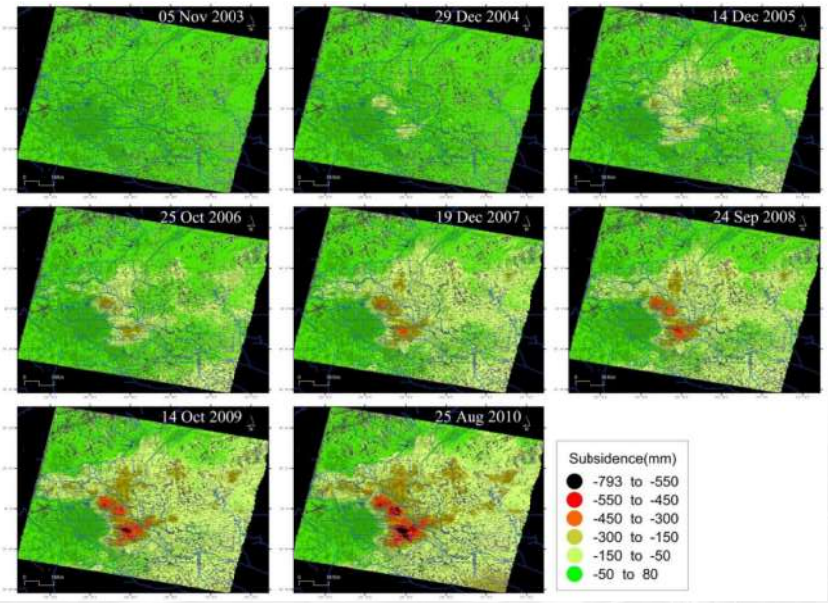
--- dwellings in megacities;

--- Infrastructure cannot keep pace with urban development;

……

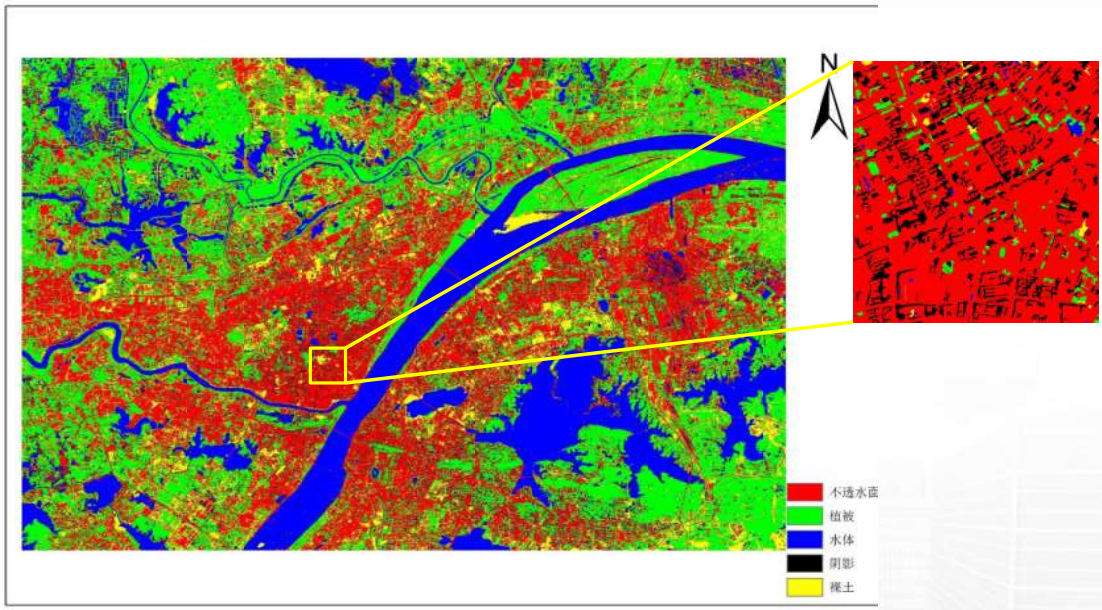
These problems in Chinese cities cannot be solved by smart cities, and only by grasping the design, planning and infrastructure construction of real cities at the same time can smart city construction be implemented.

The spatiotemporal evolution of land subsidence in Beijing



The above figure shows the spatiotemporal evolution process of land subsidence in Beijing during 2003~2010, and it can be seen that the land subsidence is increasing year by year.

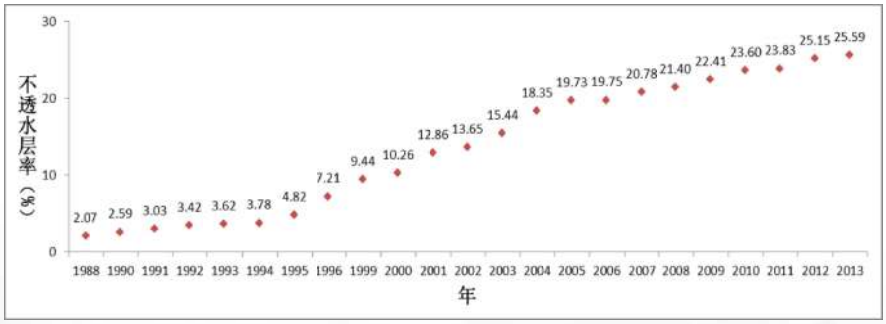
Distribution of impervious layers on the ground in Wuhan

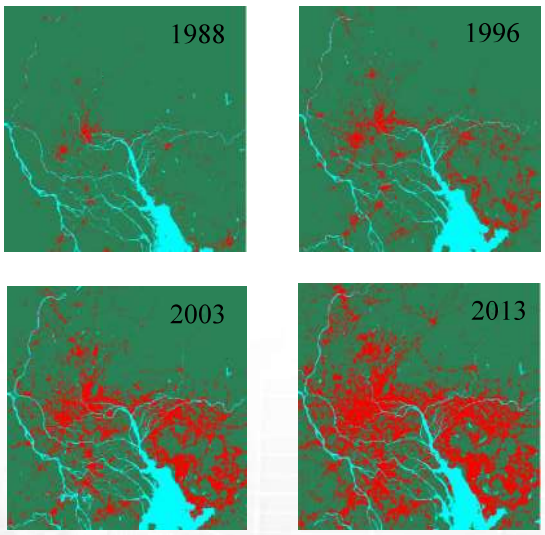


Dense building area: impervious surface: 78.754% Shadow: 15.417%

Vegetation: 4.440% Bare soil: 0.780% Water body: 0.609%

Impervious surface distribution in the Pearl River Delta (1988-2013)





The impervious surface of the entire Pearl River Delta is 25.6%, and the core urban area of Guangzhou is more than 75%。

The problem of dwelling in megacities

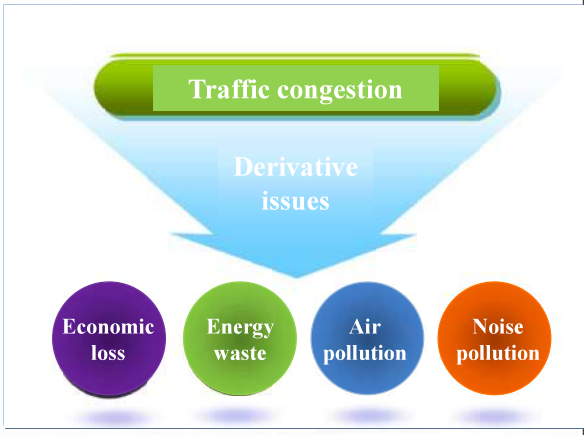
Rapid growth of urban population.

In 2011, the urban population exceeded 50%.

In 2020, the urbanization rate reached 63.89%, and the number of cities reached 687.

Traffic congestion in megacities caused by inadequate infrastructure

- United States
- Economic losses due to traffic congestion amounted to $87.2 billion in 2007
- 2.8 billion gallons of gasoline wasted
- 4.2 billion hours wasted



- China (2011 CAS Report)
- Residents of 15 major cities spend 57.6 billion minutes more than Europe commuting to work every day, equivalent to economic losses of up to 20 billion yuan
- The "contribution" of exhaust gas to air pollution has exceeded industrial emissions and ranks first among all pollution emission sources

Contents

5. Final remarks

1. Digital twin city is an advanced stage of digital city and a new height of smart city;

2. We should use 5G/6G, the Internet, the Internet of Things, urban information model, spatio-temporal big data, cloud computing and artificial intelligence to seriously build a smart city based on digital twins;

3. In the intersection of two centuries of history, we must not only grasp the various intelligent applications of smart cities based on digital twins, but also improve the construction grade of real cities, promote the upgrading and development of new smart cities and national governance, and seek the welfare of the people.

Lecture Slides

Invited Talk 발표세션

1

Project PLATEAU: The Initiatives of Japanese Digital Twin

프로젝트 플라토 : 일본 디지털 트윈 이니셔티브

Uchiyama Yuya

Speaker Profile

Uchiyama Yuya

Urban Policy Division, City Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Japan

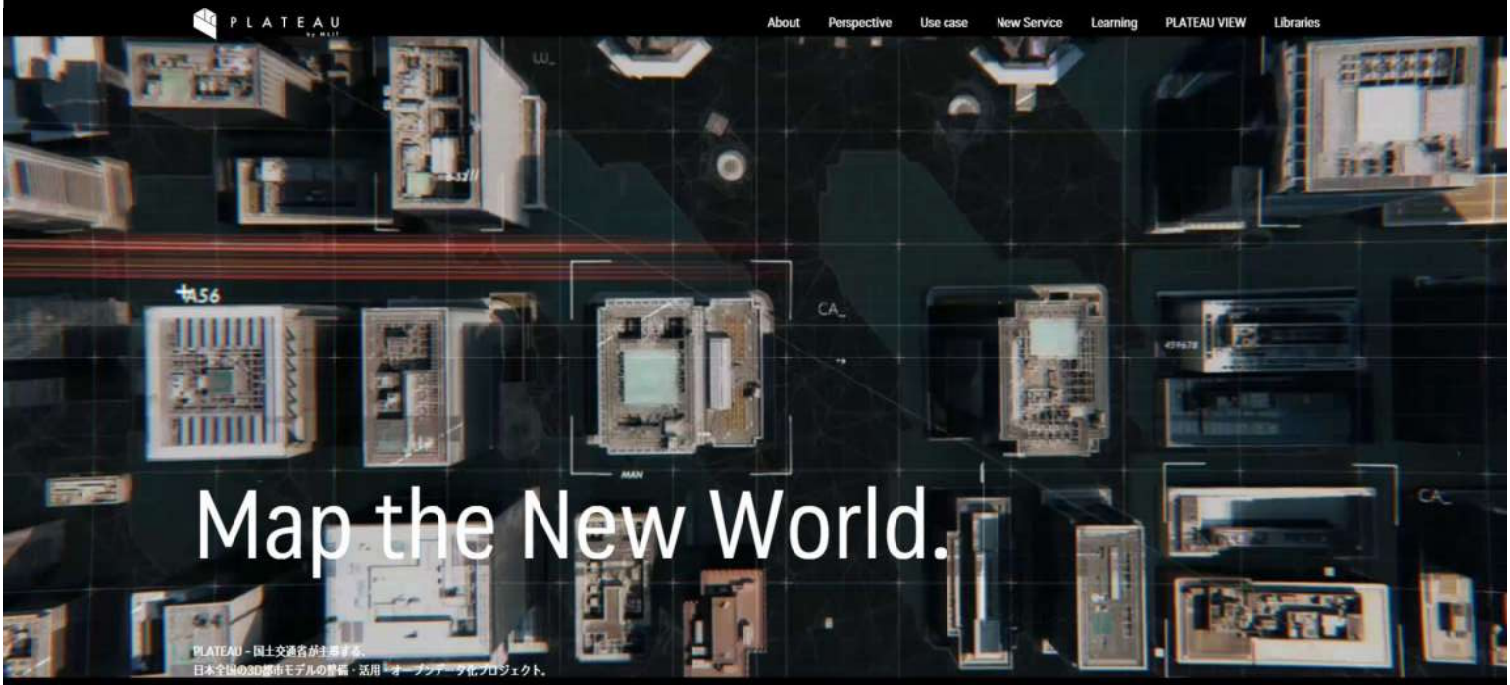
Mr. Uchiyama is the project manager and director of project PLATEAU, a Japanese digital twin initiative. He entered MLIT in 2013. He served in the Water and Disaster Management Bureau, Civil Aviation Bureau, and Secretary Office to the Minister before assuming his current position.

우치야마 유야

일본 국토교통성 도시정책과장보좌

우치야마 유야 도시정책과장보좌는 일본 디지털 트윈 이니셔티브인 플라토 프로젝트의 매니저 겸 디렉터이다. 그는 2013년부터 일본 국토교통성에서 근무해왔으며, 이전에는 수자원·재난과, 민간 항공국, 장관 비서실에서 근무했다.

Project PLATEAU: The initiatives of Digital Twin in Japan



UCHIYAMA Yuya, MLIT (Ministry of Land, Infrastructure, Transport and Tourism), Japan
ISHIMARU Nobuhiro, Open Geospatial Consortium CityGML Standards WG, Japan

2022-01-28 EuroSDR Workshop 'Digital Twins for National Mapping and Cadastral Agencies and other governmental organisations'

About me

UCHIYAMA Yuya

Deputy Director of Urban Policy Division, City Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Japan

Project Manager/Director of Project PLATEAU

E-mail: uchiyama-y2vw@mlit.go.jp

Project PLATEAU Strategic Thrusts

Developing and Opening Data

Creating Use Cases

Encourage Engagement of Public and Private

Urban Digital Transformation

Sustainable City

Based on the 3D city model, analyzing various urban issues such as disaster management, environment, and transportation.

The results will be reflected in urban planning **to enhance sustainable urban development.**

Human-Centric City

By visualizing the urban structure using 3D City Models, Citizens can share policy issues.

Through the power of civic tech, developing **human-centric city can be realized.**

Agile Development for Community Design

In addition to static data of the urban activities, dynamic data can be used to simulate the situation of urban activities more precisely.

These technologies can realize **agile urban planning or community design.**

MLIT

3D City Models: a data platform of 3D urban space which represents urban structures as data

Creation of 3D City Models

Establish a scalable data maintenance scheme

- ✓ Combining **graphic data of urban areas such as "urban planning basic map," etc.** (urban planning GIS) which is developed for urban planning and **data of building and topographic height and building shapes** obtained through aerial surveys, etc. and create 3D models of buildings, etc.
- ✓ Develop 3D City Models by **adding attribute information (meaning of urban space)** obtained through urban planning basic surveys, etc. to buildings.
- ✓ Up to now, **3D City Models (LOD1 and partly LOD2) of 56 cities from all parts of Japan about 10,000km² (over 10,000,000 buildings)** in total were developed by MLIT.
- ✓ Furthermore, this year's project will **create twice the amount of data**.

PLATEAU uses three data sources

Urban planning basic map

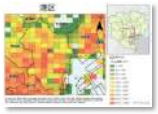
2D rectangular data of buildings, roads, blocks, etc.

Aerial survey

3D data of building heights, shapes, etc.

Urban planning basic survey data, etc.

Current status of buildings and land use, etc.



56 cities which developed 3D City Models

No.	Prefecture	City	No.	Prefecture	City
1	Hokkaido	Sapporo	29	Shizuoka	Numazu
2	Fukushima	Koriyama	30	Shizuoka	Kakegawa
3	Fukushima	Iwaki	31	Shizuoka	Kikugawa
4	Fukushima	Shirakawa	32	Aichi	Nagoya
5	Ibaraki	Hokota	33	Aichi	Okazaki
6	Tochigi	Utsunomiya	34	Aichi	Tsushima
7	Gunma	Kiryu	35	Aichi	Anjo
8	Gunma	Tatebayashi	36	Osaka	Osaka
9	Saitama	Saitama	37	Osaka	Toyonaka
10	Saitama	Kumagaya	38	Osaka	Ikeda
11	Saitama	Niiza	39	Osaka	Takatsuki
12	Saitama	Moroyama Town	40	Osaka	Settsu
13	Chiba	Kashiwa	41	Osaka	Tadaoka Town
14	Tokyo	23 Wards	42	Hyogo	Kakogawa
15	Tokyo	Higashimurayama	43	Tottori	Tottori
16	Kanagawa	Yokoyama	44	Hiroshima	Kure
17	Kanagawa	Kawasaki	45	Hiroshima	Hukuyama
18	Kanagawa	Mogamihara	46	Ehime	Matsuyama
19	Kanagawa	Yokosuka	47	Fukuoka	Kitakyushu
20	Kanagawa	Hakone Town	48	Fukuoka	Kurume
21	Niigata	Niigata	49	Fukuoka	Iizuka
22	Ishikawa	Kanazawa	50	Fukuoka	Munakata
23	Ishikawa	Kaga	51	Kumamoto	Kumamoto
24	Nagano	Matsumoto	52	Kumamoto	Arao
25	Nagano	Okaya	53	Kumamoto	Tamana
26	Nagano	Ina	54	Kumamoto	Mashiki Town
27	Nagano	Chino	55	Oita	Hita
28	Gifu	Gifu	56	Okinawa	Naha

PLATEAU Standard

Development of Standard Data Product Specification for 3D city models in Japan

Standardization of 3D city model data products in Japan

- The Standard Data Product Specification for 3D City Model was developed in March 2021 as Japan's first standard data model for 3D city model, which was updated by version 2.0 in March 2022.
- The development of this standard document has resulted in the unification of the specifications, standards, and quality of 3D city models in Japan.
- As a result, software development will be more efficient, knowledge will be shared, and data will be linked more easily.

Compatible with international standards

- The PLATEAU standard data specification is based on CityGML 2.0, an open format developed by an international standards organization OGC.
- The PLATEAU standard is a localized standard unique to Japan that adds attribute information and details LOD definitions.

