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A Research of Planning & Design Methods for Smart City Services and Technologies

조상규 Cho, Sangkyu
김영현 Kim, Younghyun
박성남 Park, Sungnam
남성우 Nam, Seongwoo
윤호선 Yoon, Hosun
문보람 Moon, Boram
이제승 Lee, Jaeseung

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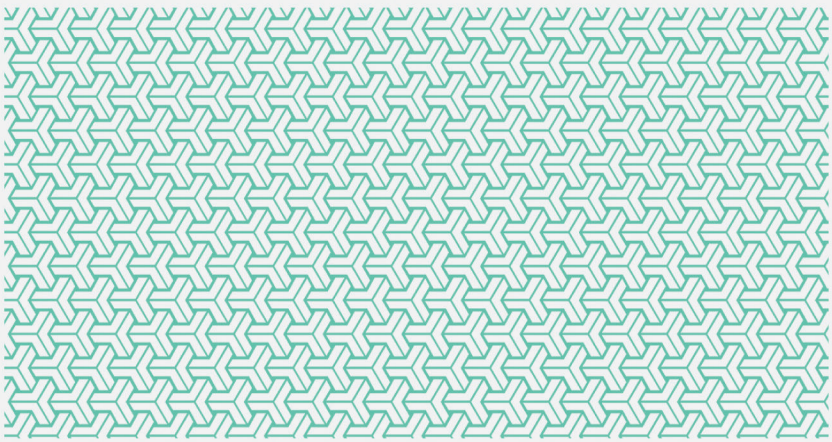
Summary



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1. Study Overview

As urban smartization is rapidly progressing through the development of 4th industrial revolution technologies and services, it is essential to predict and respond to changes in physical space in smart cities. Under these circumstances, the possibility of connection with technology and services is checked through the question of whether architecture and urban space planning are preparing and responding to the change to a smart city, and the space of future smart city services and infrastructure It is necessary to find a direction for planning.

Therefore, the purpose of this study is to predict the change of urban space according to the development of the 4th industrial revolution technology, and to suggest the direction of spatial planning considering smart city technology and service through research and analysis of smart city technology and service based on spatial planning.

2. Discussion of discourse related to future urban space change

The following is a summary of the discourses of futurists regarding changes in urban space, the preparations and changes of smart city researchers due to smart technologies and services, and the results of predictions about the latest smart city technology and service trends and changes by urban space.

☐ Prediction of changes in urban spatial structure

- The residential area of the smart city is changed to a mixed structure of micro-based satellite work space and education space in units of neighborhood districts and Inbo-gu that are smaller than neighborhoods
- 15 minutes Proximity to direct residence such as city concept

and minimized living area

- Dedicate a parking or vehicle space to a sidewalk or table space
- Airflow in the city, urban structure that can control temperature, and park layout
- Establishment of urban space plans centered on small neighborhood parks, linear parks, and green areas to improve accessibility in the future

☐ Predicting changes in mobility and transportation infrastructure

- A society in which various mobility using autonomous driving technology becomes important
- Switch to zero carbon public transport mode, such as walking, biking, etc.
- Renovation of road space, such as for exclusive use of automobile roads, to expand bicycle paths such as bicycle highways
- Prepare a public transportation system in the city center such as Air Taxi
- Change from an individual vehicle-centered road space to a pedestrian-oriented street environment through the introduction of autonomous vehicles and smart infrastructure
- Horizontal space structure considering PM
- UAM Required Infrastructure: Vertiport, Maintenance, Charging Station / Considerations: Operation Environment, Temporary Flight Restriction, Actively Controlled Airspace
- Vertiport location is adjacent to existing highways and other noisy infrastructure to reduce UAM noise problems and secure low-altitude airspace
- Vertiport (a large landing site consisting of several Vertistops) and Vertistop (a single take-off and landing point)

- Renovation of the top floor of a building-style parking lot in the city center into a PAV take-off and landing facility
- Property rights and privacy issues that may arise when PAVs fly between tall buildings in the city center
- Reorganize the ground to be pedestrian-centered by making the logistics system tunnel-underground

☐ Prediction of changes in residential, commercial, and business buildings

- Building renovations to help carbon neutrality and climate resilience
- Flexible architectural plan structure that responds to changes in population and household structure
- Building automation and smartization through IoT
- Online conferencing, telecommuting, food delivery, automatic door opening and closing to mitigate the spread of the virus, preferred technologies for people with disabilities
- It is necessary to change the housing standards such as the minimum housing standard and the number of rooms for each use due to changes such as the flat expansion of the residential space, the increase in single-person households, and the complexization of residential spaces.
- Changes in the required area for retail commercial space due to a decrease in the demand for commercial space

☐ Predicting changes in other urban infrastructure such as energy

- Implementation of carbon-neutral energy supply methods such as renewable energy sources
- Installation of canopy networks for intelligent street lights and other city services

☐ Prediction of changes in the urban information system

- Standardization for data linkage and sharing and establishment of a system for integrated management and operation of dispersed data
- All infrastructure in the city will be combined with IoT to collect data and full automation will be realized

3. Discussion of spatial-based smart technology and service survey results

☐ Street environment spatial characteristics following the introduction of autonomous vehicles

The introduction of autonomous vehicles is expected to lead to rapid changes in urban space, and in the case of Toronto, Canada, in 2035, due to changes in the urban traffic environment following the introduction of fully autonomous vehicles, spatial characteristics of the street environment different from before are presented. have.

