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A Study on the Public's Crisis Management Efficacy and Anxiety in a Pandemic Situation

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1. Introduction

The key word that is emerging the most in relation to the future society is the 4th Industrial Revolution. The 4th Industrial Revolution was presented at the World Economic Forum (WEF) in 2016, and refers to a new industrial era based on information and communication technology (ICT). The 4th Industrial Revolution can be said to be an evolved industrial revolution of the 3rd Industrial Revolution, represented by the development of an automated production system and the knowledge and information industry based on computers and the Internet. In particular, the 4th Industrial Revolution features hyper-connectivity that connects and converges new types of technologies and services such as IoT-Internet of Things, artificial intelligence, big data, virtual augmented reality, and blockchain based on information and communication technology.

As hyper connectivity in the era of the 4th Industrial Revolution has emerged as a new trend, various social, economic, and cultural changes are emerging based on this. Hyper connectivity is an important topic in the field of crisis management and can be used as a strategic concept to establish an effective crisis management system. In particular, for infectious disease crises such as MERS, SARS, and COVID-19, non-contact between people and things becomes an important means of prevention and response. Accordingly, the hyper connectivity pursued by the 4th industrial revolution technology can strengthen non-contact, which is increasing in importance.

Therefore, this study aims to discuss the direction of use of the 4th Industrial Revolution technology that can strengthen non-contact for spaces where contact between people and people and things occurs frequently. In order to achieve this research purpose, elevators, which are frequently used by citizens as closed spaces vulnerable to infectious disease crises, and where people and things frequently contact each other, were set as research subjects. In addition, it is intended to grasp the current status of the 4th industrial revolution technology that can be applied to elevators, focusing on ICT and IoT.

2. Introduction Crisis Management and Fourth Industrial Revolution Technology

2.1. Crisis Management and Future Crisis

Crisis management is a process for respecting and implementing human dignity, and is to effectively plan, coordinate, and control resources to protect the lives and property of the people from national crises. The crisis management system consists of four stages: prevention, preparation, response, and recovery to comprehensively manage the crisis. Prevention and preparation is an activity that takes place before a crisis occurs, and prevention is an activity that evaluates the risk of a crisis and tries to reduce the risk, and preparation is an activity that develops capacity to respond to a crisis. As a process after a crisis, response is a process in which direct activities of crisis management organizations are carried out to minimize crisis damage, and recovery is a long-term and continuous activity in which measures necessary to recover to a pre-crisis state.

The crisis environment in our society is getting worse, such as the increase in weather and natural disasters due to climate change, the increase in dangerous facilities due to the advancement of industrialized society, and the possibility of a new crisis due to technological development and environmental changes (in addition, 2018). In particular, the types of crises in the future society are changing into more complex and large-scale forms than natural and social disaster crises appear individually.

2.2. Fourth Industrial Revolution Technology

The 4th Industrial Revolution can be understood as a process of connecting big data to the Internet of Things (IoT) and turning it into artificial intelligence (AI). First, big data can improve economic productivity by providing accurate and rapid data in real time. In addition, the Internet of Things (IoT) refers to a high-tech technology that attaches artificial intelligence sensors to objects and exchanges

data on them in real time through the Internet, which can establish an environment that connects people and objects to information channels. Accordingly, the 4th industrial revolution technology can be understood as a fusion of information and communication technology (ICT) such as big data, the Internet of Things (IoT), and artificial intelligence (AI).

2.3. Future Crisis and Fourth Industrial Revolution Technology

Among the types of future crises, it is most important to minimize the spread of the virus in new infectious disease crises such as COVID-19. To this end, a technology that can prevent human-to-human transmission is required, and it is necessary to reduce the congestion related to the use of facilities. In the space where we live, the space with high utilization and congestion is the elevator. It is necessary to reduce congestion by maintaining safe movement and physical distance of elevator users and to install handrail cleaning, air cleaning, remote call, and connected services. Accordingly, there is a need for ICT technology convergence in which buildings and cities minimize social and economic losses caused by viruses and reduce potential effects.

Accordingly, ICT convergence technologies linking digital technologies and the Internet of Things (IoT) are being activated and the market is expanding. By installing various sensors in the elevator, interconnection is improved to measure or identify doors, shaft alignment, motor and elevator speed control, and maintenance and predictive maintenance diagnosis and sensor technology are activated, enabling advanced systems such as automatic ventilation.

3. Smart Elevator Technology and Industry Trends

3.1 Smart Elevator Industry

Elevators, escalators, moving walk, etc. are essential to modern people's lives, including residential life. They are a long-term recycling industry that repeats manufacturing→installation→maintenance→remodeling every 15 to 20 years.

In addition, it is a high-value-added technology industry led by advanced countries that requires multi-level job creation, repair, and replacement of pre-installed elevators, and is highly profitable compared to development investment in other industries.

Korea's smart elevator industry is a promising export industry, including No. 1 in IT, No. 9 in machinery, No. 5 in automobile, and No. 3 in elevator installation, and has excellent potential in convergence technology, parts materials, mechatronics technology, and base industries.