HTML version also available

- HTML version was released in March 2021 to improve convenience.

https://www.mlit.go.jp/plateaudocument/

PLATEAU Standard

Requirements of the PLATEAU standard

- Data Models, CRS, Modules, positional accuracy, quality inspection items, etc. are defined.
- Data creation methods, such as polygon creation methods and quality inspection methods, are also defined and standardized in the "3D

Item	Detail	
Data Models	CityGML 2.0/ISO 19136	a conceptual model and exchange format for the representation, storage and exchange of virtual 3D city models
	Urban Planning ADE- ver.2.0	Semantics information for urban planning *1,*2
	JPGIS 2014/ ISO191**series*7	profile of the ISO geographic information standards
CRS	EPSG:6697 JGD2011 + JGD2011 (vertical) height	Geographic (Lat/Lon/H) is used since there is no Plane Rectangular Coordinate System covering all over Japan
Modules	LOD0	Building, Transportation, Vegetation, CityFurniture, Landuse
	LOD1	Building, Transportation, Vegetation, CityFurniture, Landuse , Terrain, WaterBody, ADE(Urban Function)
	LOD2	Building, Transportation, Vegetation, CityFurniture, Terrain
	LOD3	Building, Transportation, Vegetation, CityFurniture
positional accuracy	Horizontal ±1.75m, Vertical ±0.66m	Based on Japanese regulation (Map information level 2500) used by Urban Planning Basic Map (source of LOD0)
quality inspection	品質の要求，評価及び報告のための規則(GSI) / ISO19157	Qualities (e.g. Topological consistency) are described in Data Product Specification*3 and evaluated by validation tools *4,5,6
Meta data	JMP2.0 / ISO 19115	the schema required for describing geographic information and services by means of metadata

*1 Akahoshi, K., Ishimaru, N., Kurokawa, C., Tanaka, Y., Oishi, T., Kutzner, T., and Kolbe, T.H.: I-URBAN REVITALIZATION: CONCEPTUAL MODELING, IMPLEMENTATION, AND VISUALIZATION TOWARDS SUSTAINABLE URBAN PLANNING USING CITYGML. ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci., V-4-2020, 179–186 , 2020. https://doi.org/10.5194/isprs-annals-V-4-2020-179-2020

*2 Ishimaru, N., Kurokawa, C., Tanaka, Y., Oishi, T., Akahoshi, K., Kutzner, T., and Kolbe, T.H.: CityGML Urban Planning ADE for i-Urban Revitalization, OGC 20-000r1, 2020. https://portal.ogc.org/files/?artifact_id=92113

*3 Standard Data Product Specification for 3D City Model. Handbook of 3D City Models, Project PLATEAU. https://www.mlit.go.jp/plateau/file/libraries/doc/plateau_doc_0001_ver01.pdf

*4 CityGML Geometry Validator. Project PLATEAU GitHub. https://github.com/Project-PLATEAU/CityGML-geometry-validator

*5 CityGML Evaluation System. Project PLATEAU GitHub. https://github.com/Project-PLATEAU/CityGML-evaluation-system

*6 CityGML Production System. Project PLATEAU GitHub. https://github.com/Project-PLATEAU/CityGML-production-system

*7 ISO19107（空間スキーマ）、ISO19108（時間スキーマ）、ISO19109（応用スキーマのための規則）、ISO19110（地物カタログ化法）、ISO19111（座標による空間参照）、ISO19112（地理識別子による空間参照）、ISO19123（被覆の幾何及び関数のためのスキーマ）、ISO19131（データ製品仕様）、ISO19136（GML）、ISO/TS19103（概念スキーマ言語）、ISO19118（符号化）

PLATEAU Standard

Modules of the PLATEAU standard (version 2.0)

Building

LOD0 LOD1 LOD2 LOD3

Vegetation

LOD1 LOD2 LOD3

Transportation(Road)

LOD0 LOD1 LOD2 LOD3

Landuse

LOD1

Disaster Risk

LOD1

Terrain

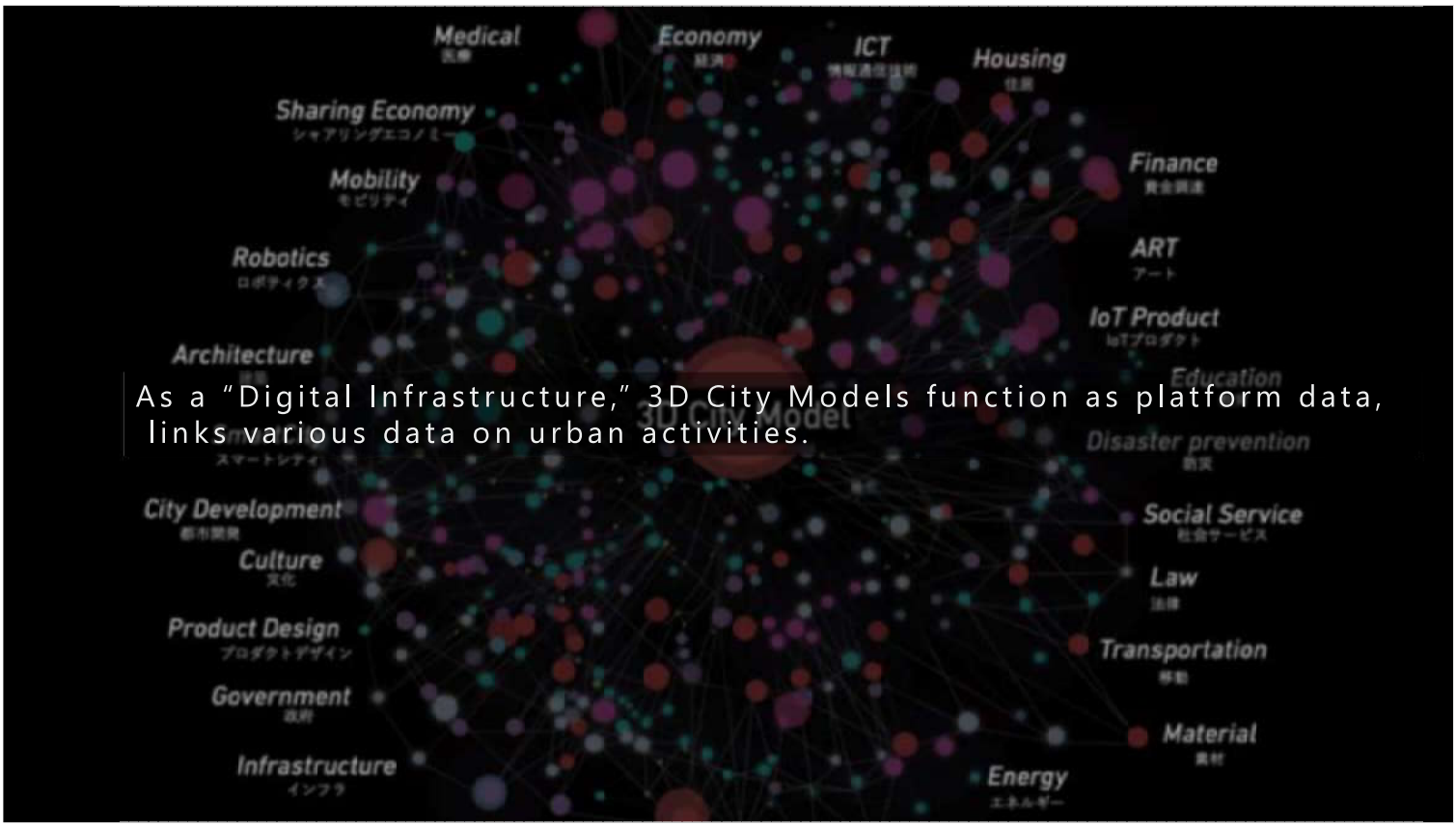
LOD1

Urban Planning

LOD1

CityFurniture

LOD1 LOD2 LOD3



As a “Digital Infrastructure,” 3D City Models function as platform data, links various data on urban activities.

1 Creation of a new solution using existing data

Urban Planning Basic Map

2D map data of buildings, roads, blocks, etc.

Aerial survey result

3D data of building heights, shapes, etc.

3D City Models

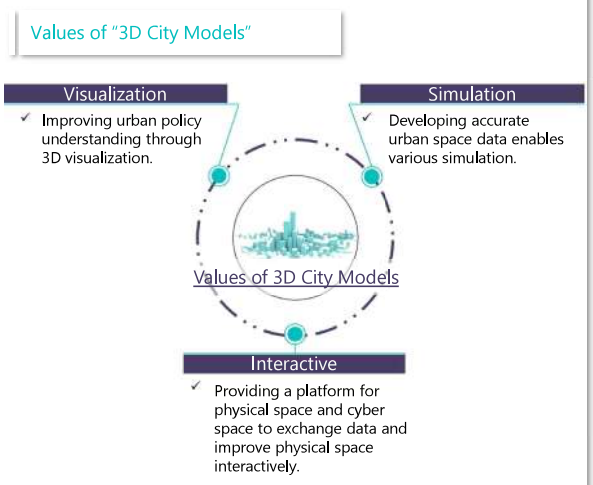
Urban Planning Basic Survey data, etc.

Current status of buildings and land, etc.

"Reusing" GIS data previously used by municipalities and develop a new value-added 3D City Models.

Establish a reasonable and scalable data development scheme using existing resources effectively.

❷ Establishment of an eco-system of 3D City Models through the development of data and use cases concurrently



Develop data and use cases concurrently. Produce applications in various fields and maximize the value of 3D City Models.

Establish a cycle of data usage in private sectors and data development in public sectors.

❸ Open format and open source

Establish a developer-friendly data usage environment including the formulation of standard specification with open format which meets international standards, documenting knowledge and creating OSS of related software.

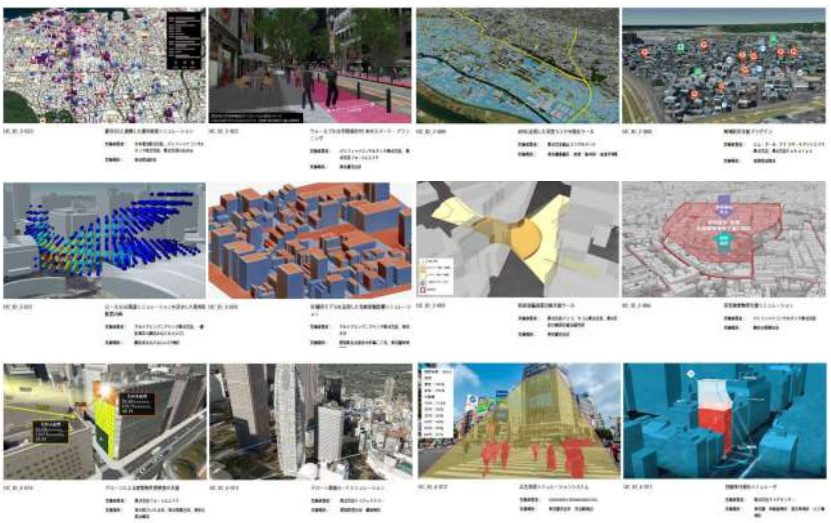
Creation of open innovation in various fields

USE CASEs

USE CASEs

A wide variety of use case development reports from Project PLATEAU, from ongoing to past projects, are available in the PLATEAU website.

https://www.mlit.go.jp/plateau/

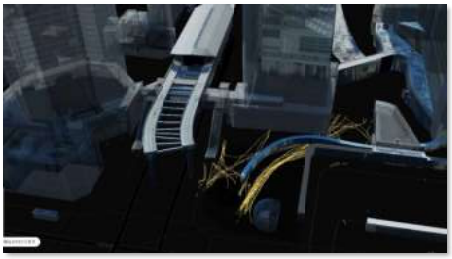


PLATEAU Technical Reports are documents that summarize technical findings on use case development.

https://www.mlit.go.jp/plateau/libraries/

Various Use Cases

Space planning using urban activity data



FY 2020 Case-Study UC_ID_1-001
"Measuring urban activities using a laser sensor on a high-accuracy and real-time basis" Matsuyama City and Hitachi, Ltd.

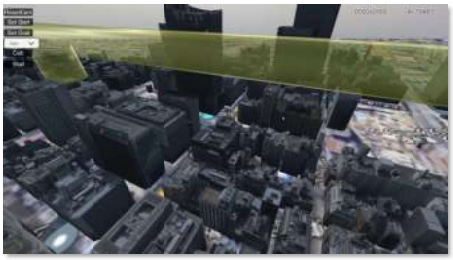
New urban experiences in virtual space

FY 2020 Case-Study UC_ID_4-001
" City tour and shopping experiences in virtual space"
Isetan Mitsukoshi Holdings Ltd.
Shinjuku 3-chome area, Shinjuku, Tokyo

Digital twins for area management

FY 2020 Case-Study UC_ID_4-007
"Implementation of digital twins for area management"
Takeshiba Area Management x Tokyu Land Corporation, Softbank

Flight simulation of logistics drones



FY 2020 Case-Study UC_ID_4-005
"Flight simulation of logistics drones" A.L.I. Technologies

Risk analysis using disaster simulation

FY 2020 Case-Study UC_ID_2-003
"Planning Disaster management policy and enhancing disaster prevention awareness through 3D visualization of time-series flood simulation data"
Mitsubishi Research Institute, Inc.

Contents in AR/XR fields

AR live streaming (2021 PLATEAU Hackathon)

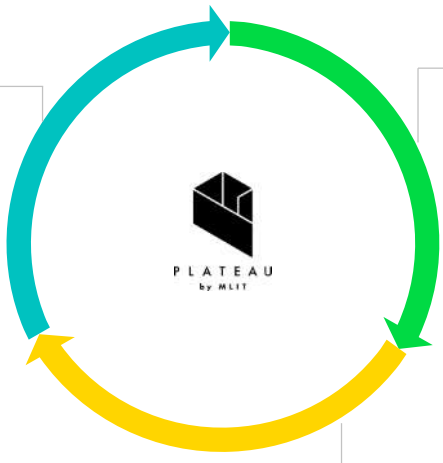
Project PLATEAU Strategic Thrusts:

Development of the Ecosystem for the creation, utilization, and sharing of open data of 3D city models.

In FY2023, Project PLATEAU will facilitate the development of the ecosystem that encourages the autonomous development, use, and sharing of open data of 3D city models through collaboration among various stakeholders, including governments, regional governments, businesses, and research institutions.

R&D and Creation of Best Practices

- Upgrading of the PLATEAU standard specifications
- Research and development of efficient data creation methods.
- Development of innovative use cases.
- Feasibility study for social implementation.



Social implementation

- Support creation, utilization, and sharing of open data for 3D city models by regional governments.
- Enhancing data coverage and promoting social implementation of use cases.

Driving Open Innovation

- Drive open innovation by providing open data and sharing knowledge on use case development.
- Release of technical documents.
- Contribution of development tools.
- Building a community of engineers.

PLATEAU by MLIT

https://www.mlit.go.jp/plateau/

hqt-mlit-plateau@mlit.go.jp

国土交通省

Lecture Slides

Invited Talk 발표세션

2

Digital GARAM+ (Digital Twin Water Management Platform)

디지털 트윈 물관리 플랫폼 Digital GARAM

권문혁(Moonhyuk Kown)

Speaker Profile

Moonhyuk Kwon

K-water

Dr. Kwon is a director of the National Drought Center and the team manager of Digital Water Management. He started his career at the Korean Water Resources Corporation (K-water) in 2002. He got a PhD at the University of Bristol at the UK. Recently, He has dedicated to a create water management platform based on digital twin techniques.

권문혁

한국 수자원 공사 국가가뭄정보분석센터장

권문혁 박사는 국립가뭄정보분석센터장이자, 디지털 물 관리 팀장이다.
2002년부터 한국 수자원공사에서 근무하였으며,
최근 디지털 트윈 기술 기반 물 관리 플랫폼 프로젝트를 수행하였다.

Digital Twin Water Management Platform

: Innovative approach for optimal water management

Nov. 3, 2022

Dr. Moonhyuk Kwon

Director of National Drought Center &

Manager of Digital Water Management Center

CONTENTS

01

Increasing complexity in water management

Increasing complexity in water management decision processes

Description of South Korea

Precipitation characteristics

Average annual rainfall ≥ 1.6 times of global average

* Global average : 813mm(USA 715mm, China 645mm)

Water per capita : less than 20 % of global average

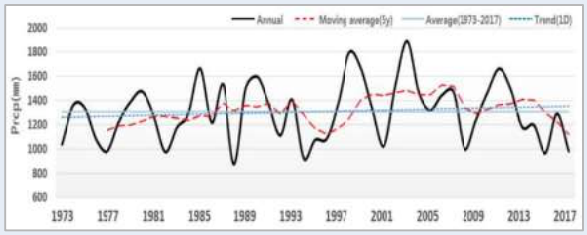
* Global Ave : 16,427㎥/yr (USA; 21,791, China 4,345)

Average annual rainfall and water per capita by country

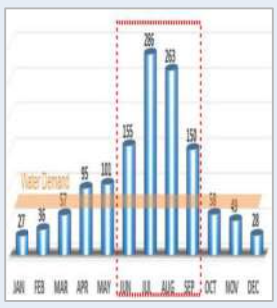
	Korea	Japan	USA	UK	China	Global Ave.
Annual rainfall(㎜)	1,300	1,668	715	1,220	645	813
Rainfall per capita (㎥/yr)	2,546	4,964	21,791	4,663	4,345	15,044

Temporal and regional imbalance

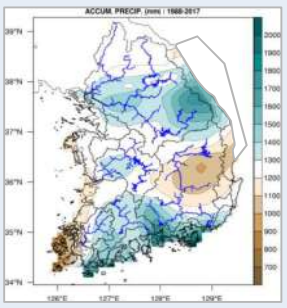
mean annual rainfall (875 ~ 1,888mm)



