

Customized Digital Health Using Biometric Data

Written by Jeong Seok-mo, CEO at MyBenefit

PLATFORM

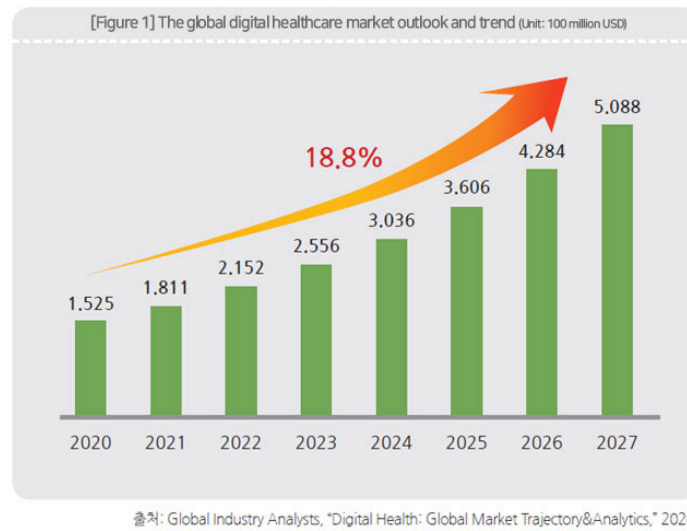
Customized Musculoskeletal Management Platform Through Motion Recognition Technology

Following the spread of ICT-based non-face-to-face services across all sectors of society after the Covid pandemic, non-face-to-face services are also spreading in the healthcare field. The platform is a non-face-to-face healthcare service in which a user performs a non-face-to-face measurement evaluation of their posture, physical strength, joint health, etc. without a trainer and receives guidance on the results. Personalized healthcare service provides services for smart health and physical activity through recommendations for exercise suitable for the individual after pre-assessment, rather than blindly starting to exercise, and through separate worn or attached equipment through the application of motion recognition technology. It is a platform that enables exercise analysis without equipment.

GLOBAL

Global Market Trend

According to a report by Global Industry Analysts (GIA), the global digital healthcare market is expected to grow from \$152.5 billion in 2020 to \$508.8 billion in 2027 at an average annual growth rate of 18.8%. In addition, the global digital healthcare market has entered a growth period with smartphones and IoT-based devices, and its growth is accelerating due to the entry of various companies, including global ICT companies and startups as well as medical device companies.



< The global digital healthcare market outlook and trend (Unit: 100 million USD) >

The global market for biometric data-based healthcare systems is expected to grow at an average annual rate of 47.1% and reach approximately \$5.247 billion in 2025. In today's digitalized healthcare system, the need for data is increasing. Worldwide, global ICT companies such as Google, Apple, and Microsoft are entering the personal healthcare industry, and in order to position themselves in this market, the most important thing is to analyze data and provide services based on measurement technologies that can be easily recorded and managed in daily life.

DOMESTIC Domestic Technology Trends

In particular, in Korea, the development of ICT technology has improved access to health information, and the demand for personalized healthcare is increasing as the level of health awareness increases. The paradigm of medical care is also changing from empirical medicine and evidence-based medicine to data-based precision medicine and personalized medicine. These days, as the new digital healthcare service market is opening up, personalized healthcare services through convergence with realistic media technologies such as body motion recognition technology can be a solution to the growing healthcare needs.

Expansion of Customized Healthcare Services

● Care for Four Major Diseases (sarcopenia, cancer, cognitive function, diabetes)

Exercise is no longer a sufficient solution for people's health. Patients with diseases also need treatment that can improve their health and quality of life by applying a customized exercise system. In order to apply a customized healthcare program to patients with diseases, it is necessary to preemptively develop exercise contents for patients with diseases and for them to undergo clinical trials through R&D regimens. Based on verified exercise data and additional research, it can be expanded to customized healthcare for various diseases.

The focus is on identifying the health and physical condition of the patient by filling out the exercise questionnaire, securing individual health data through a pre-measurement program to propose a customized exercise program and providing advanced feedback services such as customized nutritional care and lounge recovery services.

● Leading the Future of Healthcare Using ICT Technology

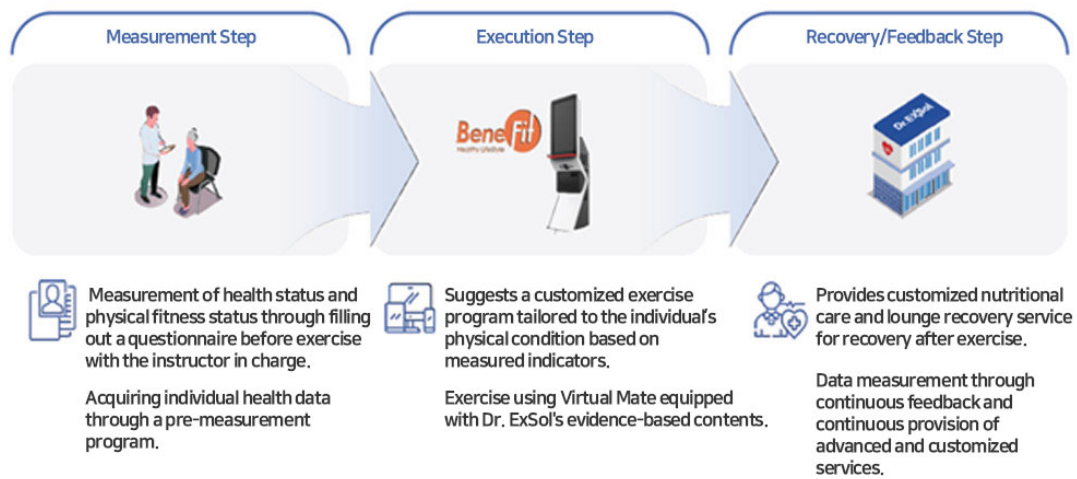
By introducing an ICT-based healthcare system, it is possible to perform continuous exercise in a small space, thereby improving individual immune functions and improving stress situations in daily life to improve psychological conditions such as depression and increase efficiency in daily life. In addition to producing customized content for special purposes such as disease prevention, it is possible to provide customized exercise content for each job type that fits the characteristics of those requiring strong physical strength, such as military personnel, the police, and firefighters. For example, an O2O (online-to-offline) service platform is emerging that connects offline to online by installing healthcare platforms in multi-use facilities such as government offices, fitness centers, and health centers to allow users to freely use content services online, anytime and anywhere, through mobile phone applications. Through this, efforts are being made to pioneer new markets with O2O service platforms in the health and fitness market and corral the unrivaled digital healthcare market by creating additional services. In addition, by not limiting healthcare to digital healthcare, economic results can be generated through expansion in collaboration with various sectors such as fashion, beauty care, shopping information, and curation.

