A Study on Convergence Design using Information and Communication Technology

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Abstract: *Future society is rapidly changing its society and economy due to the convergence of products and services, the boundary between industries and advanced technologies. Network, AI, Cloud, Big Data, and Internet of Things are ICT (Information and Communication Technology) that affects production and manufacturing systems. Hyper-Connected Society means a society in which new values are created and developed as ICT technology is enhanced, intelligent information technology that is created, collected, accumulated data through ICT infrastructure and combined with artificial intelligence is widely used in all areas of society. ICT convergence technologies, especially those applied in the design field, provide convenience and efficiency to consumers. Therefore, this paper is a smart farm produced by ICT lighting technology and ICT consumer electronics products that satisfy sensibility. Through a case analysis on various convergence designs, including ICT technology, fusion of cosmetics, and wearables, we are going to help expand contents or services that introduce augmented reality and virtual reality technologies. Through research on this, I hope that it will be used as a useful resource for the development of gradually changing convergence designs and help pioneer new service markets.*

Index Terms: *Convergence Design, ICT Convergence Technology, Artificial Intelligence, Appropriate Technology.*

I. INTRODUCTION

Recently information and communication technologies products have been introduced, and are gradually increasing, with advanced technologies ranging from smart home appliances to smart farms to smart beauty to smart health. The transformation of new industries creates convergence synergies between technologies and accelerates the development of ICT and products. These diverse industries are expected to transform existing industrial structures with new technologies that are converged on Hyper-Connected and Hyper-Intelligent bases[1].

ICT's future can meet new demands by combining them with business models in various fields. ICT consists of content, platforms, terminals and networks, and the evolution and convergence of future core technologies will affect the speed of ICT's development. As convergence between information and communication technologies and other industries is activated, technologies in converged ICT fields for securing safety and reliability, such as medical, logistics and construction, are emerging as indispensable technologies In smart ICT.

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In today's society, represented by superconnectivity and convergence, scientific spirit is transformed into new form of knowledge by converging with ICT with the development of computing[2].

The design should then be integrated with a combination of information from different fields as a variety of factors are needed to achieve a single purpose. In other words, design plans that are differentiated from others, are required for the purposes of users, and should be utilized as services with high value added. The product consisting of various core technologies, which are the result of convergence of information and communication technologies, will affect the development of smart ICT and is expected to contribute greatly to developing the era of ICT in earnest.

II. TEXT

A. Fingerprint Recognition ICT Coffee Machine

Figure 1 shows an espresso machine that can be fingerprinted. This espresso machine recognizes the user's fingerprints and creates his or her favorite coffee by database. It also recognizes users' taste and makes Americano, espresso coffee, and latte with ceramic-based nut shredder[7].

Figure 1. Fingerprint recognition espresso machine
<Sources: Creative Convergence Capstone Design with PBL>

B. Fingerprint Recognition ICT Coffee Machine

Figure 2 shows a coffee machine that can be printed with characters. This coffee machine (Textspresso) manufactures coffee according to the order received by text message. Indicate the orderer's name in the espresso bubble to distinguish individual ordered coffee and send it to the mobile phone text app through the company's cloud server[8].

Figure 2. A letter-printed coffee machine
<Sources: Creative Convergence Capstone Design with PBL>

B. Smart Transportation with ICT

Figure 3 shows Ford's development of 'Fusion' hybrid cars. Users asked to create an interface that would make hybrid cars more accessible. Studies have been conducted on how to interact with the automobile's interface and how to understand how hybrid cars work. When the driver drives at an economic speed with the right level, the dashboard changes to a leaf growing. It is a smart design considering consumers who are interested in the environment. Driving at economic speed makes drivers feel that it contributes to environmental protection and enhances user satisfaction for smart cars.

Figure 3. Ford's 'Fusion' Hybrid Vehicle Instrument Panel
<Sources: Creative Convergence Capstone Design with PB

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C. Water purifier bicycle aquaduct

Figure 4 is an example of IDEO's design innovation, which was introduced in 2008. Many people in developing countries cannot get clean drinking water easily. For this to solve the problem pedal by to move on his bicycle pump is operating the water purification effect can be designed. While carrying unclean water in the back trunk of the bicycle and pedalling, the water is purified through a pump driven by the pedals, and the purified water is stored in the water container at the front of the bicycle. This is a smart design with the right technology for bicycles to be used in underdeveloped countries.