Seasonal imbalance



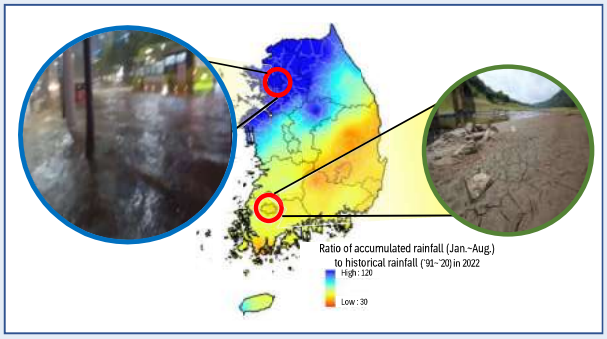
Regional imbalance



Description of South Korea

Recurring water disaster

Flood & Drought in 2022



02

Digital Twin Water Management Platform

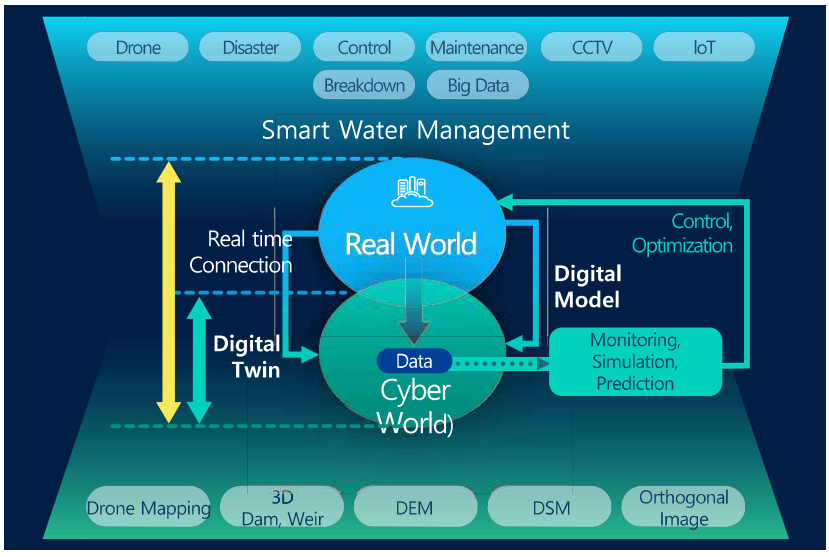
Ⅱ- 01 Background

Innovative Approach through Digital Transformation in the field of Water management

New Normal? Climate change	Increasing Risk of Compound Flooding	Digital Transformation	Digital Twin
Temperature rise by 1°C over the last 133 years (1880-2012)	Longest rainy reason and Torrential rain in 2020	"2 years worth of digital transformation in 2 months (MS CEO)"	"Digital Twin" is selected in the Korean ver. New Deal Project

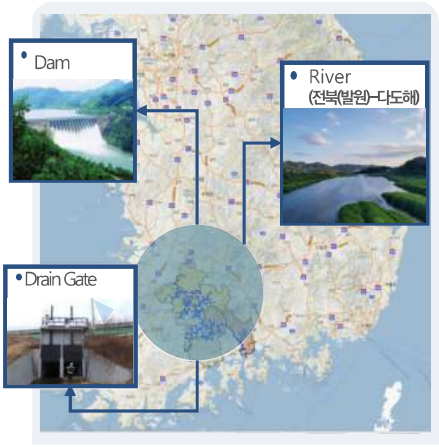
Ⅱ- 02 Objective

Cyber-Physical System that Synchronizes the Real World with the Virtual World

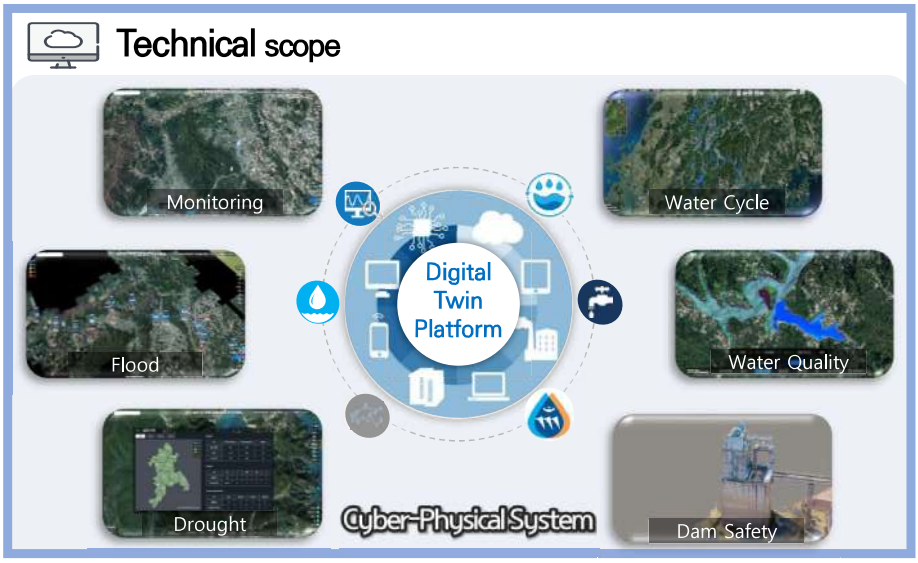


Test bed : Sumjin watershed (4,912 ㎢), River length(137km)
Technical Scope : Monitoring, Flood, Drought, etc.

Test bed



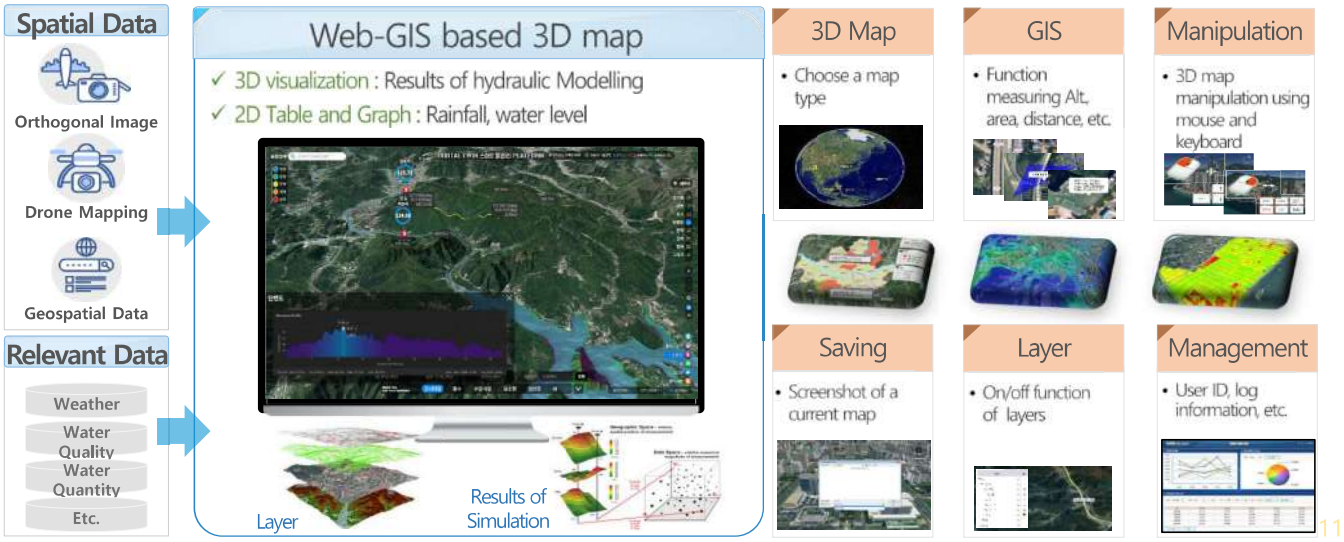
Technical scope



Main achievements

Ⅱ- 04 Architecture of Digital Twin Platform

Development of a Web-GIS based DT Platform Considering User Convenience



Ⅱ- 05 3D Base Map

3D bridge objects, Reservoir 3D Mapping, 3D map

3D Object modelling

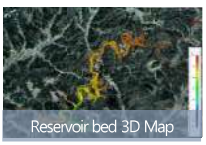
- 3D bridge production using drone mapping

Drone mapping	3D modelling
• Close-up drone mapping	• Context Capture

Reservoir 3D mapping

- Mapping reservoir bed using multibeam

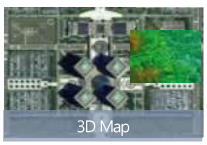
Bathymetric survey	Merging with DTM
• Reservoir bed	• Product reservoir bed DTM

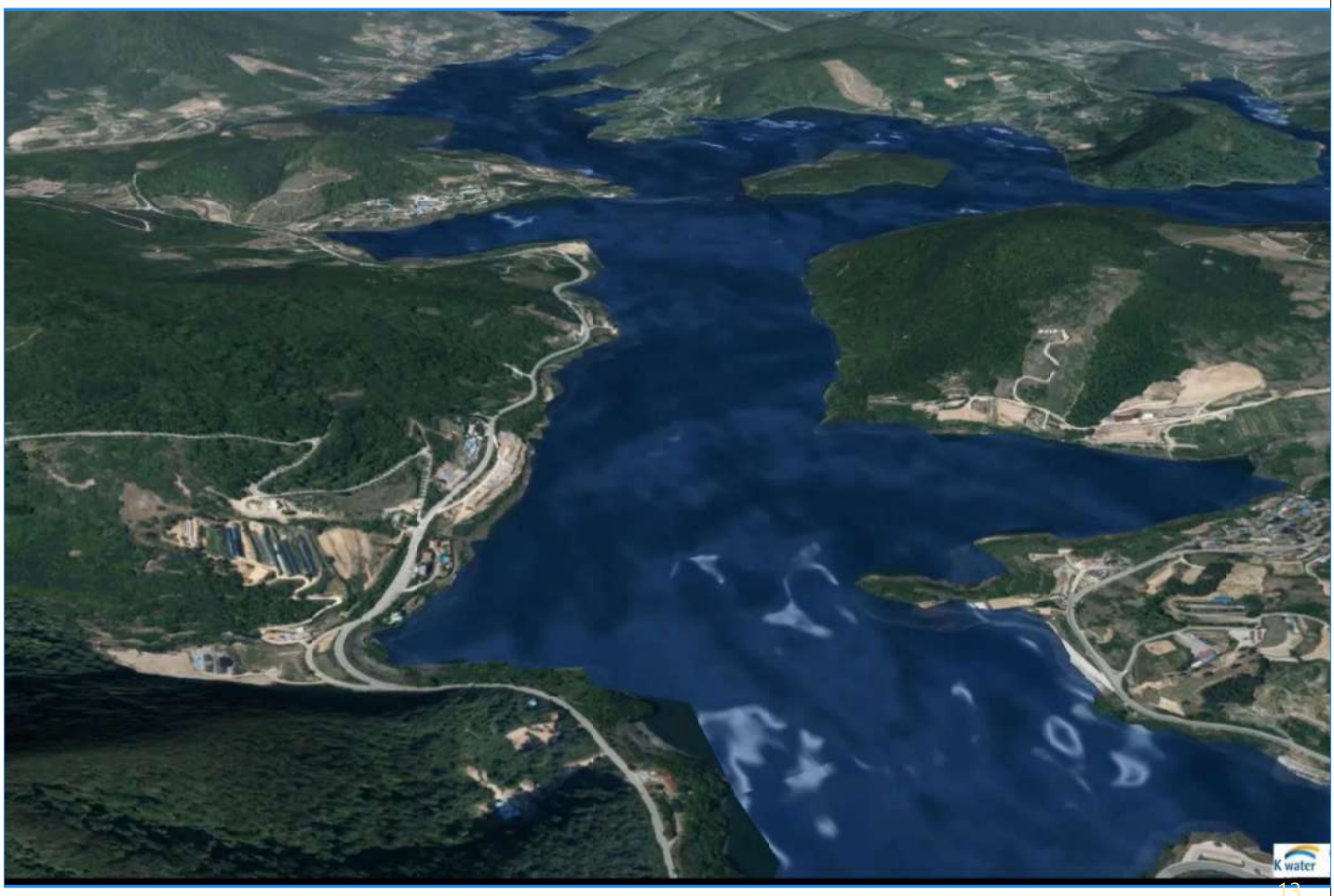


3D Map

- Merging orthogonal image with DTM

Orthogonal Image	Merging with DTM
• Areal Survey	• Create 3D map merging



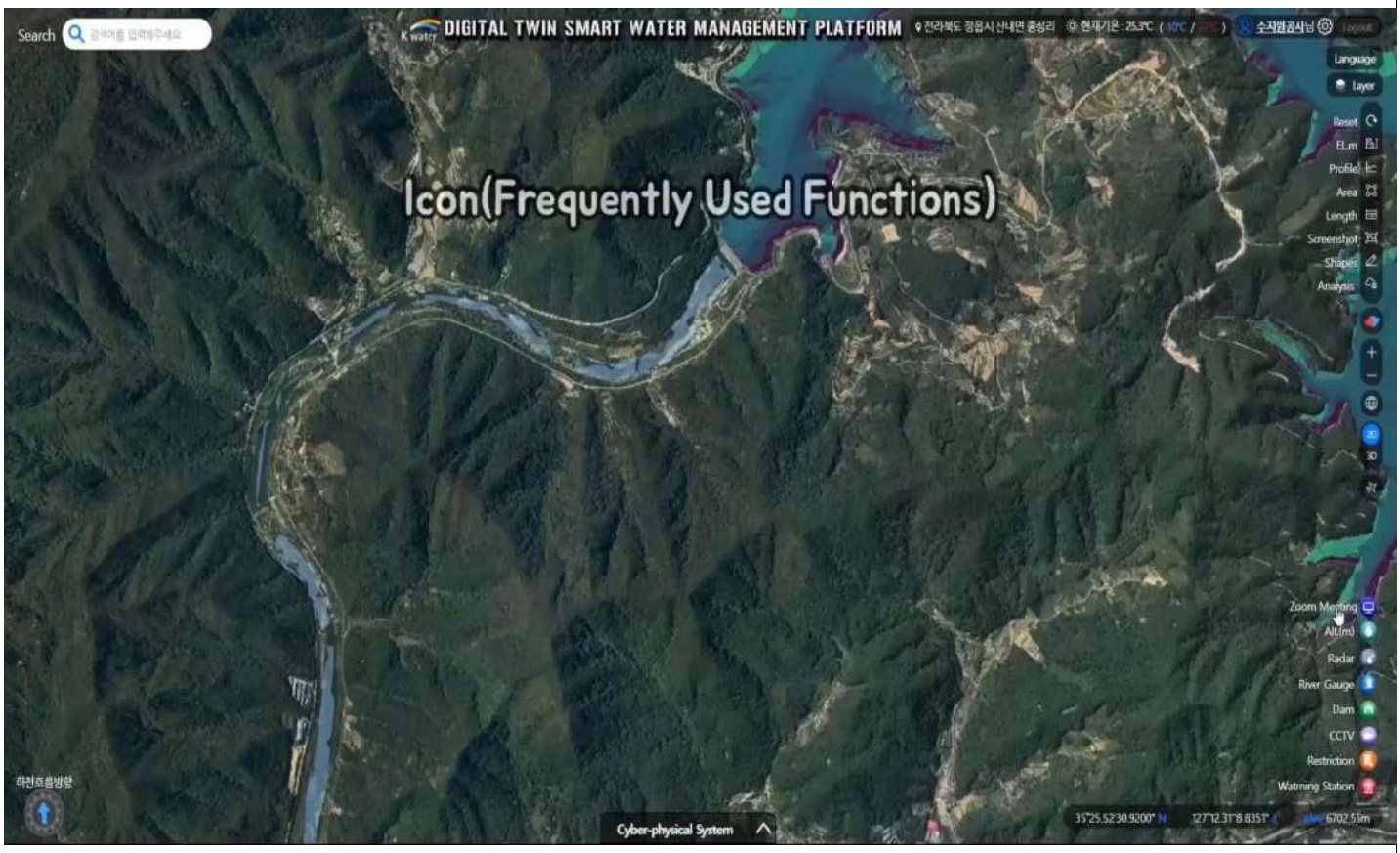


Ⅱ- 06 Display on a Big Board

Real-time Connection and Display on a Smart Big-Board

[Overview (UI Design)]

[Icons (Frequently Used Functions)]



[CPS (Cyber Physical System)]

Decision Making of Dam Operation with Digital GARAM+

1 Rainfall Forecast

Dam Basin	Observed : 160mm Forecast : 300mm
Downstream River	Observed : 150mm Forecast : 150mm

2 Analyze Dam Discharge

Quantity of Discharge from Dam
Considering the Flood Capacity of Dam

↓

Release 50% of
Planed Discharge

3 Check the Constraints

Check the Constraints
in Downstream River

↓

Damages in some areas are Expected

4 Modify of Dam Release

Modify the Quantity of Discharge
for Reducing the Damages

↓

Release 20% of
Planed Discharge

5 Re-Check the Constraints

Re-Check the Constraints
in Downstream River

↓

Minimum damages
in Downstream River

04

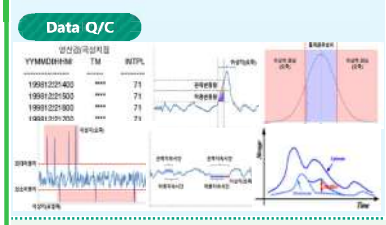
Future Works

Future works for Digital Twin Water Management Platform

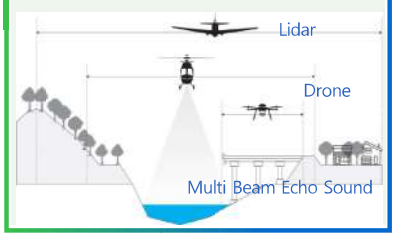
Development and Improvement of Core-Technologies

01 Data

Time Series Data
- Quality Control of Real-time Data



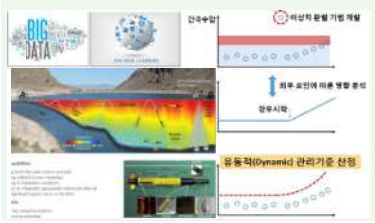
Geospatial Data
- Increasing Accuracy for Digital Transformation