● Provides "my own customized exercise" tailored to the user's posture, physical strength, and joint health level

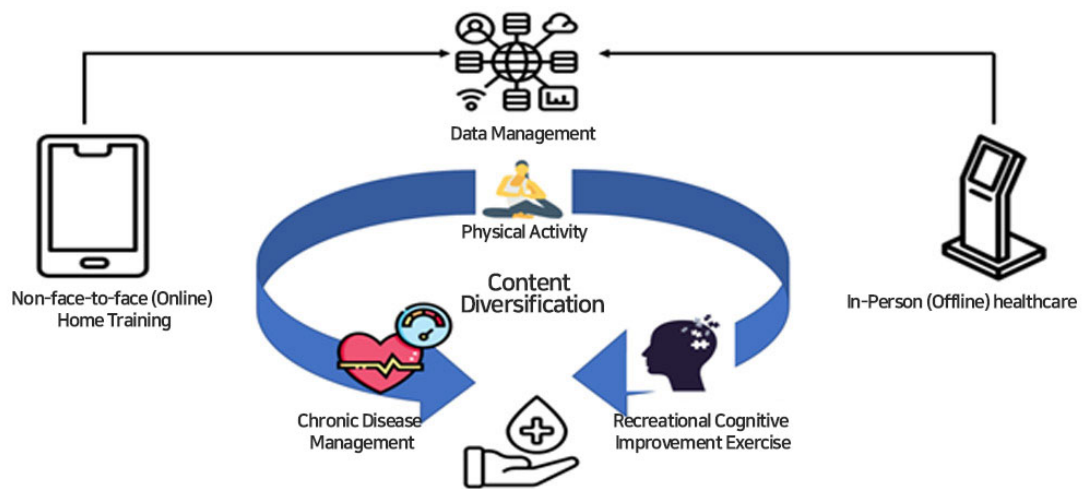
Existing exercise programs in the form of reporting and copying cause a problem in that those who follow the prescribed exercise may experience muscle imbalance or joint pain through incorrect posture. In order to prevent this, three measurement programs are performed, including dynamic posture measurement (range of motion), static posture measurement, and basic physical fitness measurement. Based on the results, customized exercise tailored to the user is provided, and customized exercise movements are performed to correct the improper posture. There is a need for a personalized healthcare system that helps people to perform customized exercise with precise movements rather than have incorrect posture.

● User-customized exercise measurement/ evaluation management service through motion recognition sensors

Existing motion recognition technology has limitations in tracking crossed posture, overlapped posture, and lying posture, so there are cases where skeleton data is obtained that cannot recognize or track incorrect posture. A personalized healthcare platform with motion recognition sensors is a healthcare platform with AI-based technology that can obtain accurate body tracking data using deep learning technology with RGB (red, green, blue), depth, and body skeleton information data secured by Kinect to compensate for these problems. In other words, by mounting advanced motion recognition sensors on healthcare devices, static movements such as the user's joint range of motion and posture and dynamic movements during exercise are acquired as 3D positional information. Through the analysis of the collected information, information such as exercise accuracy, calorie consumption during exercise (exercise amount), and performance history is analyzed in real time, and through this, it is necessary to develop a platform that can utilize multidimensional data such as management of individual cumulative data change and acquisition of group characteristic data.



<Personalized Healthcare Process>



<Customized Exercise Management Platform>

Digital Healthcare: An Essential Element of Healthcare in the Endemic Era

Due to the development of information and communication technology (ICT) such as artificial intelligence (AI) and big data, many sectors of the healthcare field are changing. Among them, starting from the Covid-19 pandemic, digital healthcare has been attracting attention. Digital healthcare is a next-generation core strategic industry that is important enough for the government to designate it as a national task. In fact, compared to before Covid-19, the digital healthcare market has been analyzed to have grown by more than 10 times.

Healthcare: Past and Present

Until now, healthcare has been centered on doctors and medical institutions. Doctors have had the role of creating information and treating patients based on that information, and medical institutions have had the role of providing space and storing and managing the generated information. In contrast, patients have been passive, and the generated information has only been available at medical institutions.

However, healthcare is currently changing from reactive and post-healthcare to advance prediction and prevention medicine. It is emerging as a new phenomenon of customized medicine tailored to each patient's unique characteristics and participatory medicine in which patients actively participate.

<Table 2-3> Changes in healthcare services according to technological changes

Category	Tele-Health	e-Health	u-Health	smart-Health
Period	Mid-1990s	2000	2006	2010 and after
Service Content	In-hospital treatment	Treatment and information provision	Treatment and prevention management	Treatment, prevention, welfare, safety
Main Provider	Hospital	Hospital	Hospitals, ICT companies	Hospitals, ICT companies, insurance companies, service companies, etc.
Main User	Medical personnel	Medical personnel, patients	Medical personnel, patients, general public	Medical personnel, patients, general public
Main System	Hospital management (HIS, PACS)	Electronic medical records (EMR) website	Monitoring electronic health records (EHR)	Personalized services based on personal health records

Source: Ministry of Trade, Industry, and Energy (2015).

Source: Social Security Committee. Estimate of the Number of Single-Person Households by Year (1985–2045).

The Rise of Digital Healthcare

The World Health Organization (WHO) in 2021 expanded the concept of e-health to include digital consumers, a wider range of smart devices, and connected devices by extending the concept of e-health to the field of knowledge and implementation related to the development and use of digital technologies to improve health. This includes digital technologies for health, such as the internet of things (IoT), artificial intelligence (AI), big data, and robotics. The core of this definition means that it will be used as a technology that can quantitatively measure a person's health-related condition and as a technology that improves human health further by processing the data obtained from it.