Figure 4. IDEO's water purifier bicycle aquaduct

<Sources: Creative Convergence Capstone Design with PB

D. Fusion of cosmetics and ICT

As ICT technology has been enhanced, intelligence information technology, which combines data generated through information and communication technology infrastructure with artificial intelligence (AI), is being widely used in all sectors of economy and society, creating new values. As augmented reality and virtual reality experience technologies have developed, smart beauty has emerged as more products and services have been applied to beauty markets. It can be interpreted as a global product, beauty service, and marketing use that enhances customer convenience by applying AR technology to mobile applications without having to touch or try products. Figure 5 opens a flash shop at a leading French cosmetics store, Cella, and helps to search information using tablets. "Sephora Visual Artist" was developed with ModiFace Company, which has AR-based interface technology. The virtual service allows customers to do makeup on their own through a computer screen without a clerk or professional stylist in the store, and when they register their photos on the "Sephora Visual Artist" via Facebook Messenger, they analyze their photos and suggest which make-up will suit them.
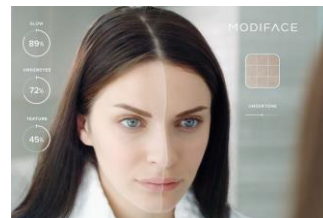

Figure 5. The Service App of Cella with Advanced Technology

<Sources: www.sephora. com>

E. Virtual Experience 'Styling Mirror'

Figure 6 shows "Styling Mirror" and "Style My Hair App" in Loreal Professional Paris. Loreal Professional Paris, a global hair brand, offers virtual experiences through digital devices such as "style mirrors" and personal mobile apps called "Style My Hair." After filming your face with a camera, you can change your style by choosing the hair color or style you want out of about 2,400 different colors and styles. In addition, hair trends, various events and discounts from salons are available in real time, enabling customers to receive new information quickly. In particular, the styling mirror's style change feature is also available as the mobile app, Style My Hair, so you can see yourself changing from various hairstyles anytime, anywhere, and download it for free from Google Play and Apple App Store. Laurel's "Make-up Genius" shows a service that scans the colors of the cosmetics in the commercial model, in addition to the existing virtual make-up functions, and then provides information on each product.

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Figure 6. ICT Beauty Styling Mirror <Sources: LOREAL>

F. 'Wearable' fused with ICT

   Wearable is a natural meaning, and is used to mean that it is possible to dress appropriately for different ways of wearing. Wearability refers to a stylish and realistic outfit that is well suited to the modern lifestyle of fashion that can be worn as a reality. This includes technologies that make ICT devices a device that can be carried around on the user's wrist or arm, and ultra-small parts and displays. IT technologies such as smart sensors, wireless communications, and mobile operating systems are combined with watches, glasses, clothes and helmets used in everyday life to provide computing environments to users anytime, anywhere.

   Wearable technology is applied to wearable computers such as smartwatches, smart clothes, virtual reality devices such as HMD (Head-mounted displays), and implants that are implanted into skin, and is used in all fields such as not only for individuals but also for industries, medical care, and military. Figure 7 is a wearable device developed by a venture company called 'MOOV NOW' that records exercise patterns simply and gives advice just like a personal trainer. 'MOOV NOW' is a next-generation wearable health device, and a feature that is different from other wearable devices is that it gives users a feedback voice in real time just like a real personal trainer. When you exercise after wearing it on your wrist or ankle, you analyze the user's activities in real time and sound them with a voice. Supporting a variety of exercises such as swimming, cycling, boxing, and weight training as well as running, 'MOOV NOW' can set up various training strengths for each exercise, enabling customized use to suit users' physical strength and goals. Real-time feedback is possible because of Omni Motion 3D Sensor technology. The wearable industry, which is drawing attention due to the influence of ICT technology, is emerging as an alternative to the depressed fashion industry, creating new high value added. As the fashion industry focuses on upgrading technologies that use ICT to enhance competitiveness, creative ideas are being created, and the biggest benefit that wearable brings to consumers is personalized service. Through mobile devices, consumers can check their health, make payments through biometrics such as fingerprint recognition and iris, and add virtual capabilities to reality[9]. In addition, control of reality through virtual reality is becoming increasingly widespread, and consumers who have been upgraded to mobile and wearable will have to understand and use new laws of enhancement[10].