3.2. Smart Elevator Technology

Smart elevator technology is an industry with a large ripple effect before and after manufacturing, and it is necessary to secure competitiveness by expanding R&D through technology development roadmap, and implementing platforming of ICT convergence technologies such as digital security systems, remote control smart grouping, and cable free lift is changing the elevator market. Smart technologies such as virtual reality (VR) and augmented reality (AR) technologies are combined to accurately measure, identify, and provide services such as safety accidents, and efficiently move passengers or objects during traffic hours through advanced routing technologies. Recognizing the ICT convergence technology market as a key field of transportation that can innovate in the future, continuous technology development and investment are being promoted on various platforms such as IoT, artificial intelligence, and dedicated terminals, centering on elevator global companies.

3.3. Smart Elevator Industry Trends

Looking at the regional market of global smart elevators, it shows a continuous growth rate. In North America, the smart elevator market is being formed with the modernization of traditional architecture and the concept of intelligent architecture. Europe is mainly pushing for huge investments in green buildings and smart city development, led by government agencies, and is focusing on expanding its business by merging with European manufacturers to smarten maintenance. In the Asia-Pacific region, complexity such as architectural design and layout is increasing to form a customized smart elevator market, and operating costs, old elevator restructuring, and advanced access control systems are growing in line with strict government norms and standards. The smart elevator market is expected to continue to grow as the Middle East, Africa, Dubai, and Oman are led by the government to invest in infrastructure construction for national development.

The smart elevator market continues to grow due to energy consumption such as carbon neutrality, green new deal, and climate change response IT, smart city sustainability safety, smart green infrastructure improvement, 4th industrial revolution IT convergence technology, and COVID-19 impact. However, smart elevators require large-scale investment in the early stages. Costs, including service installation, automation and integrated security solutions, and remote and predictive maintenance, are expected to grow modestly over the next few

years amid limited investments linked to construction infrastructure, as well as conventional elevators. Major technology components of global smart elevators can be classified into control system, maintenance system, communication system, etc. In particular, control system is expected to grow as elevator control system, access control system, security control system, sensor, micro controller, etc.

4. Utilization of ICT in Smart Elevator for Future Crisis Management

4.1. Expanded application of NFC technology to enhance contact between objects and people

A domestic elevator A company applied a smartphone Bluetooth tagging technology to a residential elevator that calls an elevator when you register the desired floor in a smartphone app in advance. In addition, motion call technology that recognizes hand movements is applied to elevators in commercial buildings so that elevators can be used without having to directly enjoy the buttons of the elevators.

By utilizing short-range wireless connection technologies such as Bulutus technology and motion call technology, contact between people and objects can be minimized, thereby reducing the spread of viruses through face-to-face contact. Accordingly, it is necessary to strengthen the non-contact between people and things by applying short-range wireless connection technology to elevators such as industrial and hospital as well as residential and commercial use.

4.2. Application of bio-technology and establishment of ICT smart operating system to enhance indoor space safety

Clean moving solution technologies such as HEPA filter anion air cleaning, ultra UV cleaner, plasma air purification fan, and clean room technology are being developed to block bacterial or viral transmission and reduce or remove pollutants in the air in closed spaces such as elevators. When these technologies are operated at all times, the operating cost of the elevator increases. Therefore, it is necessary to operate according to the current status of users using the elevator.

In order to increase the efficiency of elevator operation and strengthen the safety of indoor space, an ICT smart operation system should be established so that elevators can be used by transmitting and analyzing information between elevators and users.

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References

Hsiang, S.; Allen, D.; Annan-Phan, S.; Bell, K.; Bolliger, I.; Chong, T.; Druckenmiller, H.; Huang, L.Y.; Hultgren, A.; Krasovich E.; et al. The effect of large-scale anti-contagion policies on the COVID-19 pandemic. *Nature* **2020**, *584*, 262–267.

Hale, T.; Angrist, N.; Kira, B.; Petherick, A.; Phillips, T.; Webster, S. Variation in Government Responses to COVID-19. Blavatnik School of Government, University of Oxford Working Paper. Available online: https://www.bsg.ox.ac.uk/sites/default/files/2020-05/BSG-WP-2020-032-v6.0.pdf (accessed on 30 September 2020).

Chen, S.; Yang, J.; Yang, W.; Wang, C.; Bärnighausen, T. COVID-19 control in China during mass population movements at New Year. *Lancet* **2020**, *395*, 764–766.

Sang Min Lee.; North Chungcheong Province Elevator Industry Base Area Research Service Report," Chungbuk Provincial Office, 2020.

"Kone Product&Services." kone.com Elevators and autmatic doors KONE Corporation

"FORTUNE BUSINESS INSIGHTS." https://www.fortunebusinessinsights.com/smart-elevator-ma-market-102369

"Otis Product&Services Otis ONE."https://www.otis.com/ko/kr/products-services/otis-signature-service#service-id

Jong-Hwa Song, "A Study on Future Urban Policy for the Fourth Industrial Revolution in Germany," Ministry of Land, Infrastructure and Transport, 2020.

https://www.fortunebusinessinsights.com

"Hyundaielevator Nex (N:EX)," https://www.hyundaielevator.co.kr

"H"Hyundaielevator Advanced Remote Management Service HRTS," https://www.hyundaielevator.co.kr/en/service/maintain/hrts