Digital healthcare is an innovative field that emerged as digital technology innovations such as AI, IoT, and virtual reality (VR) converged with medical care. As big data accumulates, effective treatment is possible through the 4Ps: prediction, prevention, participation, and personalization. In addition to the existing medical data, the need to acquire various data is also increasing. In fact, due to the recent development of genetic analysis technology, cost and time for securing genetic information have decreased. In addition, the acquisition of external activity data has become considerably easier due to the development of various wireless sensors, the improvement of communication speed, and the development of smartphones.

As AI technology has advanced, diagnosis and treatment of incurable and chronic diseases, including cancer, have become more precise, and the time and cost of drug development are also decreasing. Through this, diagnosis and treatment of incurable and chronic diseases, including cancer, are becoming much more precise.

In addition, virtual reality and augmented reality (VR/AR) technology allows doctors to practice surgery, and patients to undergo examinations or surgical procedures in advance. IoT technology enables instant processing of data exchanged and shared between patients, doctors, medicines, and treatment equipment and facilities anytime and anywhere.

Four Types of Digital Healthcare

Digital healthcare can be classified into four service types.

*** Remote Medical Care:** This is characterized by remotely exchanging clinical data between patients and doctors, to support or assist in providing medical services from a long distance using ICT.

*** Healthcare Analytics:** Healthcare Analytics: This refers to mobile applications related to health or well-being, as well as mobile applications connected to wearable devices.

*** Mobile Health:** This refers to the analytical capabilities required to understand software solutions and big data.

*** Digitalized Healthcare Systems:** This is characterized by storing digital health information and exchanging digitized medical records of patients.

Various Uses of Digital Healthcare

Smartwatches are becoming more and more functional as time goes by, enabling sophisticated health monitoring such as blood pressure and electrocardiogram measurement. Among them, the most notable function is blood glucose measurement. Diabetic patients have had no choice but to prick their fingertip with a needle every time to draw blood, but the day has come when they can measure blood sugar with just a smartwatch. Although this feature has not been commercialized yet, the development of the patent and core technology has already been completed, and only discussions with regulatory bodies remain.

Recently, in Korea, research has found that a treatment that helps stroke patients with home rehabilitation exercise using AR has been helpful. Stroke patients are prone to falls due to loss of balance and brain damage. AR programs recognize the patient's body with a sensor to monitor the patient's movements and transmit the movement records to professional therapists, making it possible for them to provide appropriate feedback to the patient immediately. As a result, the patients' fear of falling was noticeably reduced, and no fall accidents occurred after using the AR rehabilitation exercise program.

Overseas, it is known that many of the new digital healthcare services include telemedicine functions. In particular, new types of services are drawing attention as they are developed one after another in combination with various models such as smartphones, wearable devices, AI, and chatbots. The Covid-19 pandemic brought attention to telemedicine, and since 2020, many patients around the world, including in the United States, have begun to use telemedicine. In Korea, telemedicine was illegal before the Covid-19 pandemic, but it is now temporarily legal. From February 2020, when the government temporarily began allowing telemedicine, to May this year, the number of prescriptions provided over the phone was confirmed to have reached about 2 million. This level of interest is expected to continue even after the post-COVID-19 era arrives.

Why You Should Focus on Digital Healthcare

The global digital healthcare industry is expected to be a \$152 billion market by 2020. This corresponds to 35% of the world semiconductor market size of \$433 billion. Digital healthcare is expanding into the general healthcare field along with disease prevention and is growing at a very rapid pace. Although utilization has been slow due to existing regulations and technical problems in various fields, in the near future, as regulations are improved and technologies are further developed, the aforementioned predictive medicine and personalized medicine are expected to become the core areas of medical care.

Chronic diseases are known to account for about 41% of medical expenses in hospitals and clinics. Digital healthcare is being presented as an alternative to paying such medical expenses. In fact, in the case of Gangwon-do, after being designated as a special digital healthcare pilot zone, hospital and clinic expenses have decreased significantly.

In order to activate digital healthcare, it is necessary to establish a diagnosis and management system that supports and resolves the legal and institutional regulations related to the sharing of personal information such as medical records.

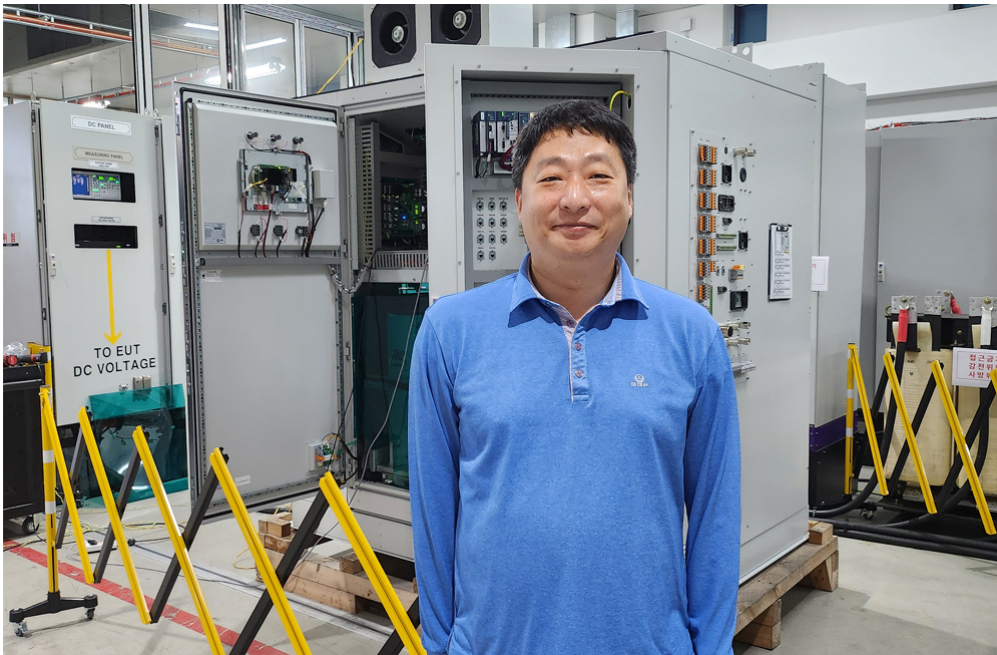
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People in ICT

We will transform into an energy management system company with “the courage to not fear new challenges.”