Figure 7. 'MOOV NOW' developed by MOOV Company
<Sources: blog.naver.com/maquekr/220448417448>

G. An LED-equipped handbag

   Inside the Leoht handbag in Figure 8, LED's are installed, allowing the bag to be opened brightly in the dark to hold or take things out. The leather wall of the bag has a battery and a USB port, so you can charge it with electricity or cell phones at any time.
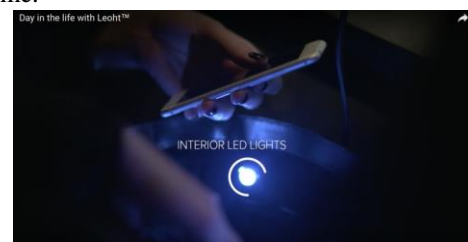

Figure 8. Handbag Leoht with LED
   <Sources: Day in the Life with LeohtTM, Handback's Future >

H. LED Color Handbag

   In addition, a product has been released that can change the color of the entire bag by changing the color of the LED light installed inside the bag. Smart handbags that incorporate Internet of Things technology as smart items that border products and IT are gaining popularity.
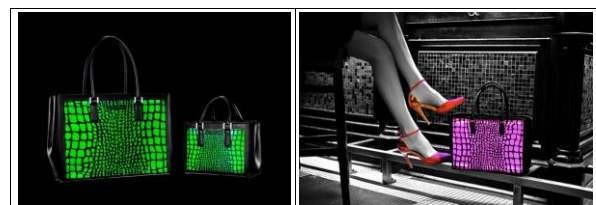

Figure 9. LED Color Handbag
<Sources: Day in the Life with LeohtTM, Handback's Future >

I. ICT Technology and Health Care

   Innovations in ICT technology can be linked to our bodies to manage our health. Connecting health to our bodies like the Internet of Things is called Smart Health Care, which enables us to recognize and manage our bodies. Smart healthcare industry is an industry where ICT and mobile technologies are integrated into the health care and medical service industry, and related ecosystems are composed of various enterprises

and institutions, such as manufacturing and software-related enterprises, telecommunications and hospitals[5].

Smart health care industry is in the early stages of industrial development and needs new technology development such as securing industrial competitiveness through development of technology, materials and design, and preparing clinical platforms, and has characteristics that are more important than other industries[3]. Figure 10 is Apple's Apple Watch4, which was released in September 2018, which includes the function of the ECG to accurately recognize the sudden change of users and automatically contact 911 when the heart condition is connected to doctors and medical institutions and phone users cannot be used due to falls or falls. It also accurately informs users about the actual effects of exercise through the operating sensors contained in smart watches.

Figure 10. Apple Watch
<Sources: 2016 Martketsandmarkets >

Using smart healthcare using ICT technology to protect one's health is the way to prepare for aging society. As the paradigm of medical services has shifted from treatment and hospital to prevention and consumerism, smart healthcare has emerged, and digital technologies outside of existing medical systems such as artificial intelligence, Internet of Things, wearable devices, smart phones, and cloud computing are rapidly being integrated into the medical field, and the existing healthcare sector is expanding[6]. The global artificial intelligence health care market is also growing rapidly, and the global market for artificial intelligence healthcare in 2015 reached 71.3 million dollars, and is expected to rise to 754.7 million dollars by 2020. (*2016 Martketsandmarkets*)

J. Agriculture with ICT

The Industrial Revolution has changed the lives of mankind and agriculture needs a future response to avoid making past mistakes that were relatively marginalized.(*Fourth Industrial Revolution, Agriculture, R&D Issue Report, Agricultural, Fisheries and Food Technology Planning Evaluation Institute, 20167.p1*)

Smart Farm, a combination of information and communication technology and automation technology, shows that agriculture is gradually scientific, from the production system of growing farm products to distribution and consumption to rural areas. Smart farms use ICT technology to measure and analyze temperature, humidity, and soil of crop-growing facilities, and operate controls according to the analysis results to change them into appropriate conditions. This technology is possible in terms of productivity and quality of agricultural products, even though labor or energy is invested less by checking and remote management of crops. The future is when the structure

of agriculture is being transformed into a technology-intensive industry and the development and supply of technologies for smart farming, which is applied with information and communication technologies, is needed[4]

Figure 11 is an example of Toshiba, a Japanese electronics manufacturing company. After floppy disks began to be shunned by users, the Yokosuka production plant was transformed into a farm that grew various vegetables, such as lettuce and spinach. Within the sterile clean room, all the steps of growing vegetables, from germination, cultivation, and water harvest, are taken at once, and the cultivation room is supplied with clean water with the removal of chlorine alkali, and the ICT cultivation management system keeps the optimal environment. The vegetables that grow here are not just ordinary vegetables, but are growing in a climate control room with a uniform supply of nutrients and fertilizer. With no bugs, pesticides, dust and germs, the Toshiba farm's vegetables can be eaten clean and healthy, and after incense it will be developed into smart farms and even robots to harvest vegetables.

