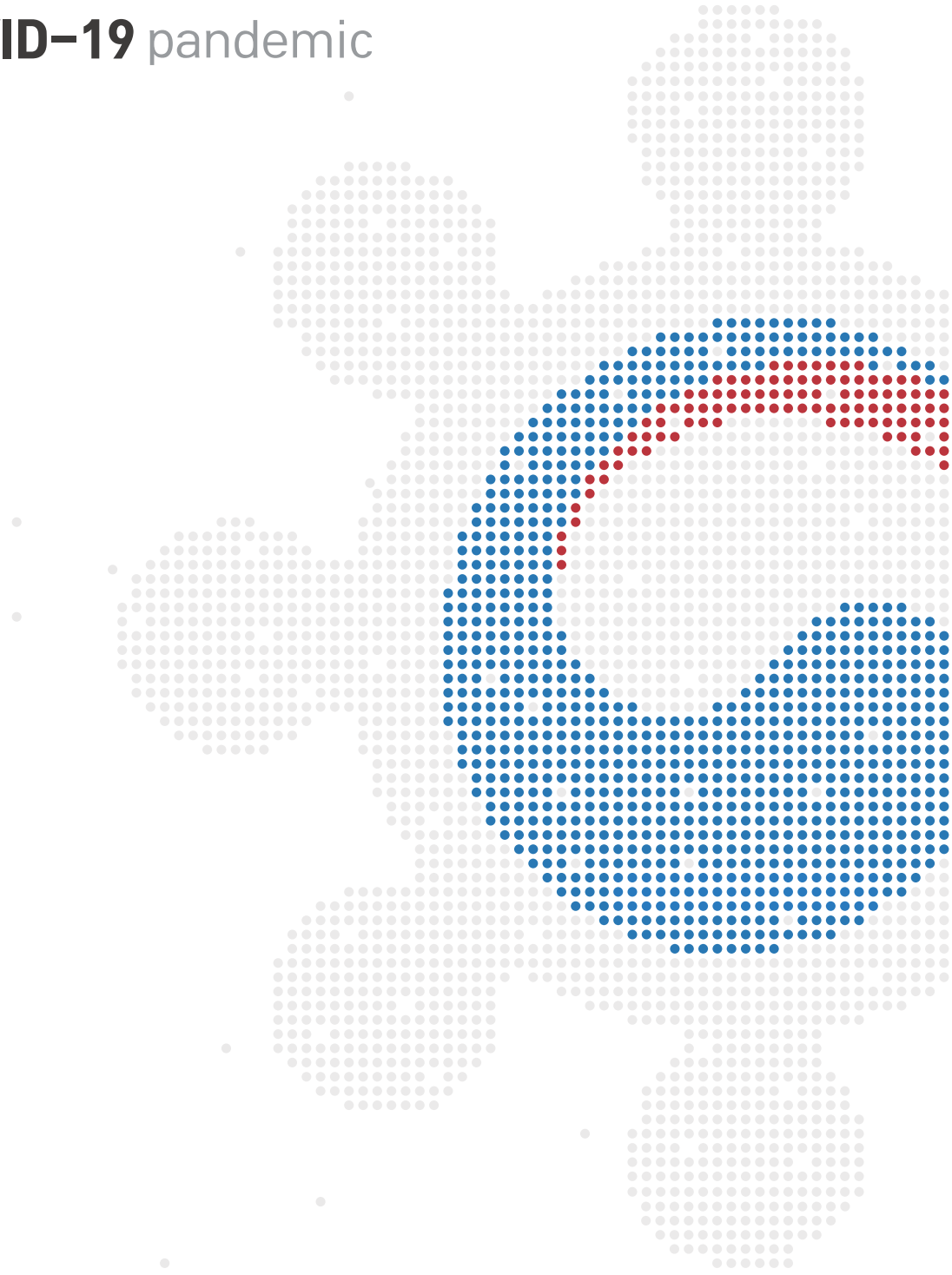
KOREAN ICT services

against **COVID-19** pandemic



NIA NATIONAL INFORMATION SOCIETY AGENCY

Let us overcome together and
move forward as one.
We can do it now, just as we have always done.

2020. 03. 22.

Message from **President Moon Jae-in**: Together, Let's Move Forward

Prologue

COVID-19 was a big shock to our everyday lives and our national crisis management system. Despite our hopes at the beginning of the spread, COVID-19 was declared a pandemic, and it worries me that regardless of the country, the trust people had in their government's public management system would turn into insecurity and ruin our everyday lives, as well as devastate the mind.

The Republic of Korea has been continuously emphasizing the crisis management capabilities as well as the resilience of the government and the civil society ever since dealing with the spread of infectious diseases such as Severe Acute Respiratory Syndrome (SARS) in 2003 and the Middle East Respiratory Syndrome (MERS) in 2015. Furthermore, the Korean Government has been preparing for an unpredictable national crisis by establishing an infectious disease prevention and management system using ICT technology in order to realize effective crisis management and efficient policy execution.
In this COVID-19 crisis, the spread of the virus to local communities, which was turning into a serious situation, was able to be put to a stop by setting "openness', 'transparency', and 'cooperation with the civil society' as the national disaster response principles, and by establishing a strategic test-trace-treat system through cooperation between various ministries, local governments and government agencies. In addition, Korea was able to enter a stabilization phase by halting the rapid spread of COVID-19 through actively utilizing mobile-based ICT technology to manage confirmed patients in and out of the country as well as suspected patients, and through strong execution of self-quarantine, social distancing, and public-private partnership public mask supply policies.