Interview | Kim Young-guk of Destin Power



By far one of the biggest issues recently is energy security. It is not an exaggeration to say that the 21st century has entered the battlefield of renewable and eco-friendly energy. Even on this battlefield, there are people who are working hard towards sustainable development and solving energy problems. Let's hear the story of Destin Power's Kim Young-guk, who develops power conversion systems.

Q

Hello, please introduce yourself to our readers.

Hello, my name is Kim Young-guk, I work at Destin Power Co., Ltd. Destin Power is a company that develops power conversion systems in a platform mode and supplies them according to the characteristics of the various distributed power generation sources. Destin Power develops and produces fuel cell inverters, PCSs (power conversion systems) for ESSs (energy storage systems), microgrid inverters, industrial UPSs (uninterruptible power supply systems), and electric vehicle chargers based on inverting and converting technology. Basically, we are a company specializing in power conversion in the electronics field.

Q

What kind of work are you in charge of at Destin Power?

The way to develop a power conversion system in a platform mode is to develop it by dividing it into DC power conversion modules, AC power conversion modules, and core common modules. I am participating in the development of core common modules.

Q

What is Destin Power's main technology and how is it being used?

Destin Power's main technology is the power conversion system. The power conversion system is an essential system used throughout the production, supply, storage, and use of electricity, and its importance is highlighted in the renewable energy industry, where power conversion efficiency is directly linked to economic value. The fuel cell inverter converts the DC electricity generated by the fuel cell into AC electricity to be delivered to the power system, and the PCS for ESS converts electricity generated by the power system from DC to AC and AC to DC to charge or discharge the battery. In addition, the microgrid inverter is a key system for supplying electricity by creating an independent power system by linking renewable energy and batteries to an island or other locations without a power grid.



Q

How did you become interested in the field of power conversion systems?

I majored in electrical engineering, and also I had a technical foundation through solar inverters when new renewable energy became a megatrend and as ESS systems began to spread explosively in Korea, I have tried to advance technology through a PCS for battery charging and discharging. We are now aiming to expand technology through fuel cell inverters and EV (electric vehicle) charging systems. In other words, the reason for interest is confidence in the business future of the power conversion system and the technology that can be applied to a variety of products.



Q

Could you tell us one of your company's strong points?

We are a company that can contribute to the prosperity of mankind by reducing greenhouse gas emissions, and it is possible to maximize individual capabilities through the ability-first principle. We have a horizontal organizational culture, so anyone can express a variety of opinions and ideas.

Q

Are there any memorable episodes that you have from your work?

The most memorable moment was when we installed and commissioned a microgrid system on a developing country's small island that had no power supply system. The island was in an environment where electricity could only be used for about two hours in the evening with a diesel motor because electricity was not connected from the mainland. But with our power converter, electricity was supplied 24 hours a day by using solar power and a battery system. When the system was established and completed, I was able to feel pride in my work from the cheers of the natives and the laughter of the children.

Q

What kind of skill does an individual need to join Destin Power?

As a leading power conversion system company, our company values the courage to not be afraid of new challenges, and I think I was hired because I appealed to them in this point in the interview. Please keep this in mind if you are applying for work.

Q

What are your future goals?

PCS technology is not the only factor in Destin Power's successful transition in the power conversion system market. This was possible because the digital twin concept, which was applied based on experience throughout the production site, played an important role. Based on the development of these power conversion systems and the experience of various installation site operation services, I hope we can switch to becoming an energy management system company.

Q

Any messages to our ICT Industry Hot Clips readers?

Destin Power is a company that deals with both development and production of power conversion systems, and already possesses ways to adapt its know-how and technology for production and development, such as smart factories. We will strive to become a better company in energy management technology in the future.

ZOOM IN - I

Leap toward a global communication company with occupational accident prevention solution

HHS CO., LTD. CEO Han Hyeong-seop



HHS CO., LTD.

- **Implementing Agency**

National Information Society Agency

- **Business Details**

MEC-based 5G convergence services Company operating business that seeks to be a leader in the public sector

- ☒ **Company Status**

- **CEO**

Han Hyeong-seop

- **Business Type**

Development and supply of Software development and supply

- **Year of Establishment**

2016. 03.

- **Homepage**

<http://www.hhskorea.com/v2/index.html#/>

- ☒ **Key Accomplishments**

Product substantiation project jointly with Ulsan HQ's of Korea Industrial Complex Corp., and LG U+.

Won Innovation Awards for two years in a row in CES 2021 and CES 2022.

Succeeded in inviting investment of KRW 500 million from Korea Technology Finance Corp.

Smart safety management systems unique to the company



HHS has been making its efforts to improve the elementary basic quality of life of mankind based on future technologies such as biosignal processing and AI technologies. The company mounts biosignal processors on safety helmets for the real-time transmission of information of workers to control the server to allow the administrator to monitor such information. The HHS-developed modules developed by HHS attached to safety helmets provide opportunities for analyzing brainwaves and heart rates to prevent safety accidents and take actions for such accidents, if any, in the industrial industry; thus for yielding fundamental effects.

The smart safety management systems developed by HHS provide capabilities differentiated from conventional systems. While the functions of conventional systems are limited to monitoring environments surrounding workers, and the volume of the collected information is highly restricted; the systems of HHS boast of their capabilities that in employing AI to predict and prevent accidents through big data analysis of the collected biosignals. In recognition of these innovative technologies, HHS won innovation awards at CES, a world-leading electronics exhibition CES in 2021 and 2022 in a row. Further development and progress of HHS are anticipated expected to utilize biosignal information in the era of big data.

Developing the safety management system with ICT funds for the first time in the world



HHS succeeded in inviting investment from ICT funds when it participated in the regulatory sandbox project hosted by Korea Industrial Complex Corp. in 2020. Then, the company participated in a project called, “Advanced application of MEC-based 5G convergence services to the public sector” hosted by the Ministry of Science, ICT, and Future Planning and National Information Society Agency to develop a smart safety management system based on biosignal processing for the purpose of yielding achievement from ICT funds.