Hyundai Motor Company and Toyota Motor Company presented a new future shape that mobility will change at the '20 CES Consumer Electronics Show. Hyundai Motor Company presented a smart city that links an autonomous driving shuttle and a flying car, and Toyota Motor presented a smart city image through the harmony of users, autonomous driving shuttles, and buildings.

Hyundai Motor's future city has several hubs that connect autonomous shuttles and flying cars. It is a transportation system that installs hubs all over a large city, moves to the hub with an autonomous shuttle, and moves to other parts of the city or other cities through a flying car.

Toyota Motor Corporation announced plans to build a new smart city (Wooven City) with the theme of self-driving shuttles and coexistence of

people, and it is a project that is currently under construction. Wooven City is an urban development project that aims to develop into a self-driving smart city by utilizing the Toyota factory and surrounding land in Shizuoka Prefecture, Japan (700,000 m2). This is the core of urban development.

What is attracting attention is that it is a transport-only road network built underground, where small autonomous robots transport goods and deliver goods directly to the living room of each household through an elevator. In addition, various roads were designed such as vehicle roads that can be driven by pollution-free autonomous vehicles such as Toyota's electric vehicle model 'e-Pallet', trails where pedestrians and personal mobility services coexist, and park trails exclusively for pedestrians.

☐ Changes in urban space due to the decrease in private cars

Self-driving cars and shared cars are expected to reduce the number of privately owned cars and, along with that, the number of parking lots is expected to decrease by about 46-93%.

. In particular, it was argued that the road area would also be significantly reduced. The reduced parking lot and road space are expected to include parks, open-air cafes, community spaces for residents, and spaces for pedestrians, cyclists, and PMs.

Among them, it is predicted that the piloti structure of multi-family houses to secure parking lot will be filled with other uses such as residential facilities and shopping malls. It is designed in a shape similar to the taxi waiting area, and it is predicted that the existing large-scale parking lot will be greatly reduced.

☐ Reduction of the radius of the living area

The development of information and communication brings about changes in urban space. The radius of the living area will be gradually reduced, and it can be expected that the radius of the living area will be

reduced and densified along with the mixing of urban space uses. Therefore, urban space in living zones will become more important.

As a representative overseas case, the '15-minute city' plan in Paris, France can be cited. Its main goal is to build an infrastructure that allows people to live in a distance that can be reached in 15 minutes. It is a plan to renovate the urban space so that bookstores, grocery stores, small stores, schools, cultural facilities, medical facilities, and public services can be accessed within a 15-minute walk.

In Korea, communication infrastructure is established stably, but there is a large variation between the metropolitan area and non-metropolitan areas. is presumed to be necessary.

☐ Location of urban space, such as residential areas for energy generation facilities

In order to solve the problems in the energy sector in smart cities with smart technology and increase the energy supply of the city itself, it is necessary to additionally expand renewable energy power generation sources in the smart grid system. It is required to activate an energy-sharing community and create an urban ecosystem for sharing optimization.

Energy efficiency is understood as an important means of improving the urban environment, which is the main purpose of smart city construction, and the intelligent power grid (smart grid) is discussed as an important new technology in terms of energy efficiency in smart cities.

Busan Eco-Delta City, a national pilot city, is building an urban eco-friendly energy generation model by supplying optimal new and renewable energy according to the smart city electricity demand forecast. In order to consider the intermittent characteristics of eco-friendly energy and to propose power generation facilities optimized for the city center, a fuel cell (SOFC)-centered high-efficiency energy power generation source was constructed to minimize the power generation area and focus on power generation.

In the past, these energy facilities have been selected as separate facilities, but in a smart city, energy generation systems and related facilities must be introduced in the city center, so space planning must be reflected and related systems must be improved.

4. Direction of spatial planning considering smart technologies and services

In the direction of future urban space change and spatial planning, the major achievements of this study, first, strategies for realizing future smart urban space through smart city technologies and services were presented. The detailed strategies were presented as resolving regional imbalances, densification of living areas and development of station-oriented smart cities, activation of microgrid-based distributed energy for climate change and carbon neutrality, and expansion of smart welfare such as priority application of technologies and services to declining areas.

In conclusion, the spatial planning direction in consideration of smart technology and service, which is the key achievement of this study, is presented as follows. First, for a street space considering autonomous driving and PM, the function and physical form of the street space should be flexible, and convergence to accommodate various functions and planned considerations for autonomous vehicle, PM, bicycle, and pedestrian spaces.

Second, for the aerial space considering UAM, it is expected that new issues such as noise and privacy issues will arise from flying around buildings. Measures such as limiting the height of surrounding buildings are required to avoid safety hazards and interference during take-off, landing and flight.

Third, for a residential space with a complex energy facility, it is

necessary to control the solar radiation shielding of the space to secure the amount of insolation for the smooth development of new and renewable energy and to install it in a location with a high open rate. Activation by providing incentives was proposed. At the same time, it was suggested that consideration should be given to easing the separation distance regulations according to the current housing construction standards in preparation for the creation of a hydrogen charging station and fuel cell power plant complex, or to secure a buffer zone to secure safety in the city center.

Keywords

Smart city, Smart technology/service, Spatial application, Change prediction, Planning direction