Now, the Republic of South Korea has hope that it can overcome the COVID-19 crisis and it is participating in international crisis response activities. In order to find the ultimate solution to COVID-19, no one, whether a country or a company, is sparing any expense in investing for a vaccine or a cure, and researchers and medical staff worldwide are working hard towards the goal of early development by sharing research information. Governments from around the world are also opening the confirmed cases of their countries public as well as encouraging civil societies to cooperate in social distancing campaigns to halt the spread of COVID-19.

The National Information Society Agency is publishing the "Korean ICT Services Against COVID-19" in hopes of contributing to stabilizing the national crisis and the social chaos around the globe. I wish that this casebook can help in preparing for unpredictable crises in the future and I sincerely hope that the world can declare the end of COVID-19 and actualize our hopes of returning to our everyday lives.

Moon Yong-sik
President of National Information Society Agency

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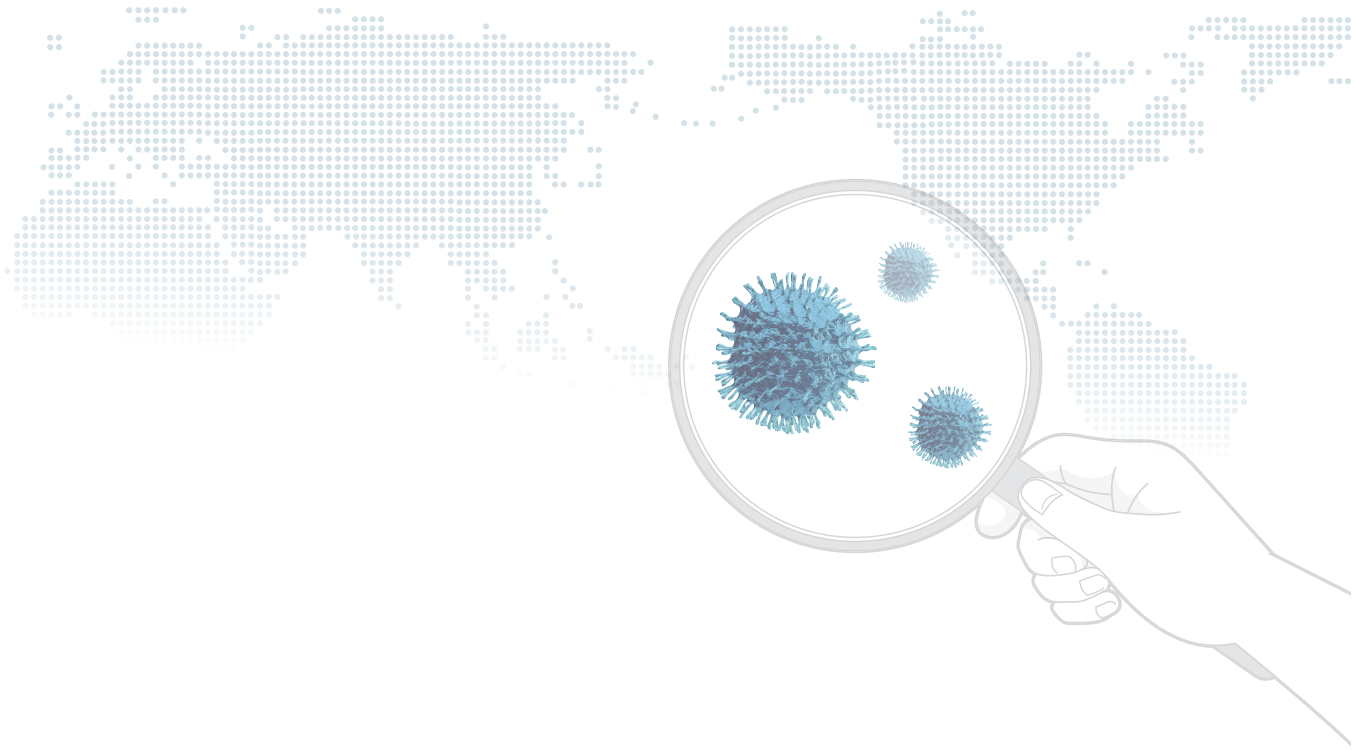
Introduction