The development was the sole case in the world, and the company faced the hardship of complicated processes from adapting equipment to product development; however, HHS was provided with know how by technologies transferred from the Korea Brain Research Institute, and Korea Institute of Machinery and Materials. Furthermore, the company conducted capability tests at Korea Conformity Laboratories, and succeeded in objectifying the capability index.

HHS says that the key to such success is the willpower of the people of the company’s employees to operate new services that have not been experienced so far. The company identified demand in the markets in the course of operation of businesses, and it was able to launch technologies of higher integrity by listening to the opinions of workers in the fields. As a small startup business, HHS started with four people, and grew to the number of people to eight. The enhanced technological capabilities of the company are attributed to its participation in new projects.

Growing into a global company through research of big data

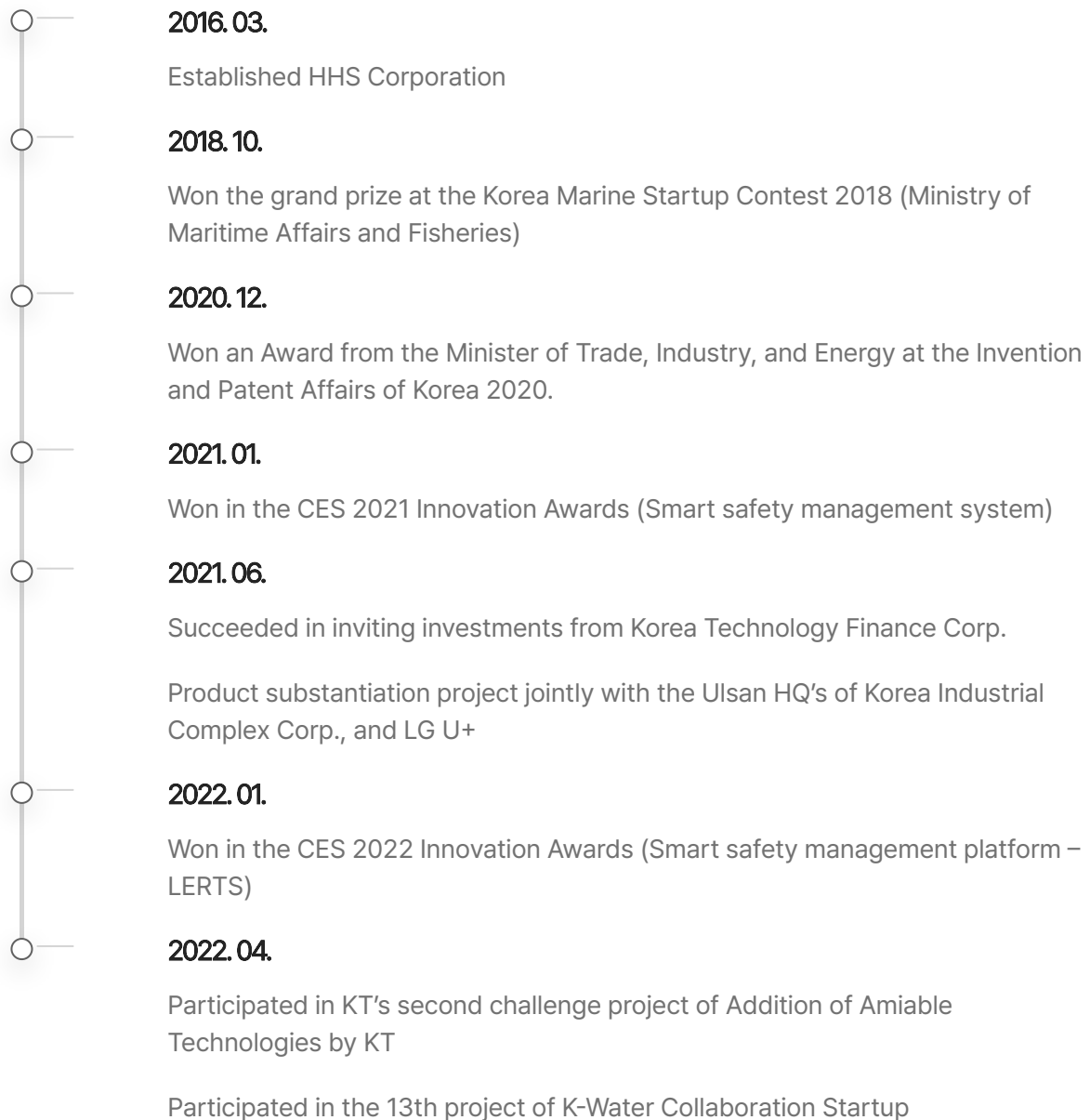
Since participating into in ICT fund projects, HHS has established its objective of finding markets for its products. The company plans to launch its business in overseas markets, which failed to achieve due to COVID-19, and to improve the integrity of products through the validation of various technologies at public authorities in Korea. The company also sets up aims to grow into the world's best biosignal analysis company by operating a real-time biosignal analysis system for some 20 thousand people by aggressively inviting investments.

However, investments to in HHS have not been sufficient for operating mass production systems so far. Accordingly, the company plans to enhance technological integrity by accelerating industry academe R&D through analysis of biosignals of people and big data once the company achieves its short term objective of applying its technologies to a small number of fields.

HHS confesses acknowledges that the need for considerable ICT funds were big and strong support for challenging and creative ideas of the company targeting the markets in coming the next ten years. ICT funds were the foundation on which the company has become a leader in future safety management technologies. HHS encourages startup businesses wishing to participate in ICT funds to perform consistent R&D, and not to give up their unique ideas. Small startup businesses are capable of wielding great advantages in the era of convergence, so they should use programs of supporting small businesses to the largest extent.



TIME LINE



ZOOM IN - II

Realizing ideal community values with barrier-free technologies to provide light and salt to visually impaired people

Head of Global Marketing Division at Dot Co., Ltd. Yong-hwan Joo



Dot Co., Ltd.

☒ General Status

- **Implementing Agency**
National Information Society Agency
- **Business Details**
Diffusion of intelligent information service

☒ Company Status

- **CEO**
Kim Ju-yun, Seong Gi-gwang
- **Business Type**
IT
- **Year of Establishment**
2015. 04.
- **Homepage**
<https://www.dotincorp.com/kr/>

☒ Key Accomplishments

Developed Dot Pad, Dot Kiosk, and Dot Watch with advanced technologies exclusively made by the company.