02 Analysis Model

Improvement of Model and System
- Accuracy, Calculation Time, Converter

Data-Driven Analysis Model
- Considering 4th Industrial Revolution : AI, IoT

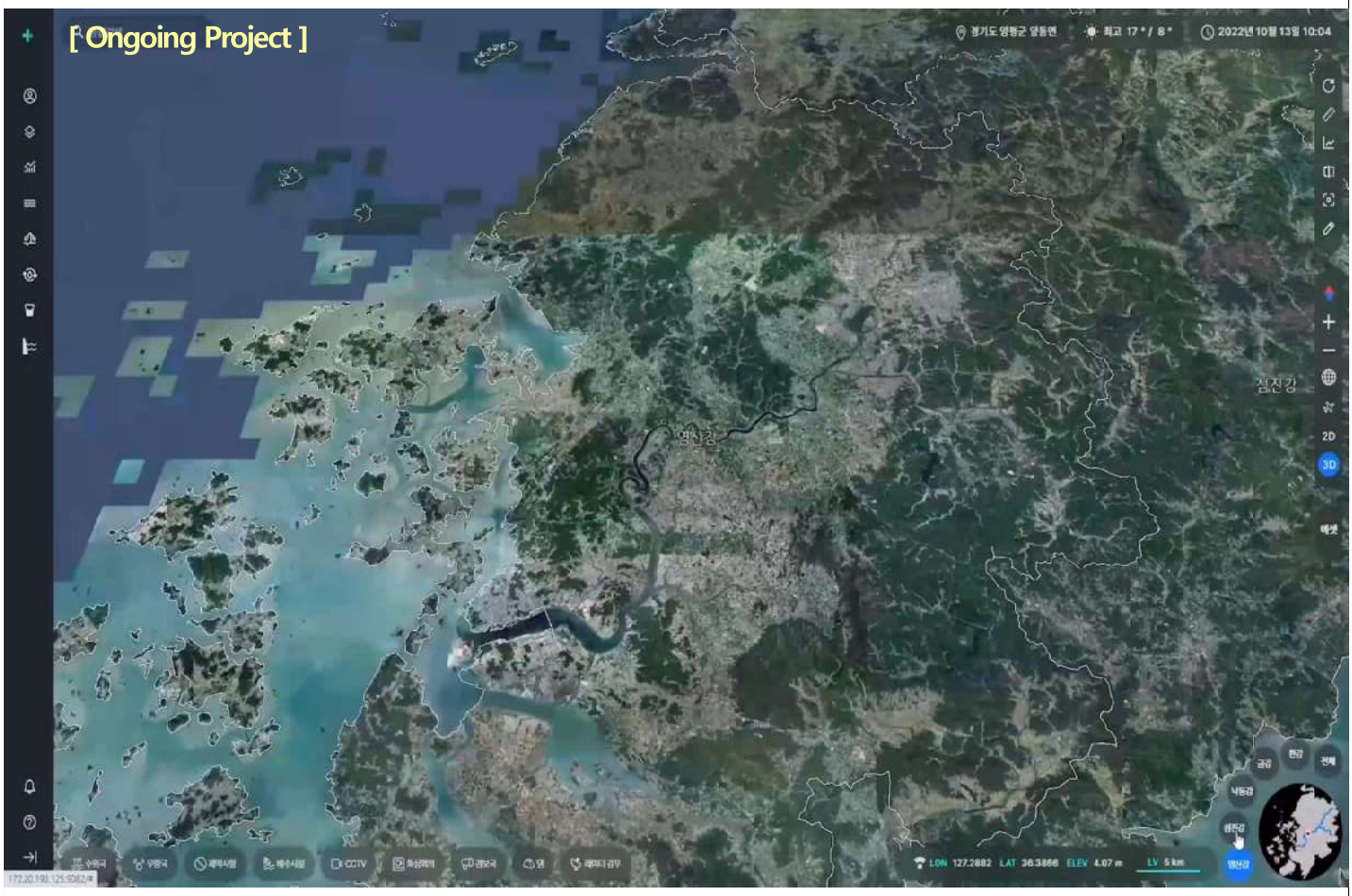


03 3D Display

Development of 3D Engine
- Tech. Independency considering Expendability

Production of 3D Object
- Improvement of 3D Object Modeling

Thank you for your attention.



Lecture Slides

Invited Talk 발표세션

3

Implementation of Digital Virtual Seoul Using 3D Spatial Data(S-Map)

3차원 공간데이터를 활용한 디지털 가상 서울 구현

김태현(TaeHyun Kim)

Speaker Profile

Dr. TaeHyun Kim

Seoul Institute of Technology

Dr. Taehyun Kim has various job carrior including SK C&C,
Seoul Metropolitan government and and the Seoul Research Institute.
He is conducting research on solving urban problems using the 4th industrial revolution technology.

김태현

서울기술연구원 선임연구위원

김태현 박사는 SK C&C, 서울시, 서울연구원 등 IT업계, 공공기관, 연구원 등에서 다양한 실무 경험을 가지고 있으며, 현재는 서울기술연구원에서 빅데이터, 스마트시티, 확장현실 등 4차산업혁명기술을 활용하여 서울의 도시문제 해결을 위한 연구를 수행하고 있다.

Implementation of digital virtual Seoul using 3D spatial data (S-Map)

TaeHyun, Kim

Seoul Institute of Tech.

Established in 2018 for the first time in a local government to solve and improve Seoul's urban problems through application of science and technology

TaeHyun, Kim

(Senior Research Fellow, Ph. D. in Urban Planning)

Seoul Institute of Tech(2018~)
XR, Digital Twin, Smart City, Big Data

Seoul Institute(2010~2018)
Urban Master Plan, Urban Regeneration, Regional Stratagic Plan

Seoul Metropolitan Gov.(2004~2010)
Urban Planing Information System, Urban Spatial Policy

SK C&C(1999~2004)
Land Information System, Legal Information System, Expert System

Contents

- Digital Virtual World Trends
- Status of “Virtual Seoul” in Seoul
- Digital Virtual Seoul Implementation Case (UE5 PoC)
- Digital Virtual World Implementation Issue

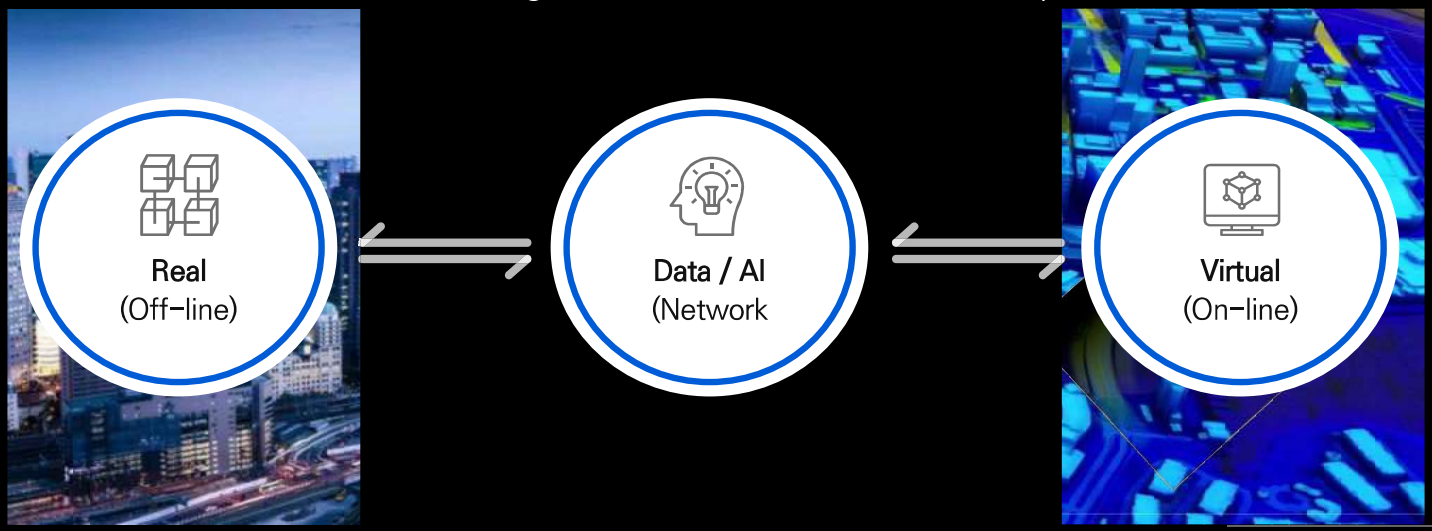
Digital Virtual World Trend

Urban Planning, Real Estate

The 4th Industrial Revolution: The Beginning of Smart City

Future space: Convergence of artificial intelligence-based real world (off-line) and digital virtual world (on-line)

Innovative changes in life, work and leisure are expected



Digital TwinCountry

Digitally replicate the real world
analyze and predict in the digital space → Spatial Information System

Source: Ground and underground integrated management digital twin system ISP (Ministry of Land, Infrastructure, and Transport, 2022.1)

Metaverse Platform

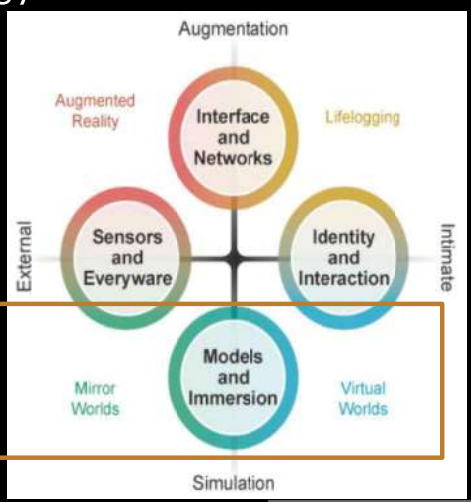
XR+DNA/Blockchain, etc. Metaverse Core Element Technology, a New Type of Platform

Request for proposal for metaverse platform construction support project (Ministry of Science and ICT, 2022.3)

Metaverse

The Outcome of the Encounter Between Video Games and Web 2.0 (2007) → "A fused world created by mediating and combining physical and virtual space through immersive technology"

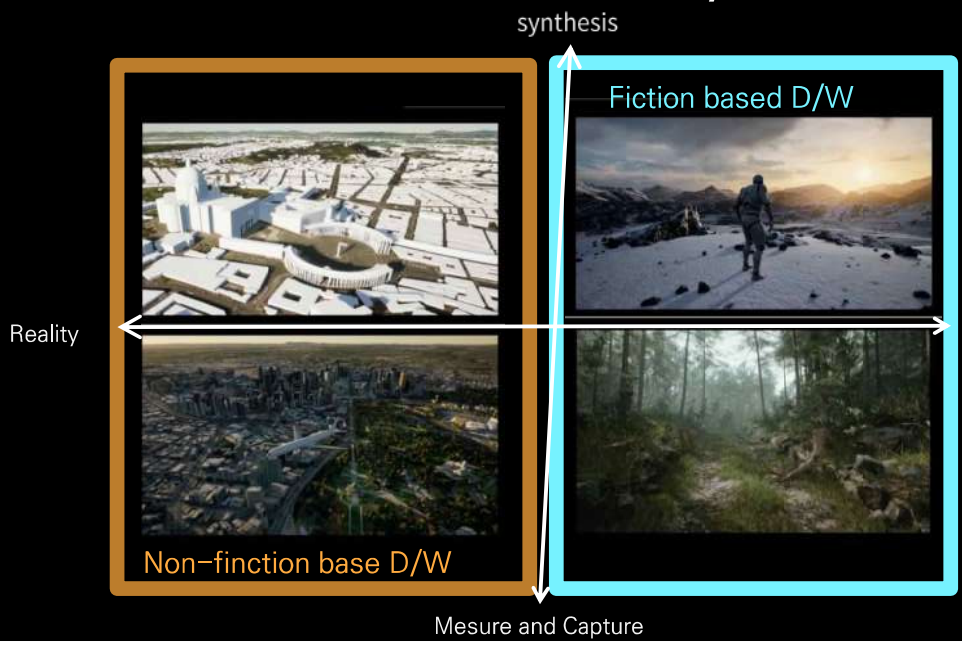
What happens when video games meet Web 2.0? When virtual worlds meet geospatial maps of the planet? When simulations get real and life and business go virtual? When you use a virtual Earth to navigate the physical Earth, and your avatar becomes your online agent? What happens is the metaverse.



Acceleration Studies Foundation(2006), "Metaverse Roadmap, Pathway to the 3D Web"

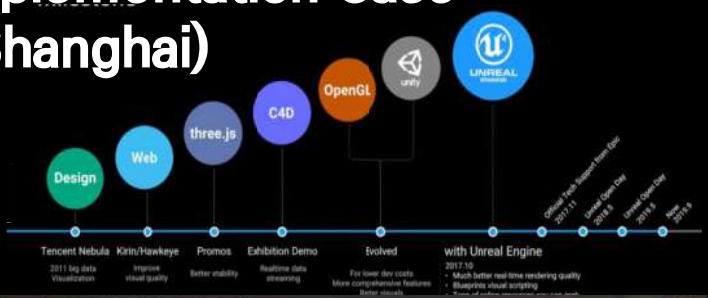
Types of digital virtual worlds

fact-driven vs creativity-driven



Digital Virtual City Implementation Case (Cloneed Shanghai)

Beijing-based digital twin specialist 51World built a Shanghai virtual replica model covering 3,750 square kilometers with Unreal Engine



자료 : 텐센트(https://www.youtube.com/watch?app=desktop&v=VYWsB93oCDg)

Digital Virtual City Implementation Case (Virtual Gothenburg)

Inspired by the computer game industry Use of information to describe buildings, roads and other objects Build using parametric

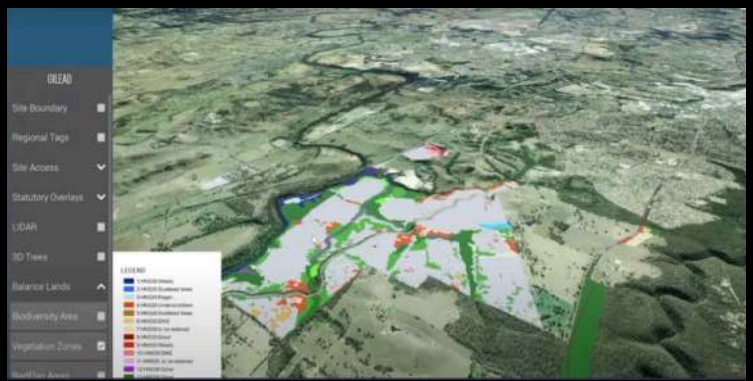
Digital Twin – Urban Development Gothenburg – City of Goteborg (goteborg.se)

(152) Virtual Gothenburg | Build: London '19 for Architecture | Unreal Engine – YouTube

Digital Virtual City Implementation Case (V2i Realtime)

Develop Immersive Master Plan Assets and Services with Unreal Engine, Stream Pixels, and Leverage Cesium for Unreal

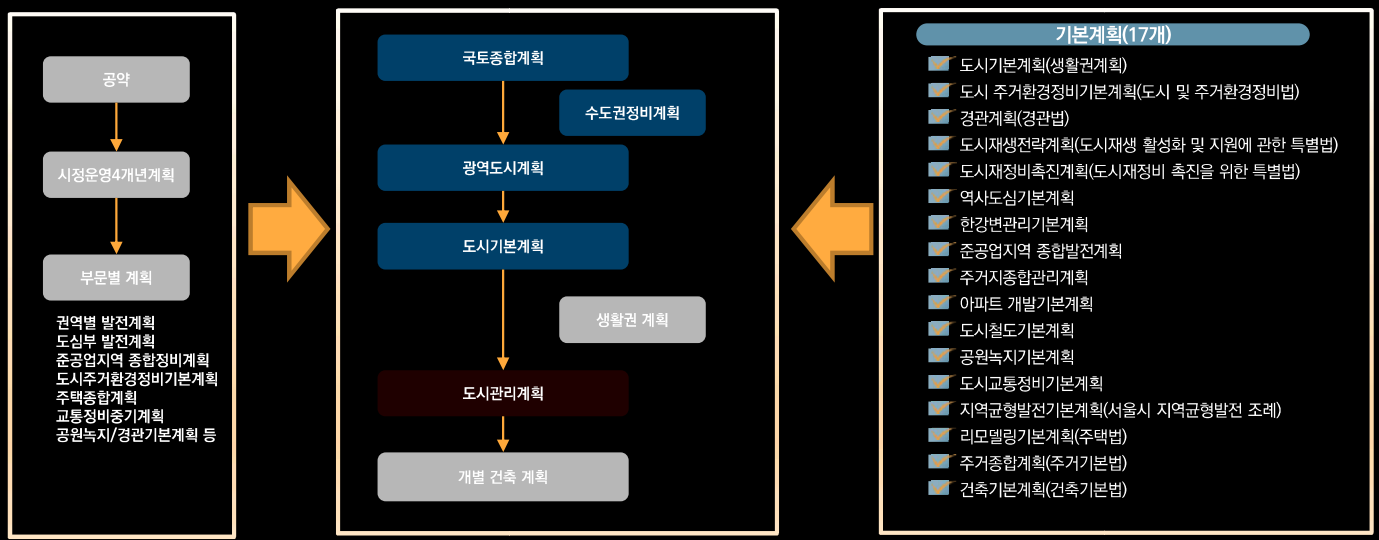
Visual Language: Confusion and Misunderstanding Digital Storytelling, Lendlease Metaverse



https://www.unrealengine.com/ko/spotlights/unreal-engine-is-helping-real-estate-developers-to-accelerate-urban-master-planning

Seoul Urban Planning Information Systen

Requirement for spatial change: spatial planning



Communication method of urban planning

A series of processes to establish and implement a desirable future image of the city (vision, explanation, decision)

3D spatial database

S-UPIS 구성

Construction of 3D spatial information for urban planning business support

- Trerrain : 1m×1m, aerial photography 10cm×10cm, 1/3,000

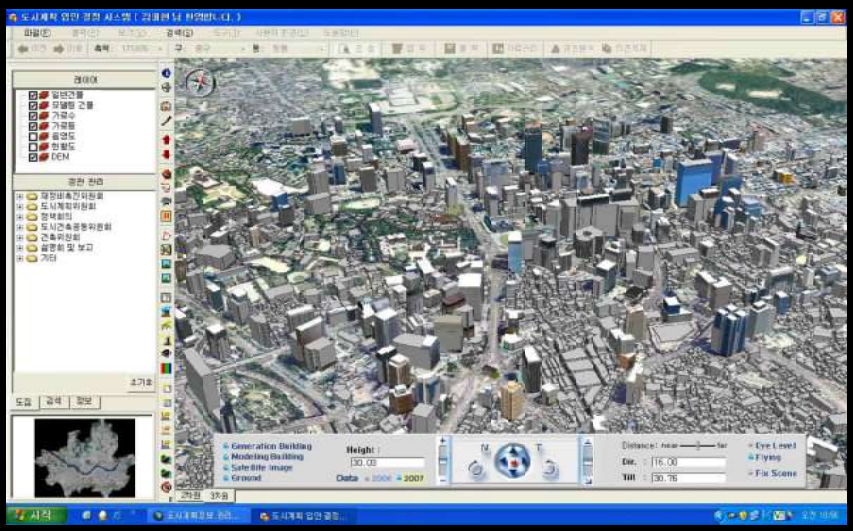
Collection of urban planning maps

- Building mass model : Building outline X number of floors
- Realistic model : Important buildings , bridgs, palaces etc. 1,200
- 3D distribution map, such as building use, age, etc.