01 Background

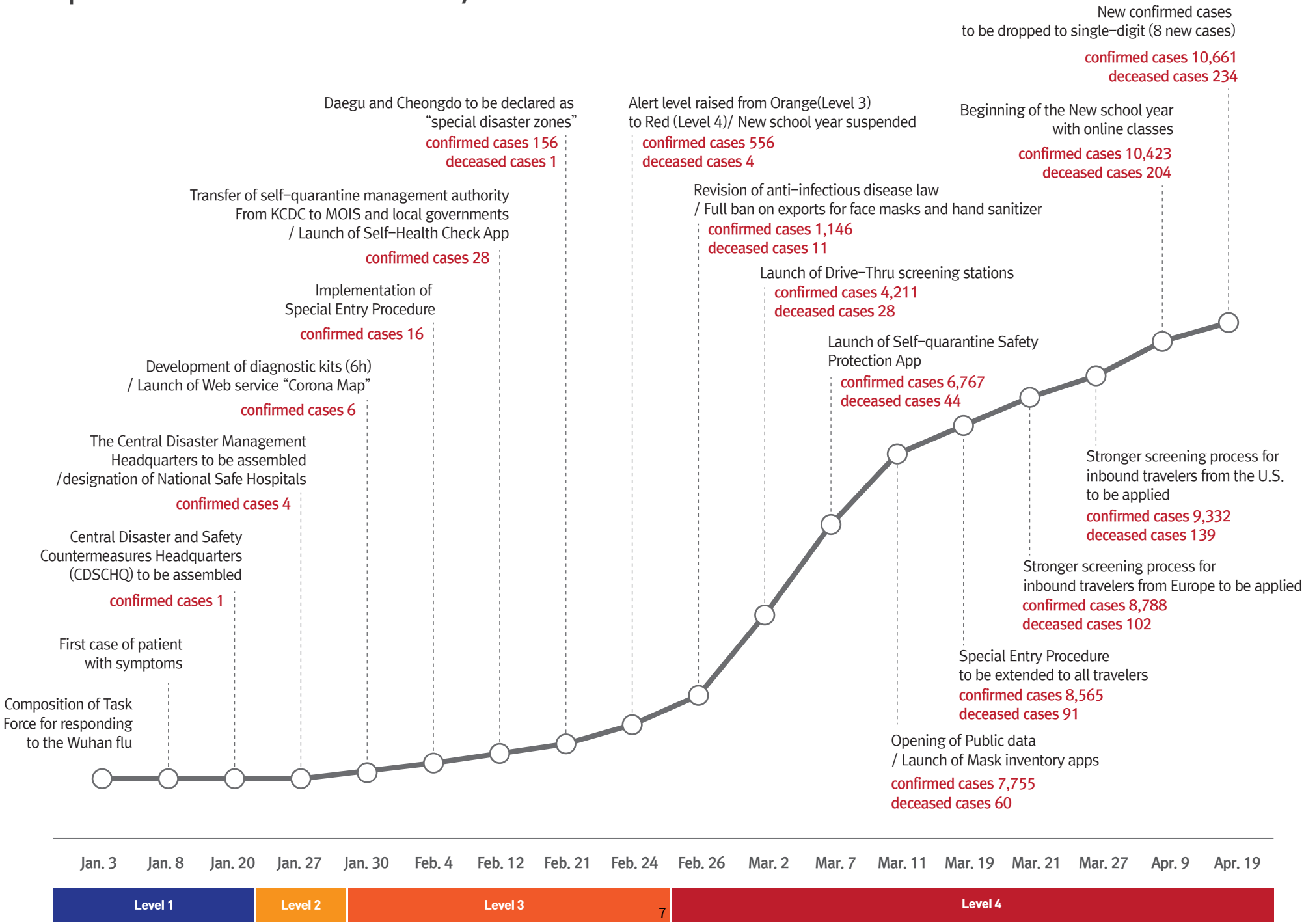
COVID-19 has spread around the world and the disease labelled as a global pandemic is now growing rapidly. As healthcare professionals and citizens of Korea join their hands in the fight against COVID-19, many governments around the world are paying attention to efforts made by the Korean government in responding to the disease utilizing ICT with principles of openness and transparency.

The Republic of Korea experienced a global disaster called COVID-19 a little earlier than other countries after the COVID-19 confirmed in January 2020.

Yet, as a stage of stabilization of the diffusion trend, the Korea government would like to help a little to overcome the global disaster by introducing and sharing the case of the COVID-19 response using ICT.