Elected as an exclusive supplier for the Dot Pad supply project in the U.S. In 2022.

Elected as a partner of Google in developing pads for visually impaired people.

Establishing a venture business at the age of 26



Dot, a community venture business, is a technology oriented startup company established in 2015. Dot is executing lively activities with its target, 'realizing a barrier-free community,' and has succeeded in developing several products including 'Dot Watch,' a braille smart watch for visually impaired people, 'Dot Barrier-Free Kiosk' for both people with and without disabilities, and 'Dot Pad,' a tactile monitor for visually impaired people.

'Being barrier-free,' the objective of Dot stands for a community-based campaign for lowering physical and institutional barriers to create communities good enough for the everyday life of people with disabilities and elderly. At the core of the company are technologies that render environments that free people with disabilities from barriers and are accessible to anyone.

The objective of Dot was born when Kim Ju-yun, CEO and the founder, was studying in the U.S. He was so passionate for management and realizing revolutionary ideas to open businesses two times during his studies. After he was told by a visually impaired friend that the Bible in braille has 20 or more volumes in total, he became determined to develop contents for visually impaired people and open a new business at the age of 26.

Dot Pad' at the center of revolutionary education for visually impaired people



Dot currently holds a number of patents, among which with the leading patent is display technology of embedded tactile images for visually impaired people. Visually impaired students have difficulty with experiencing geometric figures such as diverse diagrams and graphs. 'Dot Pad' developed by Dot allows realizing 3D images with 300 cells and 2,400 pins to provide such students with opportunities to learn complex and various characters and diagrams. Beyond the limitation of conventional terminal consisting of a single 32-cell line only, Dot Pad realizes various image contents such as mathematics, science, and maps, playing a key role in providing excellent educational materials for visually impaired students.

The U.S. Ministry of Education was the first organization which has shown keen interest in our technology, and planned a state-sponsored project of supplying 'Dot Pad' to all of schools for visually impaired students in the country for four years from Sept. 2022, with Dot being elected as the exclusive supplier.

To accelerate the launch of our products in the overseas markets, Dot will introduce technology of 'Tactile Pad' this year. It will be used in place of 'Tactile Map,' which is not capable of real-time rendering information, for certificate-issuing machines and ordering kiosks. Furthermore, the most attractive feature of the product is that it allows visually impaired people to enjoy viewing artworks at museums and galleries.

Outstanding technologies of Dot recognized around the world

'Dot Kiosk' produced by Dot, a first-ever in Korea, proved its excellence at the Pyeongchang Winter Olympic Games 2018. At the core of the product lies auxiliary engineering technology for visually and hearing impaired and handicapped people, so that both people with and without disabilities can use it readily. 'Dot Kiosk' achieved such phenomenal success that foreign visitors who used the product began to call it the 'barrier-free kiosk.'

Dot also developed 'Dot Watch,' a braille smart watch. 'Dot Watch,' the matrix of 'Dot Pad' and 'Dot Kiosk,' is a specialized product allowing visually impaired people to read characters and other information in braille. Digital braille provides a function for reading the time and sentences along with various add-on functions for storing memos by linking with a smart phone.

Dot also has collaborated with world-famous designer Yu Young-gyu, and was acclaimed for the excellence of its functionality and design the world over by winning the iF Design Award, and Good Design Award. 'Dot Watch' has been a consistent best seller for visually impaired people globally since it was launched in the markets four years earlier.

Presenting happiness to some 300 million visually impaired people

Dot further accelerates technology development and currently endeavors in earnest to develop pads for visually impaired people in partnership with Google, which came about by coincidence when a Google employee posted on social media about having a visually impaired child, a social campaign for them caught on in the US. Thus, Dot has been undertaking an active partnership with Google to take part in community activities, let alone making everyday life better for visually impaired people.

Dot is an early-stage startup but it boasts unique source technologies along with some 120 patents at home and abroad, securing the first-rate competitiveness by operating our own plant integrated with such technologies. We strive in earnest to provide wellbeing and fulfilling lives to some 300 million visually impaired people globally. In short, Dot creates an environment where both people with and without disabilities can enjoy barrier-free lives.

TIME LINE



ZOOM IN - III

Support for AI Diagnosis and AI Medical Devices Development through Medical Big Data Construction and Research

KEIMYUNG UNIVERSITY DONGSAN MEDICAL CENTER Professor Si-wook Lee



KEIMYUNG UNIVERSITY DONGSAN MEDICAL CENTER

☒ General Status

- **Implementing Agency**

National Information Society Agency

- **Business Details**

Building up intelligent information industry infrastructure

☒ Company Status

- **CEO**

Lee Se-young

- **Business Type**

High level general hospital

- **Year of Establishment**

1980.

- **Homepage**

<https://www.dsmc.or.kr:49848/>

☒ Key Accomplishments

Construction of infrastructure of medical healthcare big data research.

Professors' vigorous commitment to and participation in medical healthcare big data research project.

Construction of patients-centered smart hospital.

Invigoration of Digital Healthcare Research Using Clinical Medical Big Data



We are currently living in the Fourth Industrial Revolution era. AI (artificial intelligence) is already here, and the healthcare and medical areas are no exception to this. The market size of the medical care and digital healthcare areas is projected to increase further due to medical MyData, AI diagnosis, and AI medical devices.

To make AI helpful for people, a series of process such as the big data collection, refinement, labeling, check, and service model development should be done. The data for learning is the most important factor essential for AI development. National Information Society Agency (NIA) is supporting learning data construction on varieties of data each year.

Keimyung University Dongsan Medical Center (KUDMC) is a high-level general hospital, and has made a lot of effort for digital healthcare research including AI medical device development based on huge amount of medical healthcare clinical big data for over 20 years.

KUDMC has actively adopted and constructed the relevant research infrastructure, with high ranking executives showing interest in big data construction and ICT convergence research and business and they have been supportive. Under the initiative of the Big Data Team (Team Leader: Kim Hae-yong), an organization within KUDMC for medical big data construction, KUDMC is revealing capabilities of and commitment to big data construction.