S-UPIS(2006)

Acurracy, LOD that can express a far view, reaction speed

Live simulation in urban planning committee

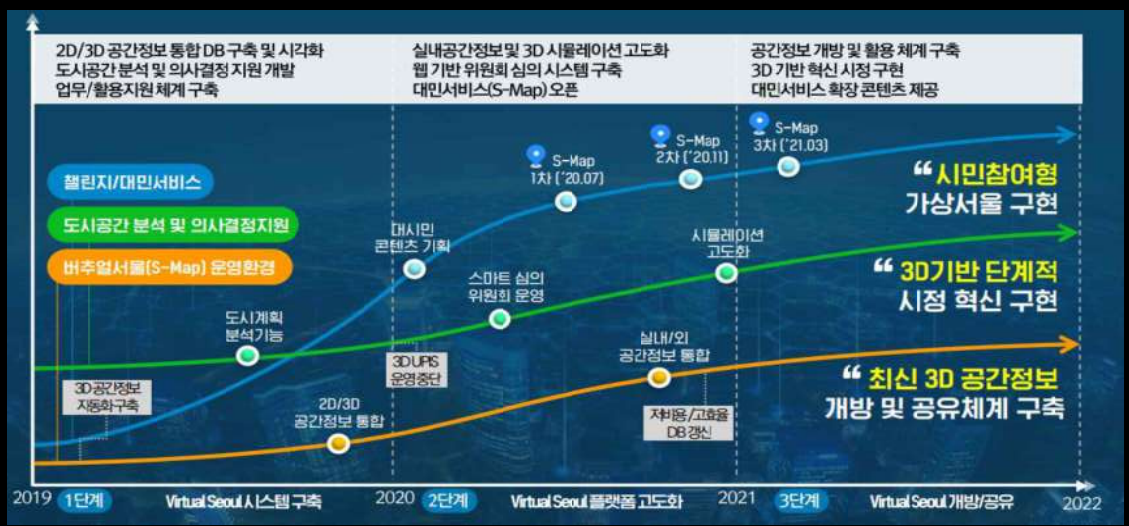


서울시 내부자료

서울시 도시계획위원회(2006)

Virtual Seoul platform(2021)

Internal decision-making support → external public service
UPIS → Virtual Seoul Integration



서울시 내부자료

Virtual Seoul plantform(2021)

Various urban spatial problem analysis and simulation support 2D, 3D spatial information-based integrated platform

서울시 내부자료

Main consern: Future spatial change

Promotion of future space changes such as “2040 Seoul Plan”

rapid housing supply with redevelopment and reconstruction

2040 서울플랜

XR기반 도시설계 플랫폼 구축 예정

Game engine as an urban planning simulator

Large-scale open world (city), realism, interaction, communication → citizen participation

	Simulation	Vidio Game
Pupose	**Learning**	Entertainment
Engaging	○	○
Connected	○	○
Interoperabe	○	○
Large open world	○	○
Visual/Physical realism	○	○

Digital Virtual Seoul Implementation (UE5 PoC)

High-precision 3D model and quality improvement

Aerial photography and 3D spatial information construction About 605㎢, 600,000 buildings + α

서울시 내부자료

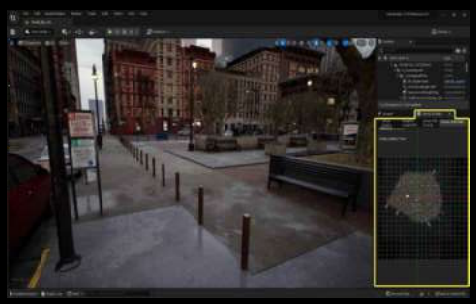
Convergence tool of digital virtual world ?

Large data volume, realism, speed, detail, scalability

3D GIS

Esri CityEngine

Vidio Game



Epic Games UE5

Movie/Advertisement

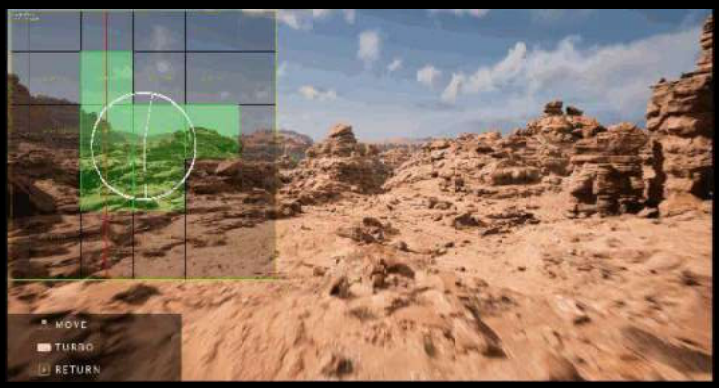
SideFX Houdini

https://vimeo.com/279039196

How to Implement UE5 Open World

World Partition

An automatic streaming system that stores the world in a single persistent level separated by grid cells, loading and unloading those cells based on distance from the streaming source



https://docs.unrealengine.com/5.0/en-US/world-partition-in-unreal-engine/

Cesium for Unreal

Free open source plugin, visualization of massive high-resolution terrain, images, 3D buildings, etc. at runtime using 3D tiles (WGS84, Cesium Ion, OSM, custom URLs)

https://cesium.com/platform/cesium-for-unreal

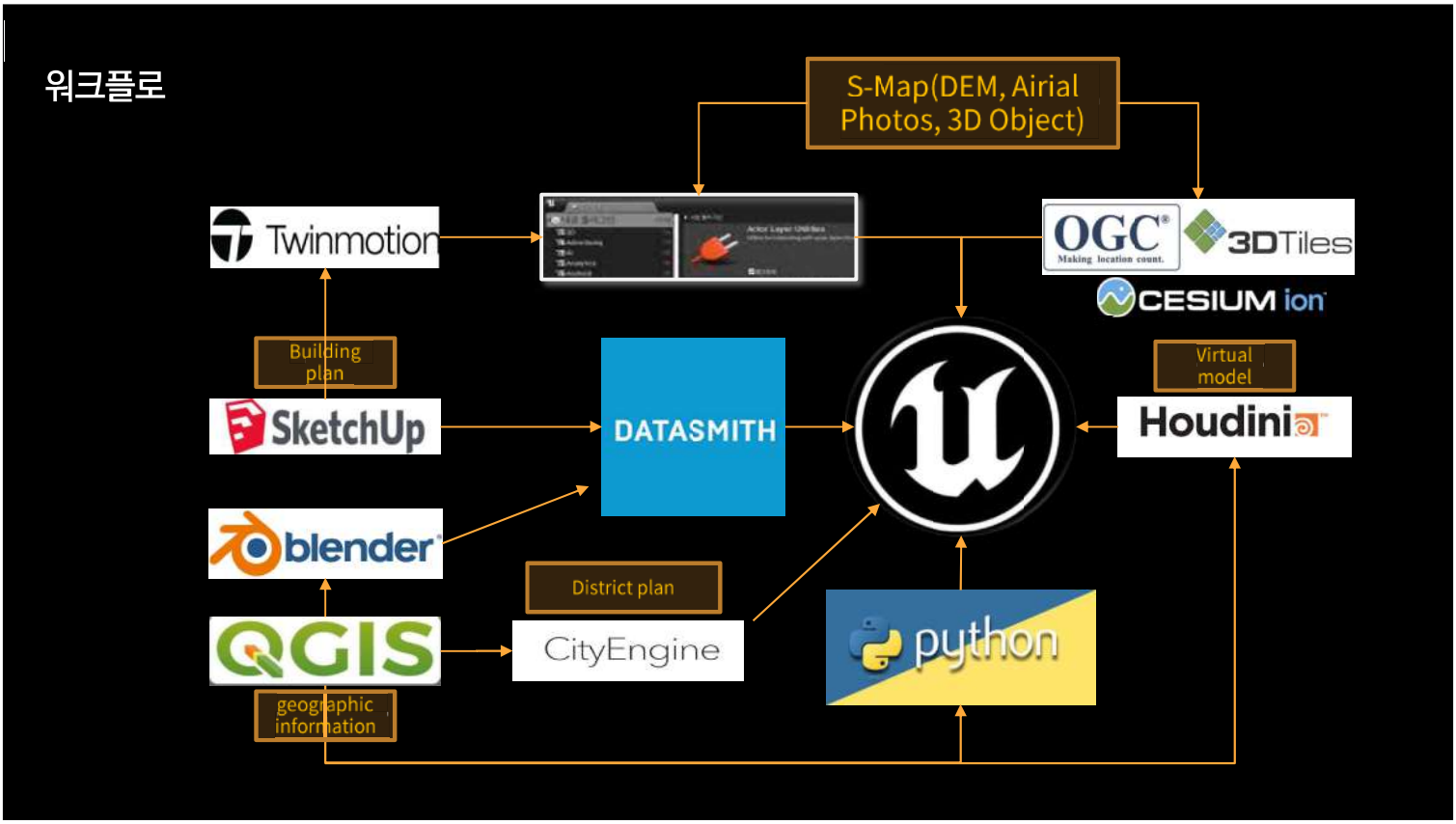
PoC Overview

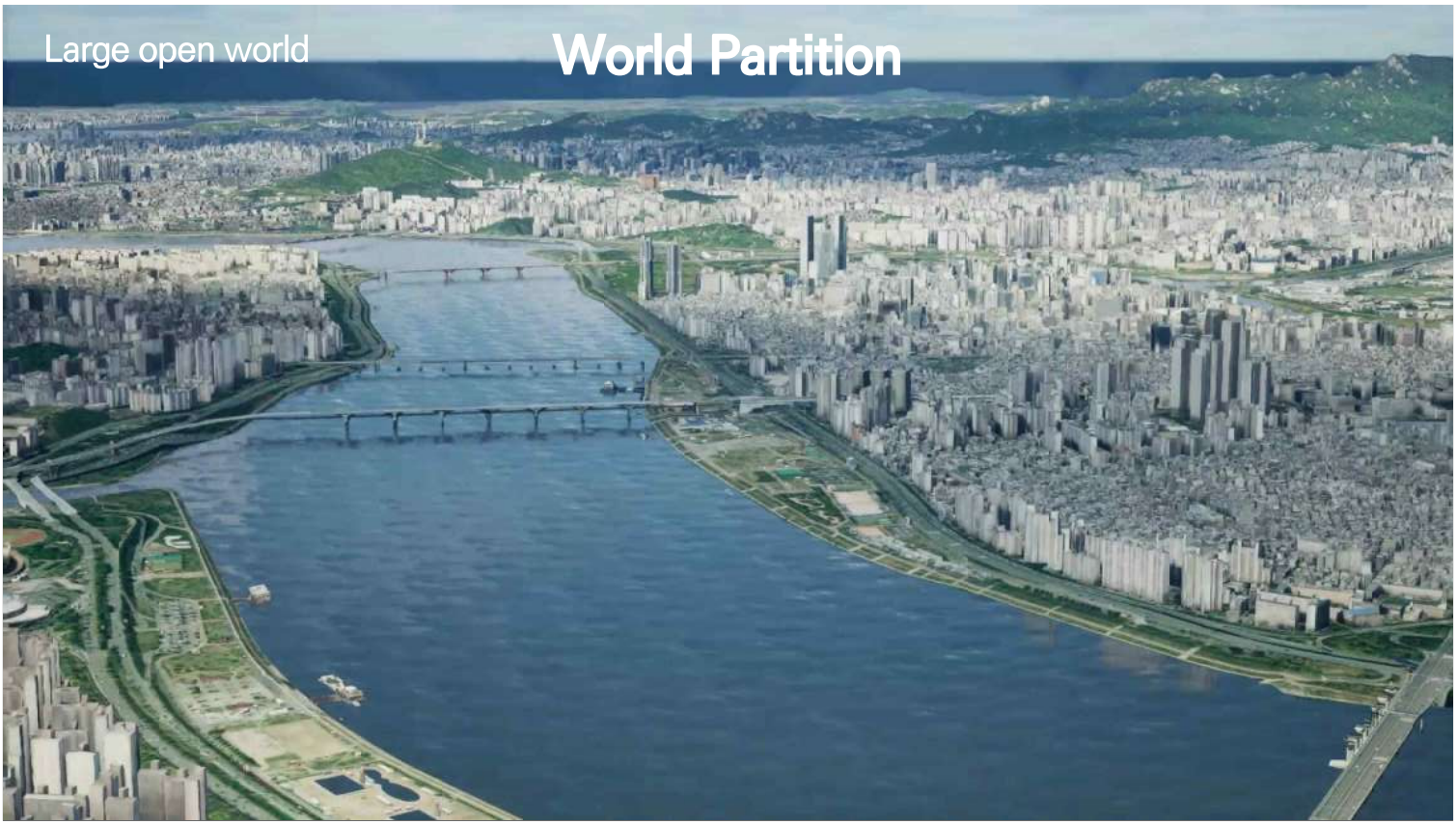
Creating a digital virtual environment using S-Map's 3D spatial data for Seoul and evaluating its usability

S-Map 3D spatial data	data conversion	Procotyping & PoC
▸ Terrain : DEM(1m×1m), Airial photos(25cm×25cm) ▸ Buildings : 700,000(LOD 3) ▸ Infrastructures ▸ Digital topographic map	3D Tiles (Helliosen)	▸ Unity Client ▸ Cesium For Unreal (World Composition)
	Digital Asset (STLogic)	▸ CesiumJS ▸ Unreal Engine (World Partition)

※ 서울시, STLogic, 헬리오센 협력 연구

워크플로


S-Map(DEM, Airial Photos, 3D Object)
Twinmotion
OGC
Making location count.
3DTiles
CESIUM ion
Building plan
SketchUp
DATASMITH
Virtual model
Houdini
blender
District plan
QGIS
CityEngine
python
geographic information


Large open world
World Partition

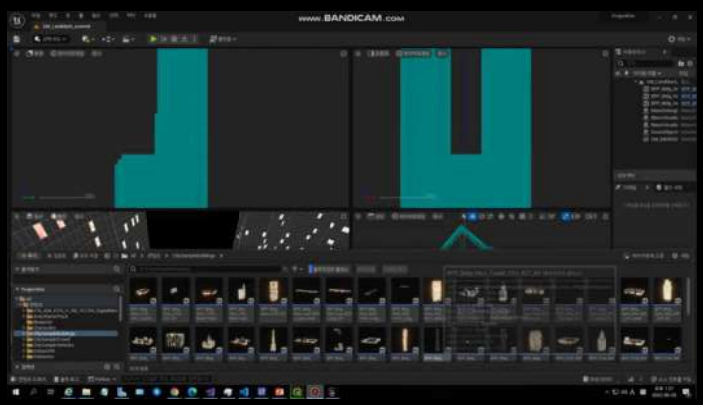
Large open world

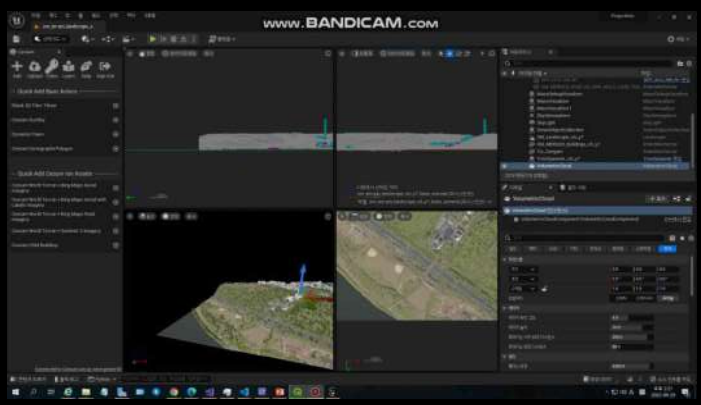
Cesium for Unreal

Future Buildings

Composition of future space considering the urban context

Modeling and Placing Objects Using the Unreal Editor





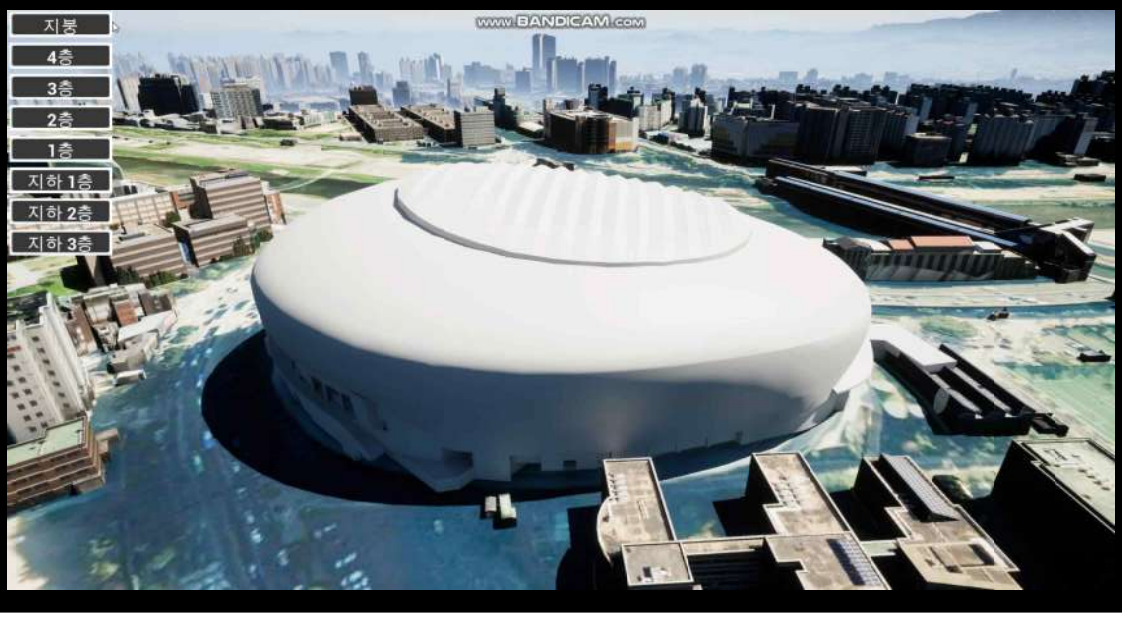
Sharing the city's future

Realistic experience through interaction

Coexistence of past, present, and future – Higher utility for long-term and large-scale projects