Spread of COVID-19 and Measures Taken by Risk Alert Level

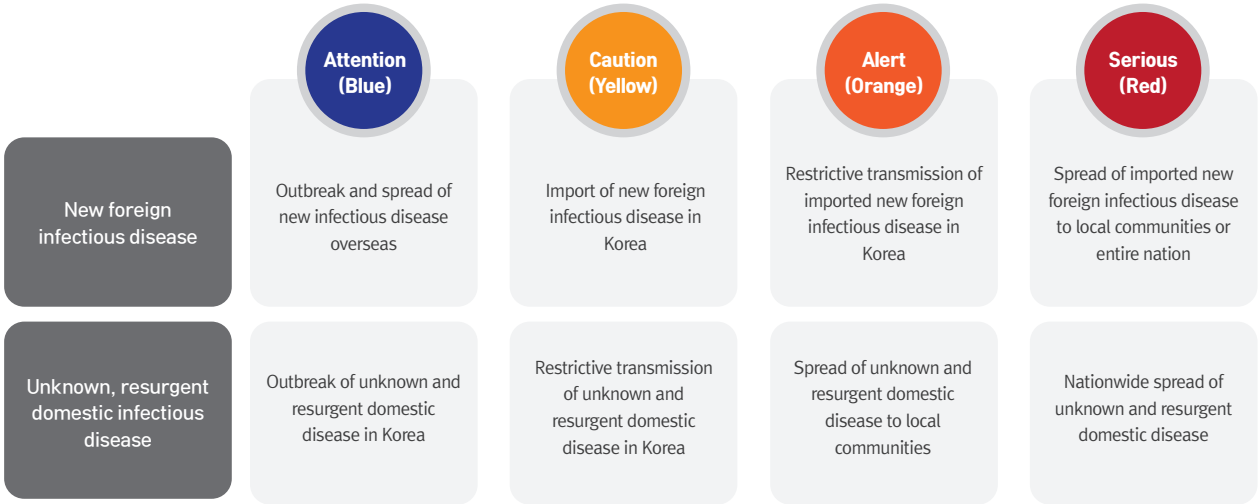


02 COVID-19 Response by Risk Alert Level

The Korean government has classified the risk of infectious diseases into 4 stages including attention (Blue), caution (Yellow), alert (Orange), serious (Red) based on the severity of the disease such as the speed of damages occurred and the possibility of disease spread.

Each risk alert level indicates as follows: Blue upon outbreak or spread of a new infectious disease overseas, Yellow upon the import of such infectious disease into Korea, Orange upon restrictive transmission of new imported infectious disease in Korea, and Red upon spread of such disease to local communities or to the entire nation.

National Infectious Disease Risk Alert Level



On December 31, 2019, Wuhan Municipal Health Commission in Wuhan, Hubei Province in China announced that 27 people were confirmed with 'pneumonia' infection and the authority was investigating the case. On January 3, 2020, the Korean government issued the national infectious disease risk alert level to Attention, installed a task force on pneumonia of unknown etiology in Wuhan, and began to operate the 24/7 monitoring system in emergency situation room centering on Korea Centers for Disease Control and Prevention (KCDC).

In an effort to strengthen quarantine inspection on travelers entering Korea from Wuhan, the government asked them to submit health questionnaires, conducted testing for those with fever and respiratory symptoms, and those with suspicious symptoms were isolated to undergo additional testing.

The sign of COVID-19 outbreak was first noticed on January 8, 2020 when a 36-year-old Chinese woman went under inspection for the unknown pneumonia occurred in Wuhan and was found to have suspicious symptoms. KCDC administered her to a designated hospital (Seoul National University Bundang Hospital, SNUBH), began to provide medical treatment in an isolated unit and conducted additional testing, while carrying out epidemiological investigations.

After identifying the first COVID-19 patient in Korea on Monday morning on January 20, the government raised the alert level from Attention to Caution, began to operate task forces in KCDC and local governments, and further reinforced activities of the national 24/7 emergency response system including close monitoring on patients, testing for suspicious cases, strengthening management and control on patients.

Source: https://www1.president.go.kr/

Source: http://www.mdtrinity.com/news/view.php?idx=1554

On January 27, the Ministry of Health and Welfare (MOHW) once again raised the alert level to Alert as 4 persons were confirmed with the disease in Korea, and began to install and operate Central Disaster Management Headquarters for Novel Coronavirus Infection (led by the Minister of MOHW).

The Headquarters deployed additional persons at quarantine sites, and designated health centers in cities, counties and districts, and local medical clinics as COVID-19 screening stations as their priority tasks. COVID-19 screening stations are installed outside emergency rooms or locations away from medical institutions so that people with symptoms of infectious diseases receive treatment before they visit to such emergency rooms or hospitals for better access to COVID-19 testing, allowing rapid testing and diagnosis on the disease in a large scale to promptly identify confirmed cases.

The Korean government has been implementing special entry procedures for all inbound travelers from China as of February 4. Hence, entrants should undergo fever checks and submit special quarantine declaration forms and health questionnaires.

The first victim of the disease occurred on February 21 and the number of confirmed cases rapidly increased to 156 cases centering on Daegu and Cheongdo. The government designated Daegu and Cheongdo as special disaster zones for infectious diseases. In the special disaster zones for infectious diseases, the government implements strategies to minimize the number of deaths, which is to promptly identify people who are potentially exposed to someone with confirmed case of COVID-19 during the incubation period, isolate and provide medical treatment, rather than tracking travel routes of individual patient, and to focus on allocating medical resources to severe COVID-19 patients.

The disease continued to spread centering on Daegu and Cheongdo in Gyeongbuk Province and the number of deaths and confirmed cases rapidly increased to 4 and 556, respectively. Hence, the government finally raised the alert to the highest on February 24 in preparation for a nationwide spread of the disease. Central Disaster and Safety Countermeasure Headquarters (CDSCHQ, led by the Prime Minister) was installed and began its operation to carry out pan-governmental quarantine activities. As the alert level was raised to Red, the Ministry of Education (MOE) decided to delay the opening of a new semester in all schools (preschool, elementary school, middle school, high school) across the country.

On March 5, President Moon Jae-in declared Daegu, Gyeongsan City, Cheongdo County, and Bonghwa County as special disaster zones as the number of confirmed cases totaled at 8,162 nationwide and 88% of confirmed cases (7,188) was found in Daegu and Gyeongbuk Province. It was the first time that the government designated special disaster zones due to an infectious disease, instead of a natural disaster. For the designated areas, the government covers 50% of recovery expenses and provides financial assistance to support daily lives and housing safety of residents. The government provides other benefits as well including relief fund for the deceased and wounded, reduction or exemption of electricity rates, national health insurance premiums, communication expenses, and gas fees.