Construction of Data for Learning Essential to AI Development



KUDMC was selected as an ICT Fund project lead institution to construct three data sets in the AI Learning Data Construction project (Head Researcher: Professor Lee Si-wook) in 2021, and carried out the following: construction of "medical imaging data containing video data for foot and gait abnormality" and "toddlers' hip joint ultrasonic data" as data for learning along with hospitals such as Kyungpook National University Hospital, companies like Infinity Healthcare, and institutions including Daegu Digital Promotion Agency and Daegu Metropolitan City.

One of the projects, the musculoskeletal video data consists of two types of data, namely "musculoskeletal rehabilitation exercise video data" and "abnormal foot and gait patients' video data." The project involves labeling of coordinates through which reference angle values can be extracted, which becomes basis in disease diagnosis, based on the pair video data per patient's disease and various types of X-rays used in hospitals, and storing in a machine learning-enabling format and opening to the public. This is slated to be released to the public through the AI Hub platform.

If AI service model using database that KUDMC has is developed, it can be used as a diagnosis assistance tool. Therefore, diagnosis fatigue is reduced, and diagnosis rate will be improved, Also an opportunity for patients to enjoy medical benefits will be provided.

Medical Data Research and Business Becoming More Active after the Project

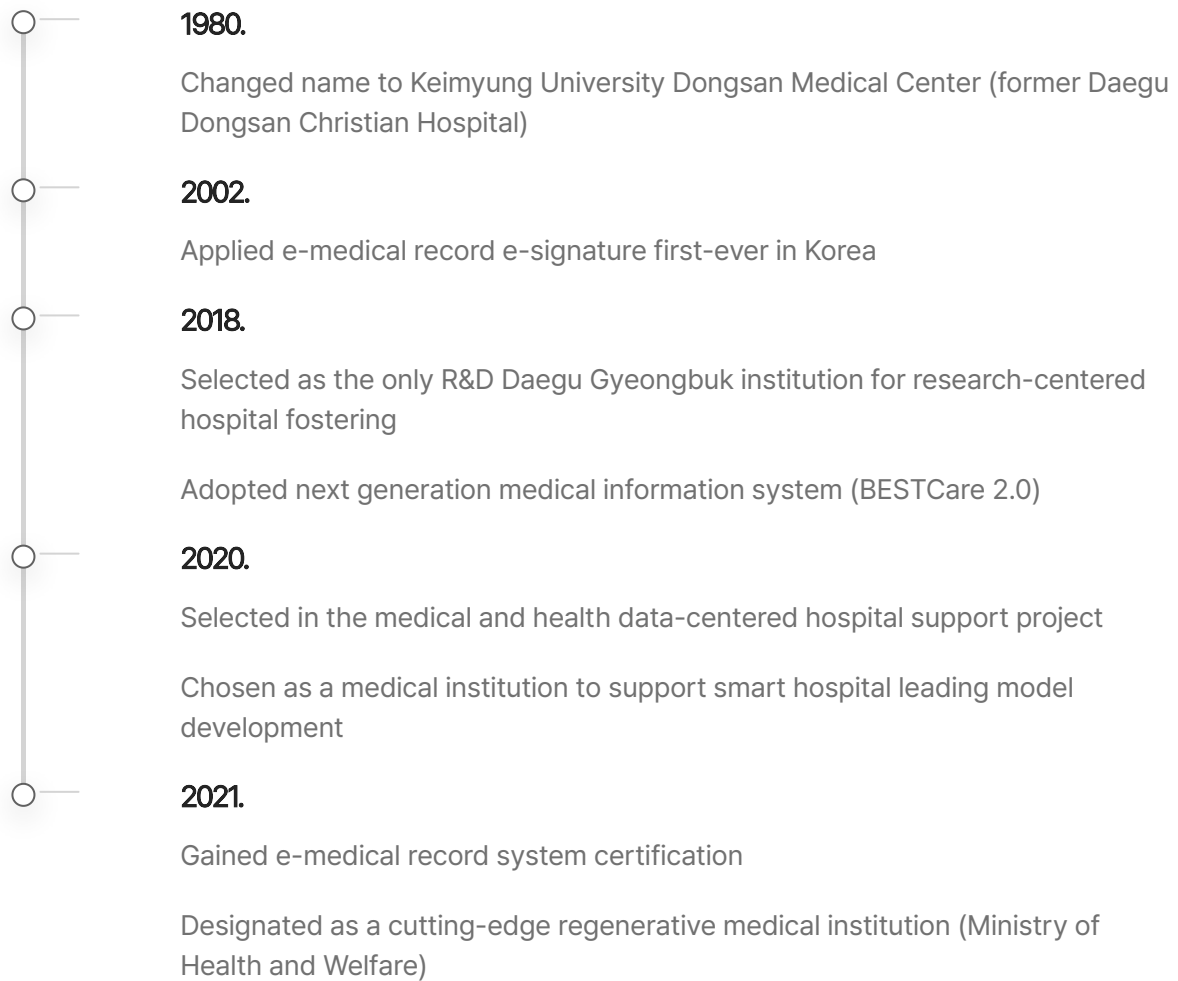
Interest in the big data project and AI development has remarkably increased, centered on capable young professors through the data construction project since KUDMC's participation in the ICT Fund project.