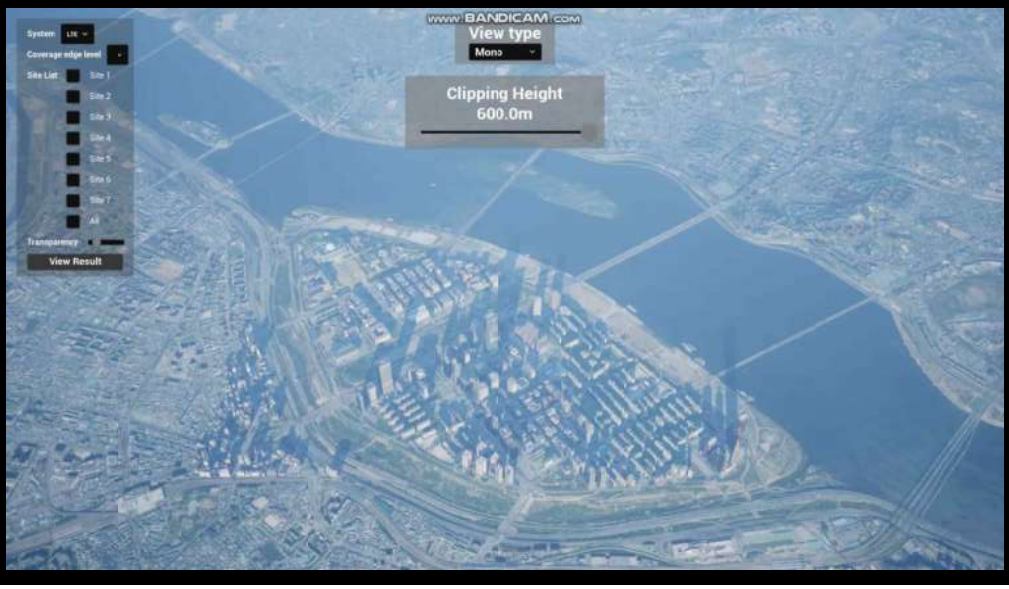
Smart city platform

Smart city platforms, city-level BIM



Radio wave simulation

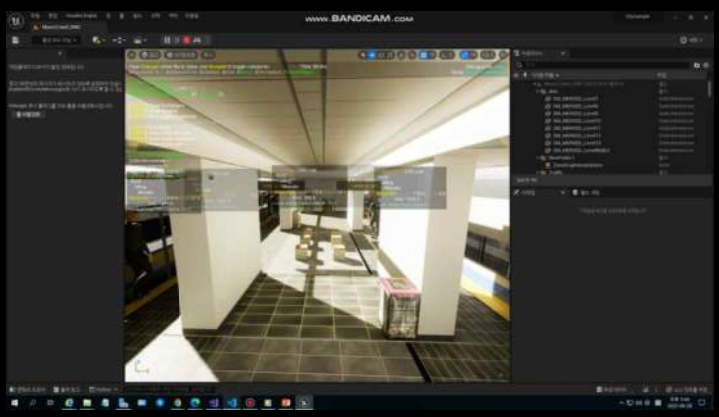
Simulation of radio wave intensity considering the three-dimensional effect of a group of buildings



Multi Agent Simulation

Micro scale-dynamic simulation of people and cars

NPC, Mass AI



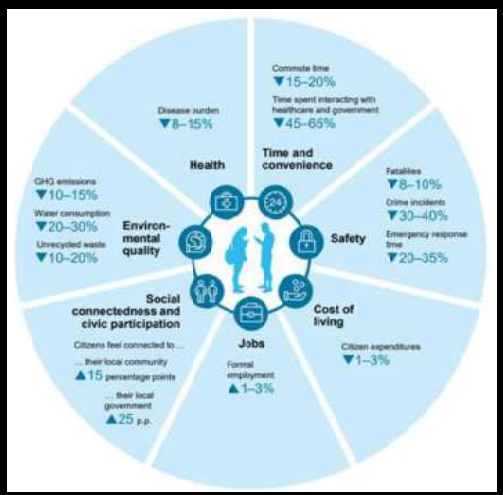
Real based Fiction

Possibility as a tool for realizing the digital virtual world

Real world

Smart City + Digital Twin + Metaverse

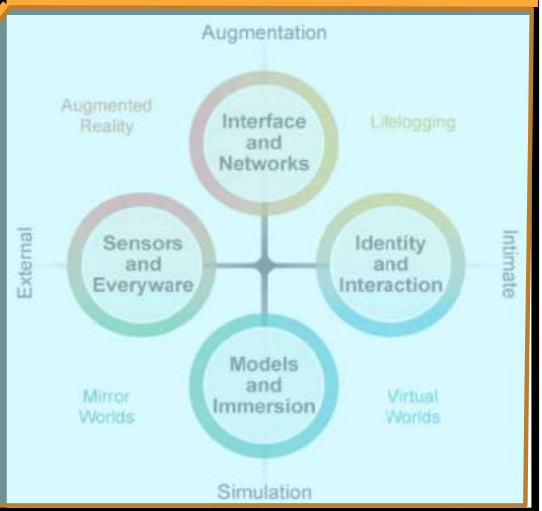
World of Experience



Improvement in smart city key life indicators (McKinsey , `18)

Management

Digital Twin (ETRI, `21)

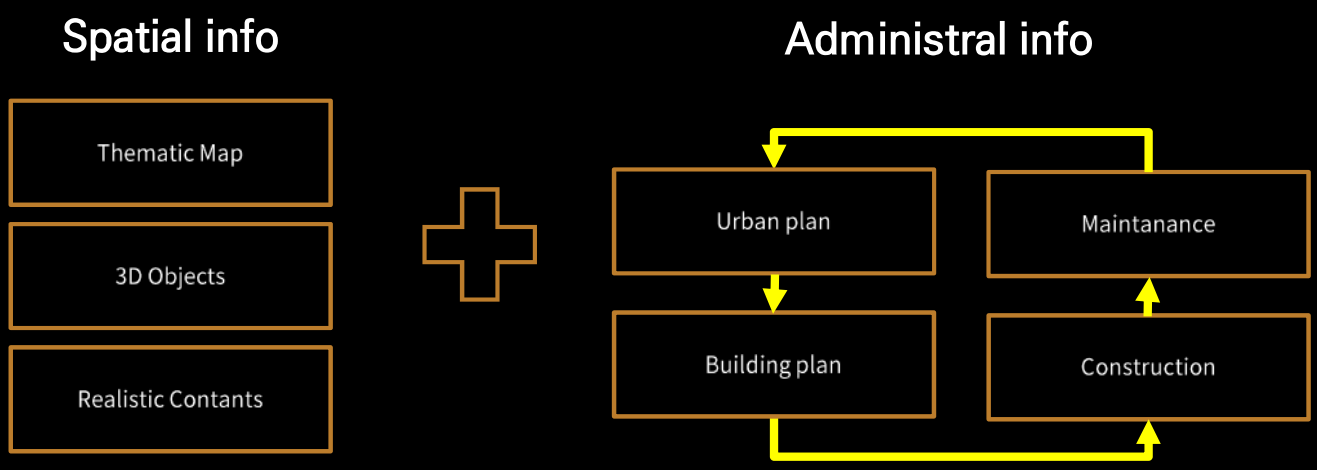


Types of Metaverse (ASF, `07)

discussion

Sustainable Spatial Data Maintanace

Parallel to the production of periodic spatial data such as aerial surveying



Data conversion pilpe lines are required

Algorithm development to solve real-world urban problems

Environmental simulation, land use change simulation etc.

Provision of 3D tile service and spatial information

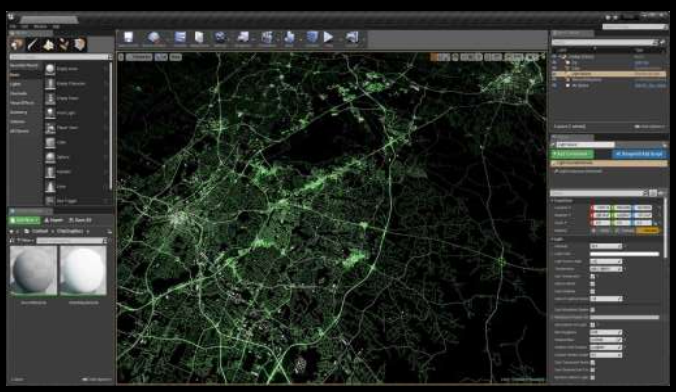
Spatial information → Creation, technology development

Public

OGC® Making location count. 3DTiles

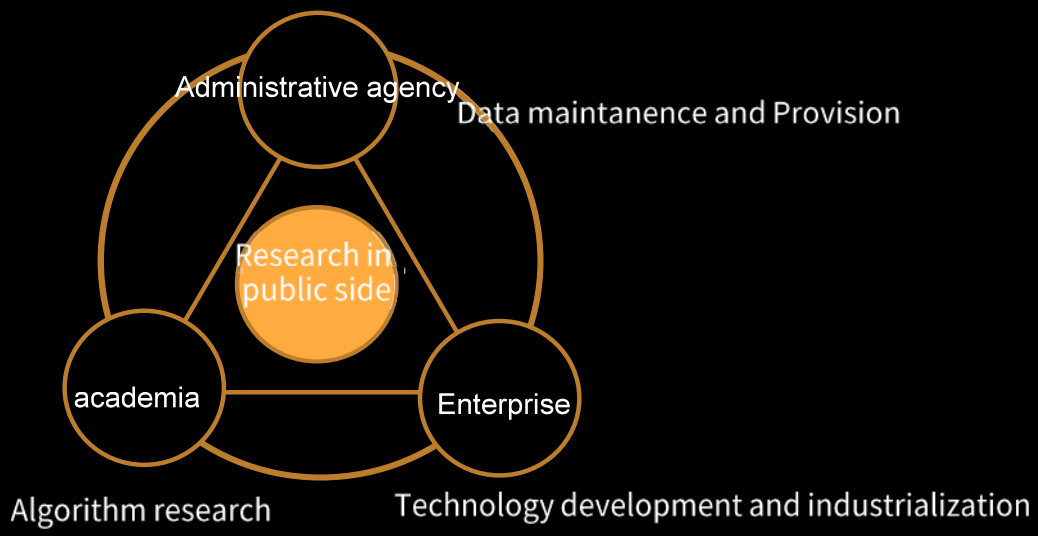
Data provision

Private



Openstreet map in unreal engine

Collaboration and cooperation for pioneering convergence areas



Thank you

Taehyun, Kim, thkim@sit.re.kr

Lecture Slides

Invited Talk 발표세션

4

Next Generation of Smart City Development through Meta-Twin Transformation

메타트랜스포메이션을 통한 미래의 스마트도시

이정훈(Jung Hoon Lee)

Speaker Profile

Prof. Jung Hoon Lee

Graduate School of Information, Yonsei University

Dr. Lee is professor at the Graduate School of Information, Yonsei University. He has diverse careers in the research fields such as Smart City Design Thinking Methodology, Development of Smart City Strategy and Performance Indicators, IoT Service Planning and Management, IoT-based big data platform, Community Living Lab. He is currently the Member of National Smart City Committee/ Smart City Committee for Seoul Metropolitan Government (Former Chair), the Special Committee Chair for Public Data Openness & Usage, Open Data Strategy Council, and the Working Committee Member of National Data Policy of the Republic of Korea

---

이정훈

연세대학교

이정훈 교수는 연세대 정보대학원 교수로서, 스마트시티 디자인씽킹 방법론, 스마트시티 전략 및 성과지표 개발, IoT 서비스 기획 및 관리, IoT 기반 빅데이터 플랫폼, 커뮤니티 리빙랩 등의 연구 분야에서 다양한 경험을 가지고 있다. 현재 국가 스마트도시 위원회 위원, 서울시 스마트시티 위원회 위원(전 위원장), 공공데이터 개발 및 활용 특별위원회 위원장, 오픈데이터 전략 협의회, 국가 데이터 정책실무위원을 역임하고 있다.

YONSEI UNIVERSITY ISi Information Systems Intelligence

2022 ICGIS - Digital Twin Driven Smart City

Next Generation of Smart City Development through Meta-Twin Transformation

November, 2022

Jung Hoon LEE, Ph.D.

Project Manager, Global Smart City Index Development Project
Director of Information Sys. Intelligence Lab & Design Factory Korea
Professor of Technology & Innovation Management,
Graduate School of Information,
Yonsei University, Seoul, Republic of Korea
E-mail: jhoonlee@yonsei.ac.kr

01

About SPEAKER

JUNGHOON / LEE

Current Status

- Professor of Technology & Innovation Management, Graduate School of Information, Yonsei University
- Director of DT (Digital Transformation) Technology Management Center, Yonsei University
- Member of the National Smart City Committee, the Ministry of Land. Infrastructure and Transport. Republic of Korea
- Vice-chairs of Smart City Committee & Data driven Public Administration Committee, Incheon Metropolitan City
- Member of the Smart Cities Committee of Seoul Metropolitan Government (former chair)
- Member of the National Data Policy Working Committee
- Chairman of the Special Committee on the Openness and Utilization of Public Data, Open Data Strategy Council

Academic Qualifications

- University of Cambridge, U.K.
  Ph.D. in Manufacturing Engineering and Management (IS)
- London School of Economics, University of London, U.K.
  M.Sc. in Analysis, Design and Management of Information Systems
- University of Manchester, U.K. / M.Sc. in Information Systems Engineering
- University of Manchester, U.K. / B.Eng. in Electronic Engineering

Industry Experiences

- Visiting Academic Fellow, University of Cambridge, U.K.
- Visiting Professor, Graduate School of Business, Stanford University, U.S.A.
- Entrue Consulting Partners, LG CNS CO., Ltd, LG Group, Korea
- (Senior Business Consultant/Senior Research Fellow)
- LG-EDS Systems Inc, Korea Manufacturing and Logistics Consultant

Academic Accomplishment
[Major Papers - Published in a total of 95 Journals/Conferences]

Lee, Y-J & Lee J-H (2016) "Knowledge workers' ambidexterity: conceptual separation of competencies and behavioral dispositions:, Asian Journal of Technology Innovation, Vol.24, No1. pp.1-22

Hu, MC,Wu, CY, Lee, JH Lu, YC (2014) "The influence of knowledge source and ambidexterity in the thin film transistor and liquid crystal display industry: evidence
from Japan, Korea, and Taiwan", Scientometrics, Vol. 99, pp.233-260 [SSCI]

Lee, J-H, Hancock, M-G, Hu, M-C (2014) "Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco", Technological Forecasting and Social Change, Vol. 89, pp.80-99. [SSCI, Most cited articles in TFS ranked 7th]

Lee, J-H, Phaal, R., Lee, S-H (2013) "An integrated service-device-technology roadmap for smart city development", Technological Forecasting and Social Change, Vol.80, pp.286-306. [SSCI, Most cited articles in TFS, ranked 6th]

Major Bibliography

『Strategic Management of Technology and Technology Innovation』

『R&D Management』

『Entrepreneurship and Innovation』

『ITS in Asia』

02

Smart Cities Index Report

Smart Cities Index Report (2017 ~ 2022)

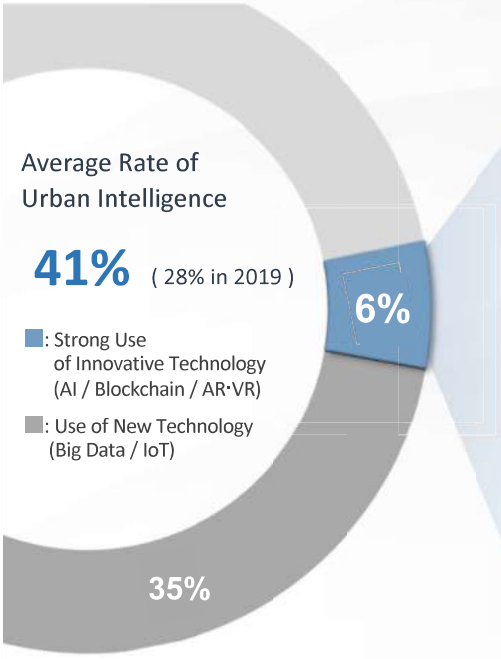
Global Index Report published every two years - Research on global-leading smart cities
to understand current status of smart cities and to present future direction of smart cities. Continuously adding new cities.

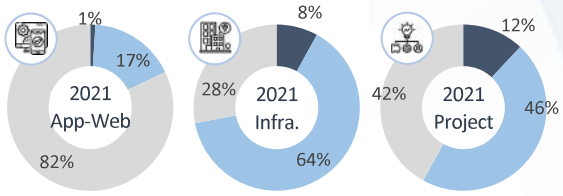
Smart Cities Index Report History

Smart Cities Performance Measurement By 8 Dimensions based on 31 cities

03

Urban Intelligence





CITIES LEADING DIGITAL TWIN

1st Seoul

- ✓ Fire Recognition System in Magok residential area
- ✓ **S-map(Smart Seoul Map)**

3rd Amsterdam

- ✓ **Local Inclusive Future Energy(LIFE) City Platform**
- ✓ Digital Twin Track

4th Helsinki

- ✓ **Jätkäsaari Smart Junction**
- ✓ Digital City Synergy


20th Incheon

- ✓ Urban air traffic complex platform
- ✓ Ifez 3차원 공간정보 서비스
- ✓ **XR Metaverse Incheon-eum**

21st Singapore

- ✓ **Virtual Singapore**

22nd Dubai

- ✓ **Dubai Here**
- ✓ One Human Reality


04

Smart Cities

Urban Project Leading the Digital twin

Amsterdam

Local Inclusive Future Energy(LIFE) City platform

▲ Integrated Smart Grid Solution

Adjustments to electricity prices and rates and integration of more sustainable energy generation can be carried out.

Area	Tech	Maturity Level
Energy & Environment	Digital Twin (based on XR)	3rd Bi-directional interaction

Helsinki

Jätkäsaari Smart Junction

▲ Vehicle speed and position data approaching the intersection are collected using sensors and mapped within a digital twin

To improve multimodal real-time traffic situation.

Area	Tech	Maturity Level
Transportation	Digital Twin	3rd Bi-directional interaction

Singapore

Virtual Singapore

▲ Analyze the buildings that have a higher potential for solar energy production

To make 3D predictions and simulations.

Area	Tech	Maturity Level
Housing & Development	Digital Twin	4th Minimum of Intelligence

Dubai

Local Inclusive Future Energy(LIFE) City platform

▲ Figure of collecting GIS information

Electronic system that provides access to geospatial data and maps of the emirate.