In the meantime, the government launched a strict social distancing campaign encouraging people voluntarily engage in the movement. Here, social distancing is a set of non-pharmaceutical interventions or measures taken to prevent the spread of a contagious disease in local communities. Some of these measures include avoiding gathering together in large groups for events and meetings, staying at home, maintaining a physical 2-meter distance between people, following personal hygiene rules, and working from home. Also, the government recommended to suspend the operation of sports, leisure, and religious facilities. The nationwide social distancing in Korea initiated on March 22 and ended on May 5 and the government switched it to moderate quarantine measures.

Thanks to harmonized efforts by the government with innovative and proactive COVID-19 response measures, matured citizens who willingly joined the social distancing campaign, and medical workers who devoted themselves to save lives, the number of new confirmed cases in Korea finally decreased to less than 8 on April 19, for the first time since the outbreak of the disease.

03 COVID-19 Response by Using ICT

Significance of ICT in COVID-19 Response

As demonstrated during Korea's fight against COVID-19, the ICT and e-government system has transformed the entire process of responding to the COVID-19, from the screening and diagnosis, prevention, quarantine to the management of patients and those who have contacted them in a more creative and innovative way than ever by sharing information with related ministries and agencies, public-private cooperation, and citizen engagement.

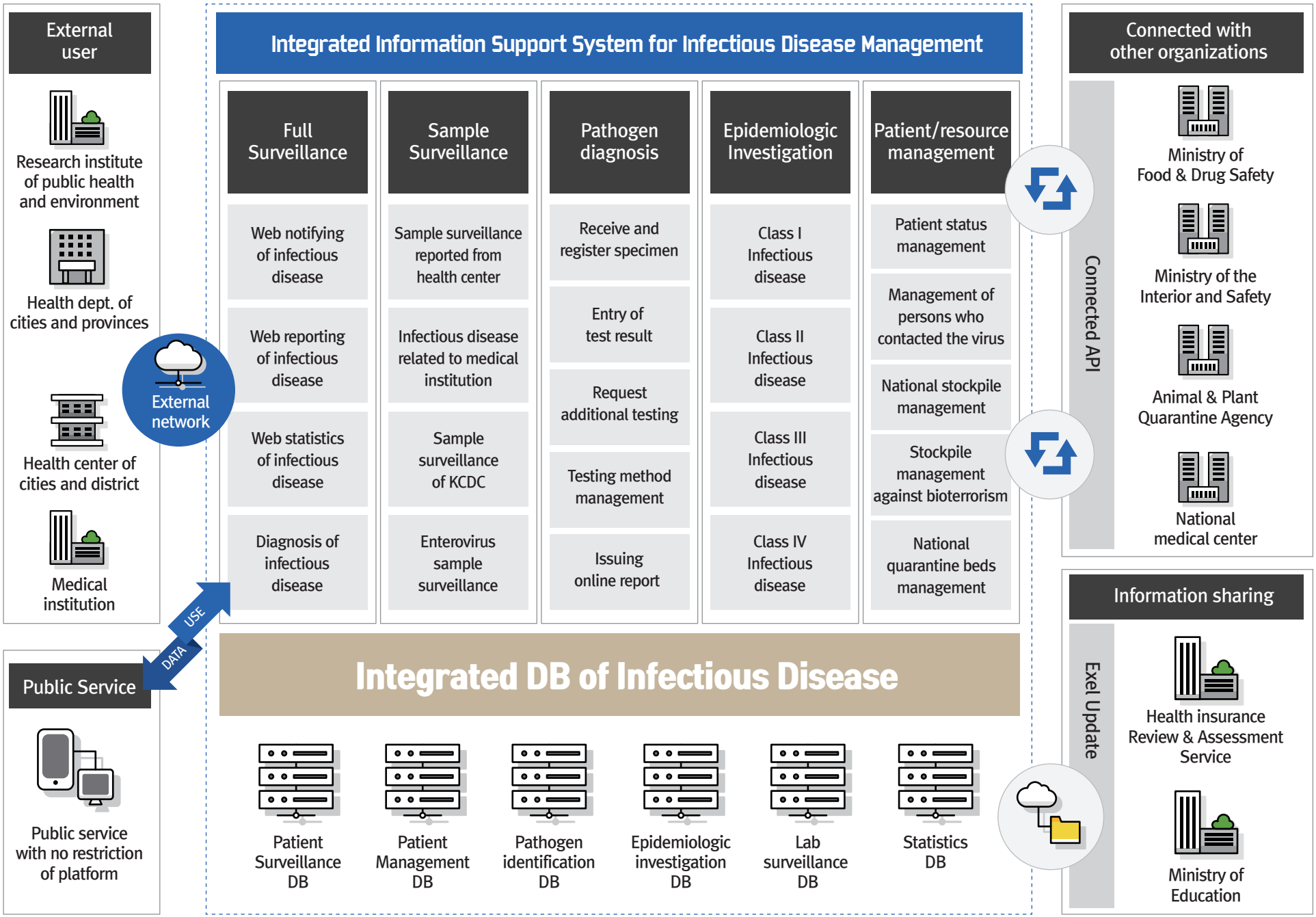
Based on one of the world's best ICT infrastructure, the Korean government enhances accuracy, promptness, accessibility, and usability of information by linking data and information between systems of different agencies and opening public data.