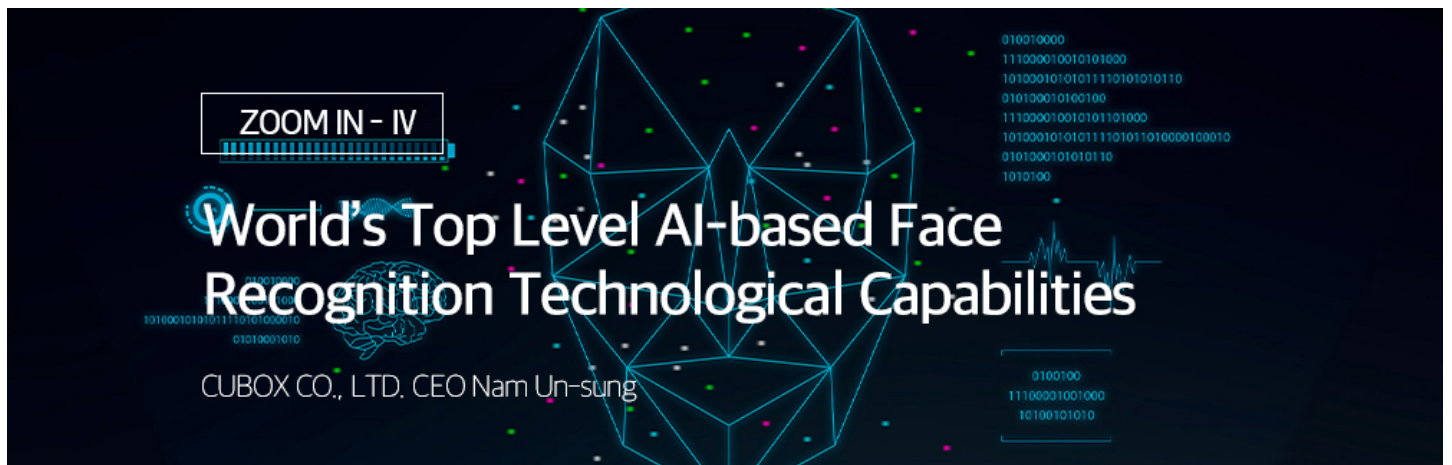
Research and projects are currently carried out using medical data in other departments as well, including cardiology, infection medicine, gastroenterology, neurosurgery, nuclear medicine, and obstetrics / gynecology.

In 2021, KUDMC was selected in the AI-based foot and gain abnormality diagnosis assistance solution development project and AI hip joint ultrasonic reading solution development project for IoT-based toddlers diagnosis development. The projects involve support for enhancement and and commercialization of the data gathered together for a pan-government medical development project, based on the experience of constructing various AI data sets.

The projects, which has been carried out for four years, needs clinical trials and certification procedures for commercialization and to obtain licenses, and the role of hospitals is huge. KUDMC is making considerable effort, including research facilities expansion and research personnel support through cooperation with Keimyung University. KUDMC plans to perform projects through cooperation with companies so that better achievement can be made.

TIME LINE





CUBOX CO., LTD.

☒ General Status

- **Implementing Agency**
National Information Society Agency
- **Business Details**
Construction of knowledge base

☒ Company Status

- **CEO**
Nam Un-sung
- **Business Type**
System software development and supply
- **Year of Establishment**
2010. 05.
- **Homepage**
<https://www.cubox.ai/>

☑ Key Accomplishments

100% market share for face recognition access control system for class A security facilities including four integrated government buildings, Incheon International Airport, and National Information Resources Service (NIRS) 100% market share for access control system.

Acquired the world's top-level NIST FRVT verification in 2020 and 2021.

Won the data construction project for AI-based learning from the Ministry of Science and ICT (MSIT) for four consecutive years.(first phase in 2020, first and second phases in 2021, first phase in 2022)

Acquired first biometric data forgery detection certification in Korea in 2021.

Biometrics is an authentication method of digitalizing by extracting the individual's unique biometric data and is hailed as a safe system whose duplication is difficult with no risk of loss. In biometrics, demand for face recognition soars as interest in contactless biometrics to consolidate preventive measures against epidemics following the COVID-19 pandemic increases. Due to its easy usability, face recognition is emerging as a key technology for financial transactions, mobile ID card, and smart city. Some companies of developed countries including China, US, France, and Russia are leading the market, boasting of technological capabilities in face recognition algorithms.

A newly emerging company in the FRVT verification of NIST ranked 24th worldwide in 2020, posing a threat to existing leading companies. It is Cubox, Korea's very own indigenous software developer. Cubox is a computer vision-related software development company established in 2020. By developing the automated immigration checkpoint for airports in 2013 for the first time in Korea, Cubox supplied the system to Incheon Airport, and it has also provided the face recognition-based access control system to various institutions including four integrated government buildings (Seoul, Gwacheon, Daejeon, and Sejong), NIRS, and KEPCO.

With its face recognition-based algorithm development experience, the company is building up data set construction knowledge to secure deep learning algorithm performance. Through this, Cubox ranked first to fifth in each category in the second half of 2021 by participating in the world-renowned NIST FRVT. By entering the leader board top class dominated by Chinese and Russian companies, Cubox has positioned itself as the world's top-level face recognition-based algorithm supplier.



Advancement of Research Competence through Construction of Data for Learning

Various technologies are required to develop face recognition, including data set construction for AI algorithm learning and deep algorithm research in addition to systematic understanding. In particular, the data set for algorithm learning is essential to construct deep learning-based AI algorithms. As a private small (medium)-sized company, Cubox faced limitations in gathering a sufficient volume of high-quality data.

At that time, the project to construct data for AI-based learning carried out by MSIT through the National Information Society Agency (NIA) was critically helpful. Cubox took part in constructing data for AI-based learning including face recognition, figure estimation data, and small object image data in the Digital New Deal project as a managing company.

Cubox has been selected as the managing company for four times since 2020, and it has been performing projects by forming consortiums with various data set construction firms for AI-based learning so the base of infrastructure could be shaped. The company got to enhance AI algorithm research capabilities while learning know-how more systematically by carrying out large-scale data set construction work. From a data consumer viewpoint, Cubox could secure the usefulness of data adequately by designing and performing the data gathering, refining, and processing process. Besides face recognition, the company could improve adaptability by aiding in understanding in the object recognition field.

Shaping Virtuous Circle Linkage with Improved Technological Capabilities

Cubox is currently recognized internally and externally. Objective certifications are being added with smooth business operations in addition to technological capabilities. The reinforcement of R&D personnel where Cubox had difficulties has become smooth, and requests for collaboration from related companies are surging. Through the successful attraction of KRW 25 billion Series B investment, the company laid the foundation for a virtuous circle, rapidly growing as a firm preparing for listing with KOSDAQ in 2022.

“We were participating in the Digital New Deal project thinking that if we manufacture the data set for Cubox’s algorithm research, this can be a key to success,” Cubox CEO Nam Un-sung explained. Cubox’s technological capabilities and research competence rapidly grew because the company understood what was needed for research and then applied them to business.

Cubox is laying the foundation for the easy application and use of face recognition algorithms in diverse fields requiring face recognition such as identity authentication, banking, access control, and control of leaving the office/ workplace. In addition, Cubox is expanding its research area to various object recognition fields including autonomous driving and robotics.



TIME LINE