Area	Tech	Maturity Level
City Government	Digital Twin	4th Minimum of Intelligence

Seoul

S-Map

▲ Provides a wide variety of spatial information

Supporting policy establishment in various fields and solving urban problems.

Area	Tech	Maturity Level
Housing & Development	Digital Twin	4th Minimum of Intelligence

Incheon

XR Metaverse Incheon Eum project

▲ Songdo Convensia XR Navigation

Transition to data-driven administration.

Area	Tech	Maturity Level
City Government	XR	4th Minimum of Intelligence

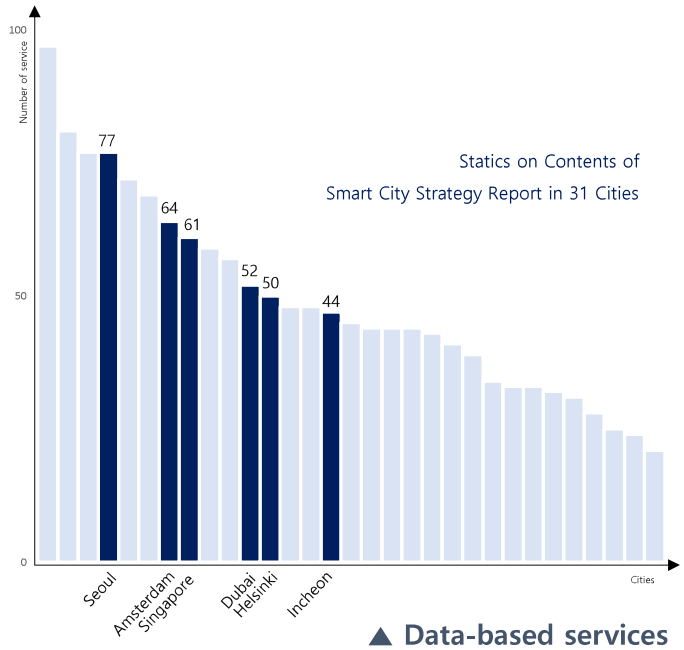
05

DATA Openness

What is Data Openness?

Data openness, one of the key determinants of a city's competitiveness, forms the foundation for digital twin projects by providing an environment for diverse talents to operate in the development of smart city services

Digital twin leading cities are also top of the list in terms of data utilization



▲ Data-based services

Leading cities carry out digital twin-related projects in areas with high data utilization among 11 data classifications.

Seoul
S-Map(Smart Seoul Map)

housing & development

Amsterdam
Local Inclusive Future Energy (LIFE) City platform

energy & environment

Helsinki
Jätkäsaari Smart Junction

transportation

Incheon
XR Metaverse Incheon-eum

city government

Singapore
Virtual Singapore

housing & development

Dubai
Dubai Here

city government

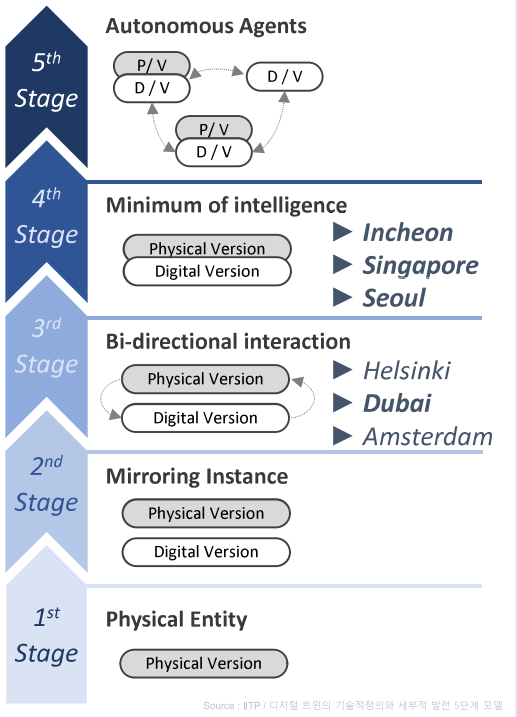
06

Digital Twin to Metaverse Extension

Digital Twin and Metaverse

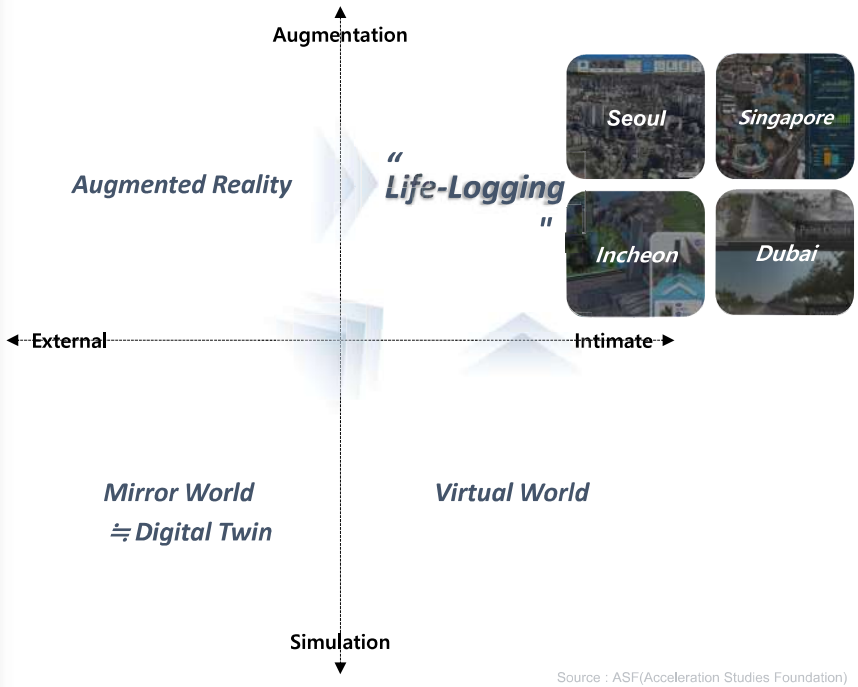
Through decision-making using the virtual environment of the metaverse, the physical phenomenon of digital twins can be identified and appropriate answers can be derived.
Some digital twin-leading cities are working on metaverse projects beyond digital twin

Digital Twin Maturity Model



Source : IITP / 디지털 트윈의 기술적정의와 세부적 발전 5단계 모델

Metaverse Load-Map



Source : ASF(Acceleration Studies Foundation)

07

Case of Seoul

Direction of Metaverse Seoul

Economy
Using Metaverse to foster Industrial ecosystems

City
Creates an XR realistic city where reality and virtuality are combined

Cultural Tourism
Can enjoy Metaverse sightseeing anytime, anywhere

Communication
Communicate more closely with citizens through Metaverse

Education
Supports realistic Metaverse learning

Administration
Realize virtual administration more convenient than reality

Source : 2022 서울스마트시티 리더스포럼 발표자료

07

Case of Seoul

Provide immersive Public Services transcending time and space!

Develop Metaverse-Based Business Ecosystem

Administrative Services via Metaverse

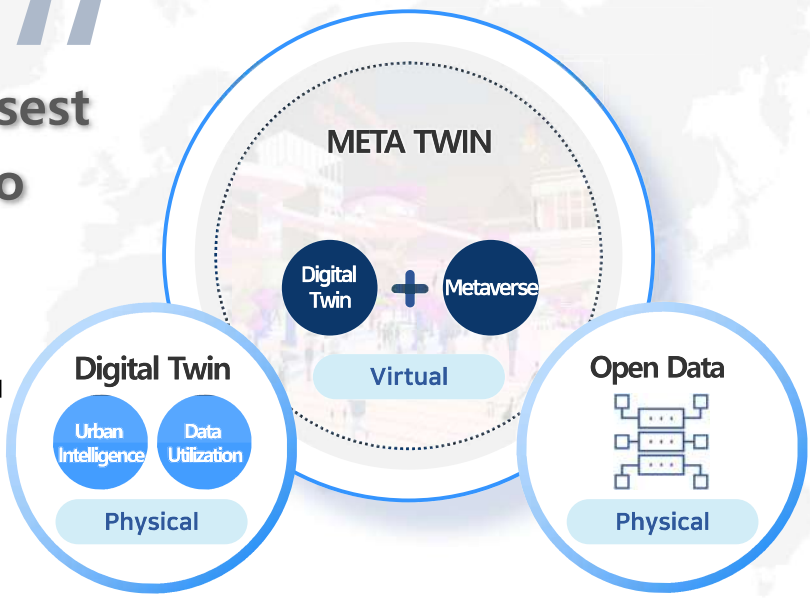
Source : 2022 서울스마트시티 리더스포럼 발표자료

08

Conclusion

Digital Twin is the closest and most basic area to prove the usability of **Metaverse**

The physical world of reality and the digital world of virtual will be connected around data



THANK YOU

YONSEI UNIVERSITY

Information Systems Intelligence

5

Measures for the Advancement of a Smart City Using Digital Twin

디지털 트윈 기반 스마트시티 고도화를 위한 방안

김익회(Ick-Hoi Kim)

Speaker Profile

Ick-Hoi Kim

Director, Smart City Research Center,
Korea Research Institute for Human Settlements

Dr. Ick-Hoi Kim is currently the Director of the Smart City Research Center, and has worked at Korea Research Institute for Human Settlements(KRIHS) since 2017. He has been a senior research fellow at the National University of Singapore from 2012 to 2017. His research areas include smart cities, geospatial big data analysis, simulation modeling, geospatial cyberinfrastructure, and high-performance computing, etc.

김익회

국토연구원 스마트공간연구센터장

김익회 박사는 2017년부터 국토연구원에서 근무하고 있으며, 2012년부터 2017년까지 싱가포르 국립대에서 선임연구위원으로 근무하였다. 그의 연구 분야는 스마트시티 뿐 아니라, 빅데이터 분석, 시뮬레이션, 지리 사이버-인프라, 고성능 컴퓨팅 등이다.

Measures for the Advancement of a Smart City Using Digital Twin

KRIHS 국토연구원

Dr. KIM, Ick-Hoi
Director, Smart City Research Center
Korear Research Institute for Human Settlements

CONTENTS

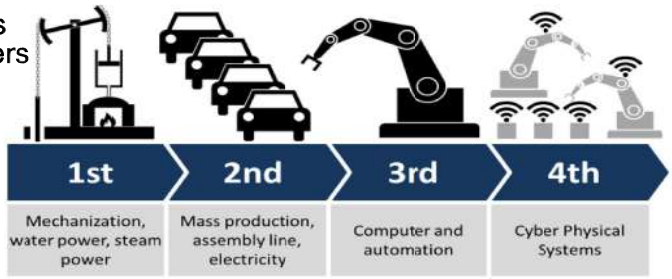
I

Smart City & 4th Industrial Revolution

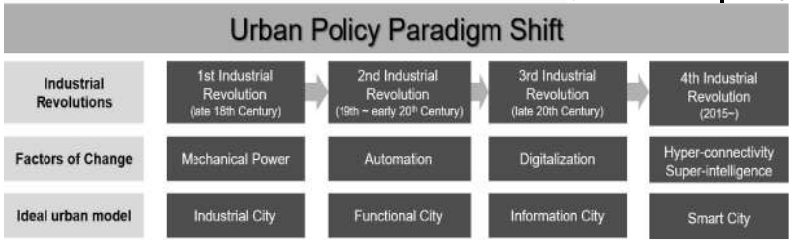
Coevolution of Cities & Industries

● The Industrial Revolution revolved around cities, resulting in urban change, either positively or negatively.

- 1st Industrial Revolution : **Invention & utilization of the steam engine led to the emergence of industrial cities**
- 2nd Industrial Revolution : Expansion & connection of cities by energy changes related to petroleum electricity, the development of internal combustion engines, mass production and the spread of automobiles, and the construction of highways
- 3rd Industrial Revolution : Informatization of cities by the birth of computers & digitalization
- 4th Industrial Revolution : Emergence of smart cities based on hyper-connectivity and super-intelligence of information cities by big data and AI



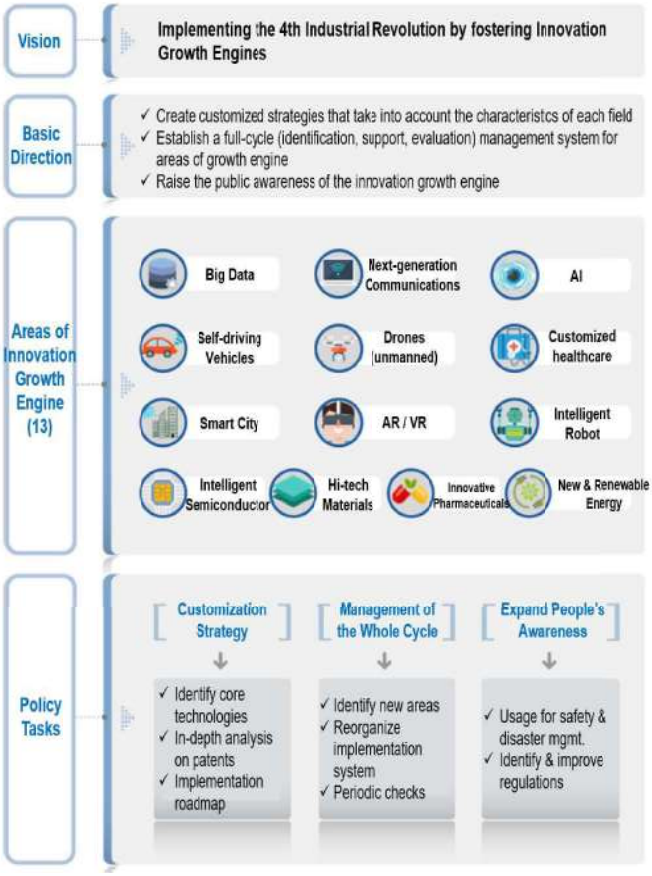
(Source: Wikipedia)



(Source: Jeong, Gyeong-seok, 2018)

4th Industrial Revolution & Smart City

- The 4th Industrial Revolution is a new industry that is based on the convergence of technologies in physics, digital, and biology and amplifies each other's fields.
- Smart City as driving engine for innovative growth
  - Dec. 22, '17 Announcement of a plan for promoting engine for innovative growth
  - Smart City, along with big data and AI, has been selected as one of the drivers of innovative growth
- Core technology of Smart City (ICBMA)



Definitions of Smart Cities

- ITU-T examined the current state of global smart cities to identify 116 definitions
- In general, smart city is defined as "an urban model that can solve various urban problems and improve the quality of life by incorporating new technologies such as ICT big data into the city."

South Korea

The term "smart city" means a sustainable city wherein various city services are provided based on city infrastructure constructed by converging and integrating construction technologies, information and communications technologies, etc. to enhance its competitiveness and livability

European Union

A smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business.

IDB(Inter-American Development Bank)

A Smart City is one that places people at the center of development, incorporates Information and Communication Technologies into urban management, and uses these elements as tools to stimulate the design of an effective government that includes collaborative planning and citizen participation.

Singapore

A Smart Nation is a Singapore where people will be more empowered to live meaningful and fulfilled lives, enabled seamlessly by technology, offering exciting opportunities for all.

United Kingdom

A city that is not a complete city, but a city that is suitable for living, resilient and capable of responding to the increase in citizen participation, infrastructure, social capital, and digital technology.

Spain

Smart City is the holistic vision of a city that applies ICTs to improve the quality of life and accessibility of its inhabitants and ensures sustainable economic, social and environmental development in permanent improvement.

Development of Smart Cities in Korea

ICT Infrastructure | Integrated Platform | Data Hub | Next?

Phase 1 (2003 ~2014)

✓ Smart city infrastructure construction
- Promotion of high-tech infra. construction projects centered on new towns
- Initiate the construction of U-City and lay the institutional foundation according to laws and decrees

Emergence of smart cities centered on leading new cities and innovation cities

- Starting with Hwaseong Dongtan ('03), smart cities around the 2nd new city and innovation city of Songdo and Pangyo were built.
- Application of smart city model that combines the already existing high-speed information and communication network infrastructure with new city space and financial resources

Construction phase

Phase 2 (2014 ~ 2016)

✓ Connection based on smart city platform
- Shifting the focus from the infra. construction to the integrated platform-based integration of information and system linkage

✓ Establishment of a governance system of the government
- MOU bet. the Min. of Land, Infrastructure and Transport (MOLIT) & Korean Nat'l Police Agency
- MOU bet. MOLIT & Min. of Public Safety & Security
- Joint project, etc. of MOLIT & Min. of Science & ICT

Info. and system connection and integration based on integrated platform

- Promotion of integrated platform dissemination project to support the linkage and integrated management and operation of the municipal urban integrated operation center

Connection phase

Phase 3 (2016 ~)

✓ Cultivation of new industries based on innovation
- Formulate policies to foster new industries based on the 4th Industrial Revolution, including the introduction of a regulatory sandbox
- Setting the direction of nat'l smart city promotion to cultivate innovative city testbeds

* Selection of Sejong, Busan, etc. as nat'l pilot cities that are built from the scratch

Residential area 5-1 in Sejong City Eco-delta City in Busan

✓ Effective solution to urban problems
- Smart city urban regeneration project to solve the problems of declining cities
- Expanded support for urban regeneration, including 5 pilot districts in '17, and more than 4 scheduled to be selected each year

Phase of promotion in full-scale

(Source: Lee et al., 2018)

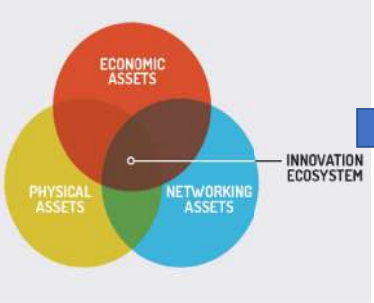
II

Smart City: Plaform of Plaforms

Urban Innovation Ecosystem

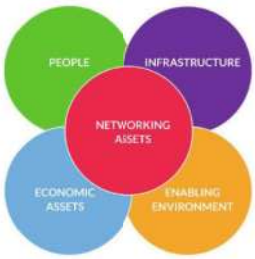
- Physical assets (yellow): Pedestrian-friendly streets, public spaces
- Economic assets (red): Startup space, relevant institutions, corporate research facilities, technology transfer institutions
- Networking assets: Establishing public and private relationships