In addition, the country actively utilizes ICT to prevent the spread of COVID-19; such examples are the development of COVID-19 testing kits and treatment based on AI technology, tracking travel routes of persons confirmed with the disease, and monitoring of those under self-quarantine with GPS.

E-government System of Korea Regarding Infectious Diseases

The necessity of improving public health and preventing diseases has increased these days along with the continuous outbreaks of new and resurgent infectious diseases such as MERS-CoV, avian influenza, and Melioidosis serving as threats to social security. Hence, the government has established 'Informatization Plan for the Prevention and Management of Infectious Diseases' in 2013 and established an 'integrated information support system for monitoring and control of infectious diseases' by phase in 2015.

The system integrates 7 activities (monitoring of patients, monitoring of pathogen and medium, diagnosis on pathogens, epidemiological investigation, vaccination, management of patients and people having contact with them, and quarantine management) related to the response of those designated as nationally notifiable communicable diseases and allows management of those activities via 'to do' section on one screen. It also displays dashboards for users to check the status of infectious disease cases at a glance by linking data with other ministries and agencies through the ‘integrated information support system for infectious disease management’.


External user
Research institute of public health and environment
Health dept. of cities and provinces
Health center of cities and district
Medical institution
External network
Public Service
Public service with no restriction of platform
USE
DATA
Integrated Information Support System for Infectious Disease Management
Full Surveillance
Web notifying of infectious disease
Web reporting of infectious disease
Web statistics of infectious disease
Diagnosis of infectious disease
Sample Surveillance
Sample surveillance reported from health center
Infectious disease related to medical institution
Sample surveillance of KCDC
Enterovirus sample surveillance
Pathogen diagnosis
Receive and register specimen
Entry of test result
Request additional testing
Testing method management
Issuing online report
Epidemiologic Investigation
Class I Infectious disease
Class II Infectious disease
Class III Infectious disease
Class IV Infectious disease
Patient/resource management
Patient status management
Management of persons who contacted the virus
National stockpile management
Stockpile management against bioterrorism
National quarantine beds management
Integrated DB of Infectious Disease
Patient Surveillance DB
Patient Management DB
Pathogen identification DB
Epidemiologic investigation DB
Lab surveillance DB
Statistics DB
Connected with other organizations
Connected API
Ministry of Food & Drug Safety
Ministry of the Interior and Safety
Animal & Plant Quarantine Agency
National medical center
Information sharing
Exel Update
Health insurance Review & Assessment Service
Ministry of Education

ICT Services for COVID-19 Response

Korea actively utilizes ICT to respond to the COVID-19 crisis and takes innovative approaches to control the infectious disease by developing AI-based testing kits promptly, tracing and monitoring confirmed patients with GPS, managing and monitoring patients and people confirmed positive to the disease via mobile apps, and quickly providing information by opening public data while ensuring transparency.

In the stage of screening and diagnosis, the country uses Drug Utilization Review (DUR) and International Traveler Information System (ITS), allowing medical institutions to have access to data on entrants from countries affected by COVID-19. By using DUR and ITS, all medical institutions in Korea can identify patients having a high probability of COVID-19 infection.

Source: https://www.huffingtonpost.kr/

Also, the Korean government takes preventive measures in the fight against the disease via smart quarantine system which enables one to efficiently check the extensive information of travelers entering Korea via a third country. It links passport information, countries of visit, information of inbound travelers, and data usage of international roaming services by telecom companies all together. Domestic residents and long-term staying foreigners, who did not have any abnormal symptoms upon entry or were confirmed negative to the test, should install the 'self-quarantine safety protection app' released by the Ministry of the Interior and Safety (MOIS) and foreigners staying in Korea for a short-term without symptoms or confirmed negative upon entry should install the 'self-health check app' by MOHW to check their health conditions daily.

In the stage of epidemiological investigation, credit card statements, CCTV analysis, location data of mobile phones are used to precisely identify recent travels of people confirmed with COVID-19 and track the spread of infection by carrying out prompt epidemiological investigations.

In the stage of patient and contact management, the national hospital ward management support system is used to effectively manage hospital wards and prepare for the shortage, and the mobile safety protection app for people under self-quarantine is applied to monitor and prevent them not to leave the isolation location.