Figure 11. Toshiba, an electronics company in Japan

<Sources: www.toshiba.kr>

K. 'Sharp's LED Plantation

Figure 12 is a Sharp factory, a Japanese electronics company that grows Japanese strawberries. Sharp is growing Japanese strawberries at an abandoned factory and is pushing for commercialization of 'plant plant' using LED lighting, plasma cluster technology, and light control technology in a space that is blocked from outside. It is a system that can produce crops without being affected by seasons or external environments by artificially controlling LED lighting, carbon dioxide, moisture or fertilizer, and is using ICT lighting technology to create a stable environment. The temperature and humidity are detected and controlled by ICT technology, and Sharp's plasma cluster air conditioning system blocks m icroorganisms and fungi.

Figure 12. Sharp's plant in Japan
<Sources: www.sharpservice.co.kr>

III. CONCLUSION

This study is about smart design using ICT convergence technology, and it studies smart design cases where products or services that combine augmented reality (AR) and virtual reality (VR) technologies are fused. In the future society, the convergence of ICT and consumer electronics, beauty, healthcare and agriculture will create synergy between high-tech and further evolve into custom services[16].

Smart design can be defined as a tool for solving problems that make 'smart life' possible and a design that creates public consensus. Smart smart design, with its convenience and efficiency, is a way to organize and incorporate the requirements of 'smart design' with the aim of 'user-centered need' rather than 'technology'. Now design has begun to discuss the importance of what value can be given to users, not only in a beautiful form by appearance. Smart design can be categorized as an area of new design studied to pay attention to the inconveniences of society and to find ways to solve problems for a better life[11][12].

The Hyper-Connected age means that everything, including people, processes, data, things, and so on, is connected to the Internet. Network technologies that are used in AI, IoT, and big data are at the core of superconnectivity, and in this era of superconnection, the range of connections will be expanded from communication with objects to interaction with various objects that transcend time and space. In a future society, it is important to define conceptually the sum of all data about an individual and to design a mobile environment and platform for the individual first in designing its operating system. In the end, contents or services that introduce augmented reality and virtual reality technologies will need to be developed further, and the following strategies are needed to strengthen the competitiveness of smart design in connection with ICT in the changing future.

First, accurate data acquisition and analysis of ICT data for smart design development is required. With the combination of advanced ICT technology (IoT), big data, social network services (SNS), and smart sensors, data analysis technology and data collection channels play an important role in expanding rapidly growing industries. As it becomes more diverse, it will provide consumers with a wider range of choices through custom production and technology as analysis technology deduces a number of complex information from simple sensor measurement data. Second, always consider the 'creative strategic methodology' that creates new innovative products in the dimensions of consumer Insight and marketing strategy Using mobile, wearable, and virtual reality technologies to provide convenience and efficiency in customers' daily lives is also a way, and continuous efforts are needed to find creative strategies that can elicit better ideas for smart design. Third, ICT convergence technology and development of professional human resources for smart design are necessary. It is only possible to implement smart web development technologies, coding technologies, and web design in terms of intellectual property research. In particular, fostering experts in agriculture is absolutely necessary. Traditional intellectual property categories, such as patents and copyrights, can classify intellectual property rights related to computer programs, genetically modified plants, semiconductor designs, the Internet, and character industries as 'New Intelligent Property Right' due to rapid development of information strategies and high technology. Smart Design, which has been integrated with various ICTs through data that are gradually increasing in size of the domestic digital market, will play an important role as a new intellectual property right in the future[13].

Through a case analysis on various smart designs that have introduced ICT convergence technologies published in the paper, it can give an indication that the product experience and satisfaction of customers due to the development of contents or services that have introduced augmented reality and virtual reality technologies are finally affecting the expansion of consumer-oriented markets[14][15]. So far, this study has looked at products that incorporate high-tech technologies for consumers who prefer custom experience, along with the ever-increasing development of technologies in response to changing times. Further research will be conducted on detailed analysis and investigation for the growth of ICT industries and the development of increasing smart design.

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