Brookings Institute

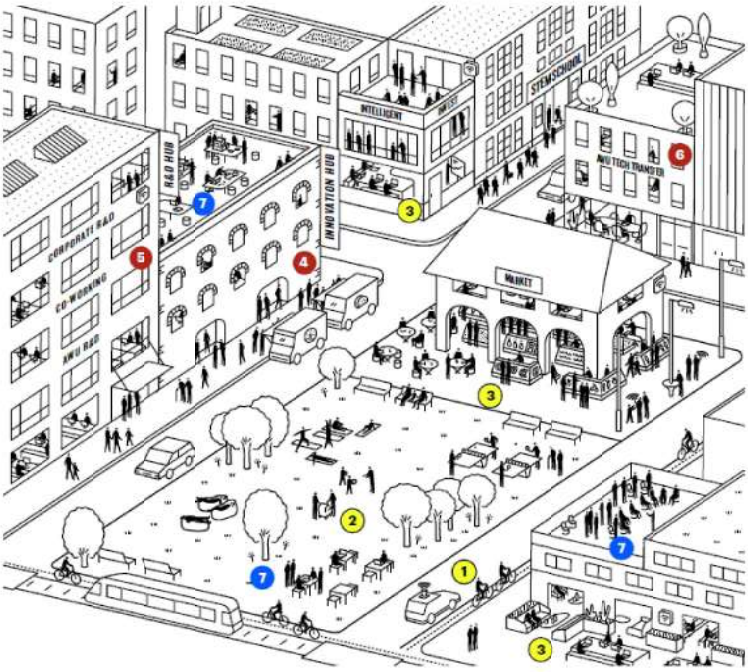


(Source: Katz and Wagner, 2014)

World Bank



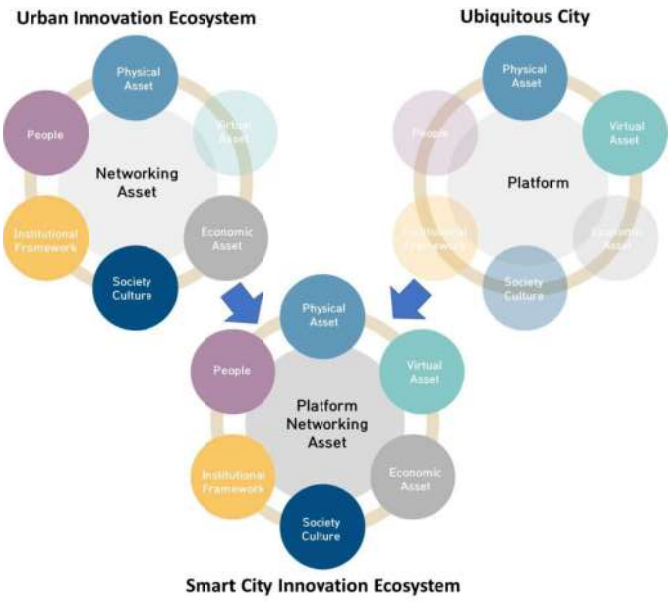
(Source: Mulas et al, 2015)



Brookings (2017, p.12); Requoted by Kim, Hyeong-ju, Jeong, Mi-ae (2017)

Smart City Innovation Ecosystem

Asset	Contents
Platform or networking assets	In a smart city, a platform is a key component to help network occur across human assets, physical assets, virtual assets, economic assets, institutions, and social cultures.
Physical assets	Physical assets, as discussed in the urban innovation ecosystem, are infrastructure that encompasses public and private facilities such as pleasant working & living environments, transportation, communication networks, neighborhoods, and offices.
Virtual assets	Virtual assets refer to the data and information collected by sensors and citizens in response to physical assets, and are also associated with city operations based on AI analysis of big data, and virtual worlds in digital twins.
Economic assets	Elements that are closely linked to the innovation ecosystem in economic terms, including actors of innovation such as companies, universities, and research institutes, as well as the capital that supports them economically. Urban Tech is particularly involved with startups that creatively solve urban problems.
Human assets	Entrepreneurs who are the most important actors in the innovation ecosystem and citizens who are the most important actors for urban innovation
Institutional framework	While it is necessary to create a private-led smart city innovation ecosystem rather than a government-led policy, the creation of a private-centric innovation ecosystem requires institutional support from the government, such as public data openness and data governance, intellectual property protection, and negative regulation.
Society & culture	Across the innovation ecosystem, innovation comes from creative talent, which requires a creative entrepreneurial spirit that is not afraid of failure and is constantly able to try new things. This spirit must have a cultural support that allows us to respect diversity and trust and collaborate with each other.

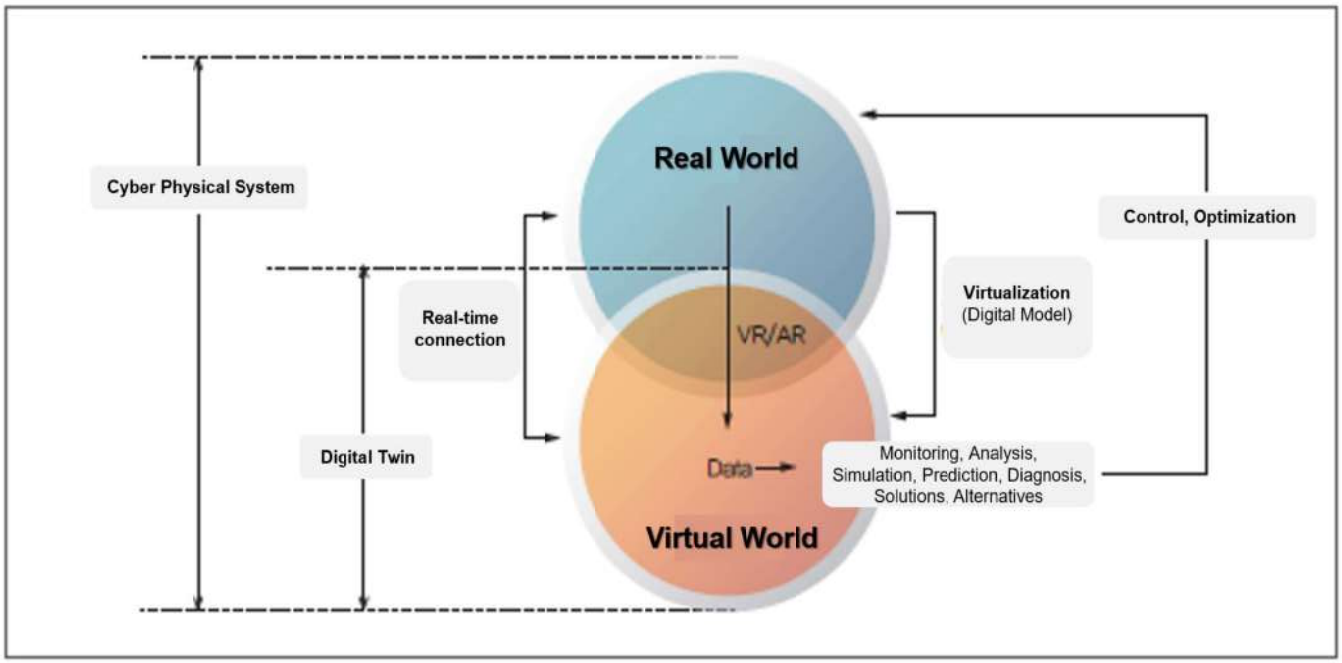


City: Platform of Platforms

III

Digital Twin as a Smart City Platform

Digital Twin

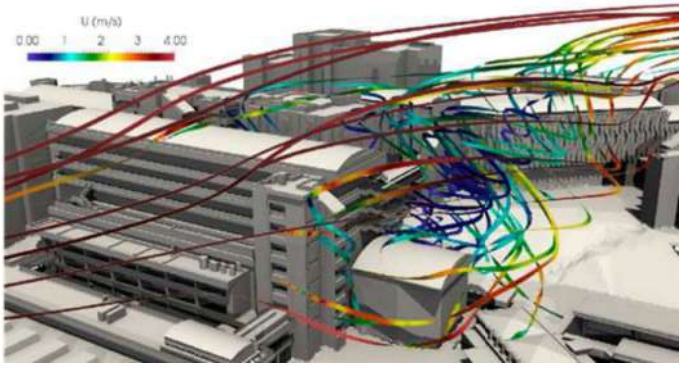


(Source: Sagong Hosang, et al., 2018)

(Source: GE, 2018)

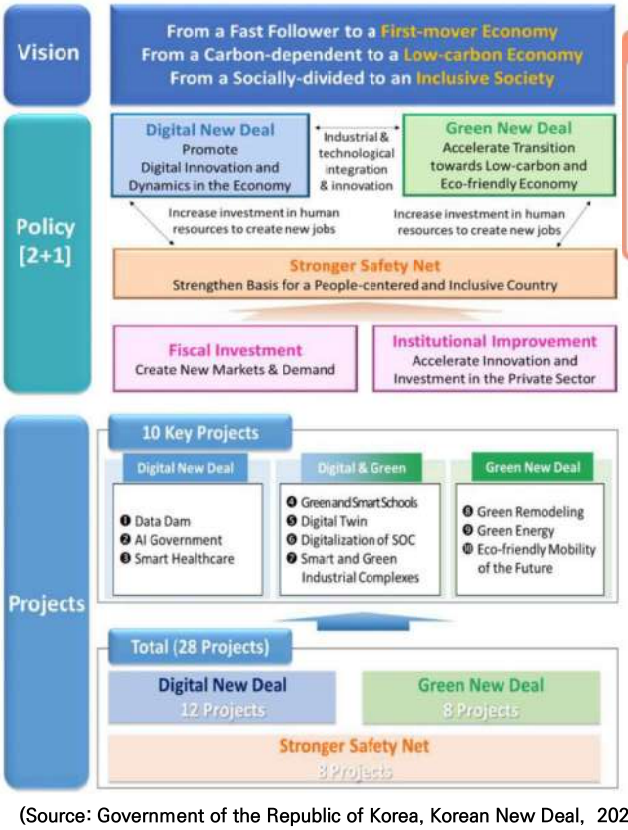
[Campus congestion analysis using WiFi user information]

[Wind path analysis using digital twin]

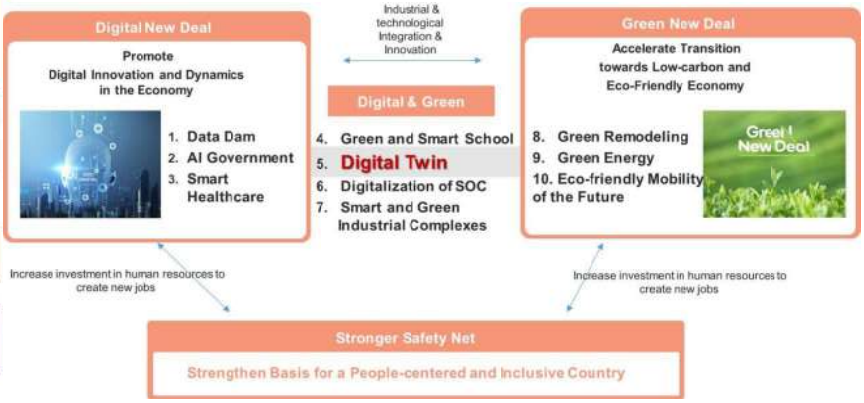


(Source: Virtual NUS, 2018)

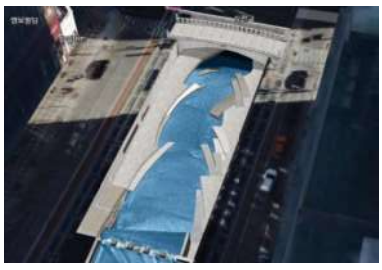
Korean New Deal & Digital Twin

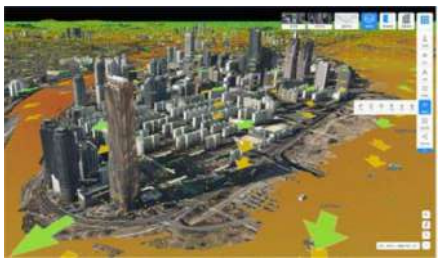


(Source: Government of the Republic of Korea, Korean New Deal, 2020)



(Source: Government of the Republic of Korea, Korean New Deal 2020; Seong 2021)





(Source: Seoul Metropolitan City 2021)

New Government Policies

No. 38 Support for efficient growth strategy of national space(Management Plan for National Policy Goals)

38 국토공간의 효율적 성장전략 지원 (국토부)

□ **과제목표**

○ 그간 균형발전 노력에도 불구, 수도권에 경제·인구 집중은 심화되고 있어 새로운 균형발전 정책을 통해 골고루 잘사는 대한민국을 실현할 필요

□ **주요내용**

○ (메가시티 조성) 기업이 스스로 투자하고, 개발하여 일자리를 창출하고, 지역 혁신을 견인할 수 있는 환경 조성

- 기업혁신파크, 도심융합특구, 캠퍼스혁신파크 등 기존 성장거점을 조성하여 규제특례, 각 부처 R&D 사업 등을 패키지로 지원
- 지상철도시설 지하화 등을 통해 구도심을 미래형 도시공간으로 재구조화

○ (강소도시·낙후지역 육성) 신규 국가산단 조성, 역사·문화 등 지역의 고유자산을 활용한 지역특화 재생 등을 통해 차별화된 강소도시 육성

- 인구 유입과 정착을 위해 주거·일자리·생활인프라가 결합된 생활 거점 조성
- 새만금 국제투자진흥지구 개발(투자여건 개선, 인프라 지원 등) 통해 민간투자 촉진
- 혁신도시를 인재와 기업이 모이는 지역거점으로 강화
  * 산업은행 부산 이전 추진 및 혁신도시 특화 지원방안 마련

○ (도시계획 개편) 규제 없이 자유로운 개발을 허용하는 '도시혁신계획구역'과 주거·업무 등 도시기능을 융복합할 수 있는 '복합용도계획구역' 도입

- 국토도시공간전략계획 수립 및 생활권 도시계획 도입을 통해 미래 여건 변화 및 새로운 공간 수요 대응

○ (국토 디지털화) 고정밀 전자지도, 3차원 입체지도 구축 등을 통해 디지털 트윈을 조기 완성하여 교통, 환경, 방재 등 도시문제 해결에 활용

- 스마트시티 시범도시(부산, 세종)를 완성하고, 강소형 스마트시티 추가 조성

□ **기대효과**

○ 메가시티·강소도시 육성과 연계를 통해 수도권에 대응하는 초광역권 형성

○ 디지털트윈 조기 완성, 도시개조 체계 개편을 통해 미래 혁신 기반 마련

Presidential Committee on "Digital Platform Govt."

대통령직속 디지털플랫폼정부위원회 **보도참고자료**

보도 일시	2022.9.2.(금) 행사 종료시점 (별도 문자 공지 시)	배포 일시	2022.9.2.(금) 09시
담당 부서	디지털플랫폼정부추진단 기획총괄과	책임자	과장 김남철 (02-750-4720)
		담당자	사무관 김 현 (02-750-4762)

대통령 직속 디지털플랫폼정부위원회 출범

□ 인공지능·데이터 등 신기술분야 현장경험 있는 최고 전문가 19인으로 구성

□ 분기별로 국무회의에 위원회 활동 보고로 정책의 실행력 확보

□ 대통령 직속 위원회인 디지털플랫폼정부위원회(위원장 고진, 이하 '위원회')가 9.2일(금) 공식 출범했다. 윤석열 대통령(이하 '윤 대통령')은 이 날 오전 10시, 용산 대통령실에서 열린 위원회 출범식에 참석하여 민간 위원을 위촉하고 앞으로의 추진방향을 논의했다.

□ 디지털플랫폼정부는 모든 데이터가 연결되는 '디지털 플랫폼' 위에서 국민, 기업, 정부가 함께 사회문제를 해결하고 새로운 가치를 창출하는 정부로,

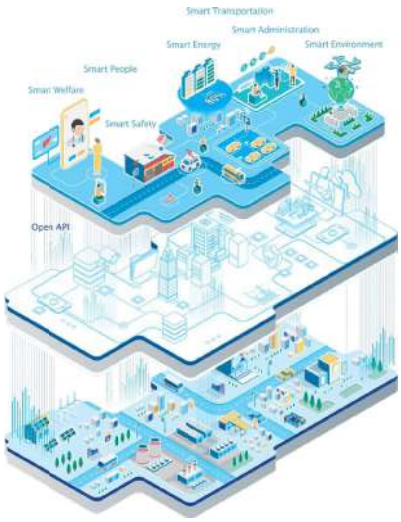
○ 정부가 독점적인 공급자로서 일방적으로 서비스를 제공하는 현재의 방식에서 벗어나, 민간과 협업하고 혁신의 동반자가 되는 국정운영의 새로운 모델이자 윤석열정부 핵심 정책 추진과제이다.

Digital Twin : New Smart City Digital Platform

- The model of a Korea smart city is a sustainable city that provides various urban services based on the existing urban infrastructure by combining construction and ICT.
  - Since the U-City, we emphasize the convergence of ICT and construction technology, and aim for a data-driven informatization city.
  - Recent policy trends are also oriented towards building data hubs based on big data, AI, and the IoT, and building digital twins.

- Oriented towards the City-As-A-Platform
  - **Implementation of virtual space to mirror physical space**
  - **Building a platform that connects physical and virtual spaces**

- Digital Twin: Digital Platforms for Cities
  - **Connect virtual space and physical space**
  - **Networking in virtual space**
  - **Digital Platform for e-participation for decision-making and policy making with citizens**



Thank You!

KRIHS 국토연구원

Panel Discussion

종합토론 패널 참여자

좌장(Moderator)

홍상기(SangKi Hong)
안양대학교 교수 | Professor, Anyang University

권영상(Young Sang Kwon)
서울대학교 교수 | Professor, Seoul National University

김경민(Min Kim)
한국 IDC 이사 | Director, KOREA IDC

윤종수(Jong Soo Yoon)
국토부 국토정보정책과장 | Director, National Spatial Information Policy Division, MOLIT

조기웅(Gi Woong Jo)
인천광역시 스마트 GIS 팀장 | Manager, Smart City GIS Team, Incheon Metropolitan City

---

문보경(Bo Gyeong Mun)
전자신문 차장 | Senior Reporter, The Electronic Times

Note

Note

Note

Note

Smart GEO Expo 2022
2022 스마트국토엑스포

KRIHS
Korea Research Institute for Human Settlements