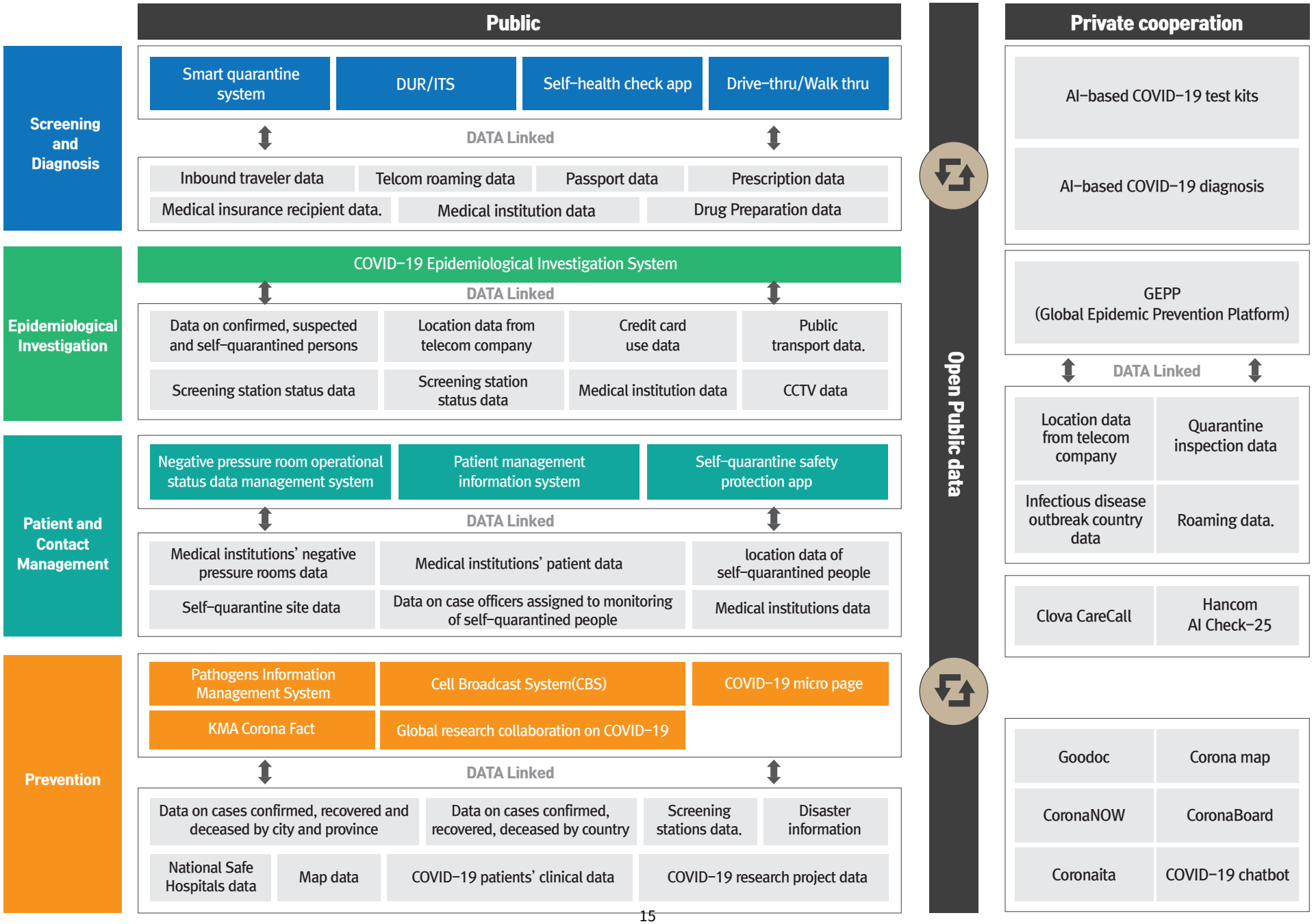
Source: https://www1.president.go.kr/

In the stage of prevention, the government disclosed public data including face mask sales and available masks in the form of open application programming interface (API) and developers in the private sector developed a series of 'face mask notification apps and web-based services' in an effort to solve problems related to face mask shortage. Based on this, various services including Mask App, Mask-Nearby, Gooddoc, Ddocdoc were launched and began to provide services simultaneously.

Examples of apps and web-based services based on public data released by the government include comprehensive mapping service containing information on travel routes of COVID-19 patients, locations of screening stations and Shincheonji churches based on Geographic Information System (GIS), public chatbot services intended to help users prevent the disease and provide guidelines for protective measures in their daily lives by using information on screening stations and travel routes of COVID-19 patients, and AI-based voicebot services that are used to check fever, respiratory symptoms of users and send the result to health center employees via email. Such ICT services are considered as representative cases of civic hacking led by people who are willing to solve social issues by themselves.

For COVID-19 response case inquiries, **contact e-mail: covid-19@nia.or.kr**

COVID-19 Response Case by Risk Alert Level and Related Information



ICT utillizing cases tackling against **COVID-19** pandemic of Korea

Screening and Diagnosis Stage

Public sector

PPP(Public-Private Partnership)

Epidemiological Investigation Stage

Public sector

PPP(Public-Private Partnership)

Patient and Contact Management Stage

Public sector

PPP(Public-Private Partnership)

Prevention Stage

Public sector

PPP(Public-Private Partnership)

ICT utillizing cases tackling against **COVID-19** pandemic of Korea

Screening and Diagnosis Stage

Smart Quarantine System
(Smart Quaratine Information System)

01 Introduction

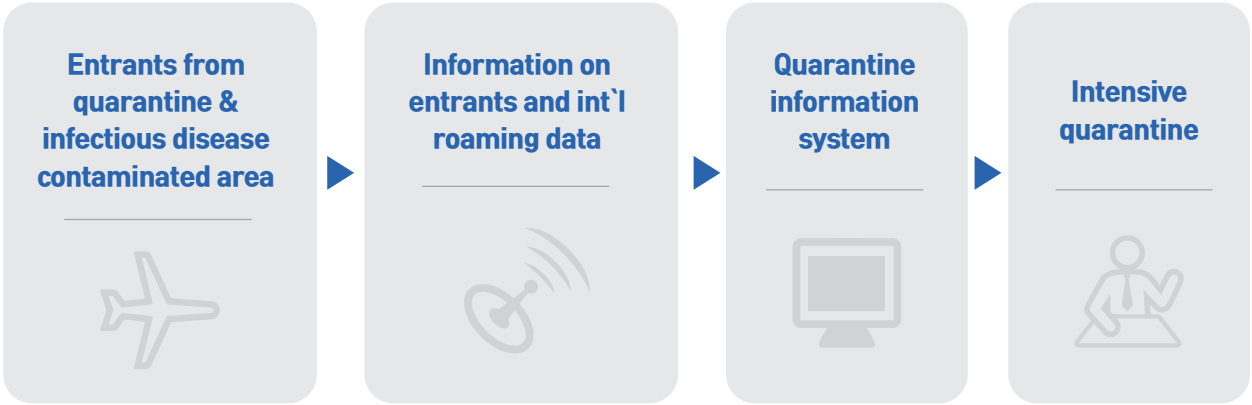
The smart quarantine system of Korea Centers for Disease Control and Prevention (KCDC) is a national quarantine system developed based on ICT network connection among the Passport Information Comprehensive Administration System (PICAS) of the Ministry of Foreign Affairs (MOFA), Immigration Information System (IIS) of the Ministry of Justice (MOJ), Drug Utilization Review (DUR)* of the Health Insurance Review & Assessment Service (HIRA) and telecom companies.

* DUR (Drug Utilization Review) is a system that connects the information of medical institutions and pharmacies throughout the country to prevent misuse and abuse of drugs (developed in December 2010)

Using the system helps gather information on arrivals from countries where infectious diseases have occurred* and those via a third country** and therefore, allows tracking and monitoring of infectious diseases during the incubation period.

* Infectious disease-contaminated areas refer to ones that are informed by WHO as having infectious disease outbreaks or countries where one year has not elapsed since the date of disease outbreak.
** Those entering Korea after visiting the disease-affected and quarantined areas via a third, non-contaminated country

Korea`s smart quarantine system was also introduced as an ICT- based measure taken in response to COVID-19 in WHO`s daily briefing (March 27, 2020).



02 Background and Purpose

In the past, the airport and seaport quarantine screening of passengers entering Korea from countries affected by infectious diseases was largely done by using thermal cameras to spot people with fever and gathering information from health questionnaires filled out and submitted by the passengers. Although such measures were very efficient to detect people with Cholera and other waterborne diseases when entering by sea, they had many limitations to effectively contain imported cases that are rapidly transmitted with a long incubation period as in the case of the Ebola virus disease (2014), MERS-CoV (2015) and Zika virus disease (2016).

With continued improvement, the current smart quarantine system of Korea has been developed in 3 phases.

In phase 1, the system was connected to PICAS of MOFA and DUR of HIRA to promptly check information of domestic residents who enter the country after 2015, when MERS-CoV spread.

A year later in 2016, in phase 2, the connection coverage was expanded to information of foreign entrants. By linking the system to IIS of MOJ to check information of foreign entrants, the quarantine service targeted all passengers including both domestic residents and foreigners entering Korea. The system was then linked to the eligibility verification system of the National Health Insurance Service so when the entrants visit medical institutions, they can check their international travel history and promptly and precisely identify or screen those suspected of infection.

Lastly, in phase 3, the smart quarantine system was connected with the international roaming data of telecom companies. KCDC started creating a network interconnection between the three major telecom companies - KT, LGU+ and SKT - and the smart quarantine system in November 2016 and completed developing the system as of today. For operation of the system, KCDC provides information on countries with confirmed cases of infectious diseases to telecom companies, and the telecom companies use subscribers roaming data, identify who visited such countries and send the result to KCDC in real-time.

By using the global roaming data, KCDC was able to track and monitor travelers entering Korea via a third country during their incubation period since arrival and build a national quarantine system with enhanced capabilities of disease prevention and response. Also behind the successful ICT-based interconnection and sharing of ministerial information was the legal and institutional support from the government.

Smart Quarantine System
(Smart Quaratine Information System)

The main reason that Korea had difficulty in promptly containing the spread of MERS-CoV back in 2015 was the lack of information sharing. Hence, the government enacted the Infectious Disease Control and Prevention Act (with Article 76-2 Request to Provide Information, etc.) in July the same year to provide legal grounds for information sharing.

The following table indicates the process of phasal development of the smart quarantine system.

Phase	Year	Focus	Requirement
Phase 1	2015	Domestic residents	▪ Link with PICAS (MOFA) ▪ Link with DUR* (HIRA)
Phase 2	2016	Foreigners	▪ Link with IIS of MOJ and health insurance eligibility verification system of NHIS
Phase 3	2016 ~ 2017	International roaming data	▪ Link with KT, LGU+ and SKT → For international travelers' stay or transit information in contaminated areas

03 Pre-requisite

Type	Requirement
System	▪ IIS, PICAS, DUR system, national health insurance eligibility verification system, international roaming data of telecom companies
Data	▪ Passenger list, passport information, entrants' information, medical institutions information, entrants' overseas travel history, etc.

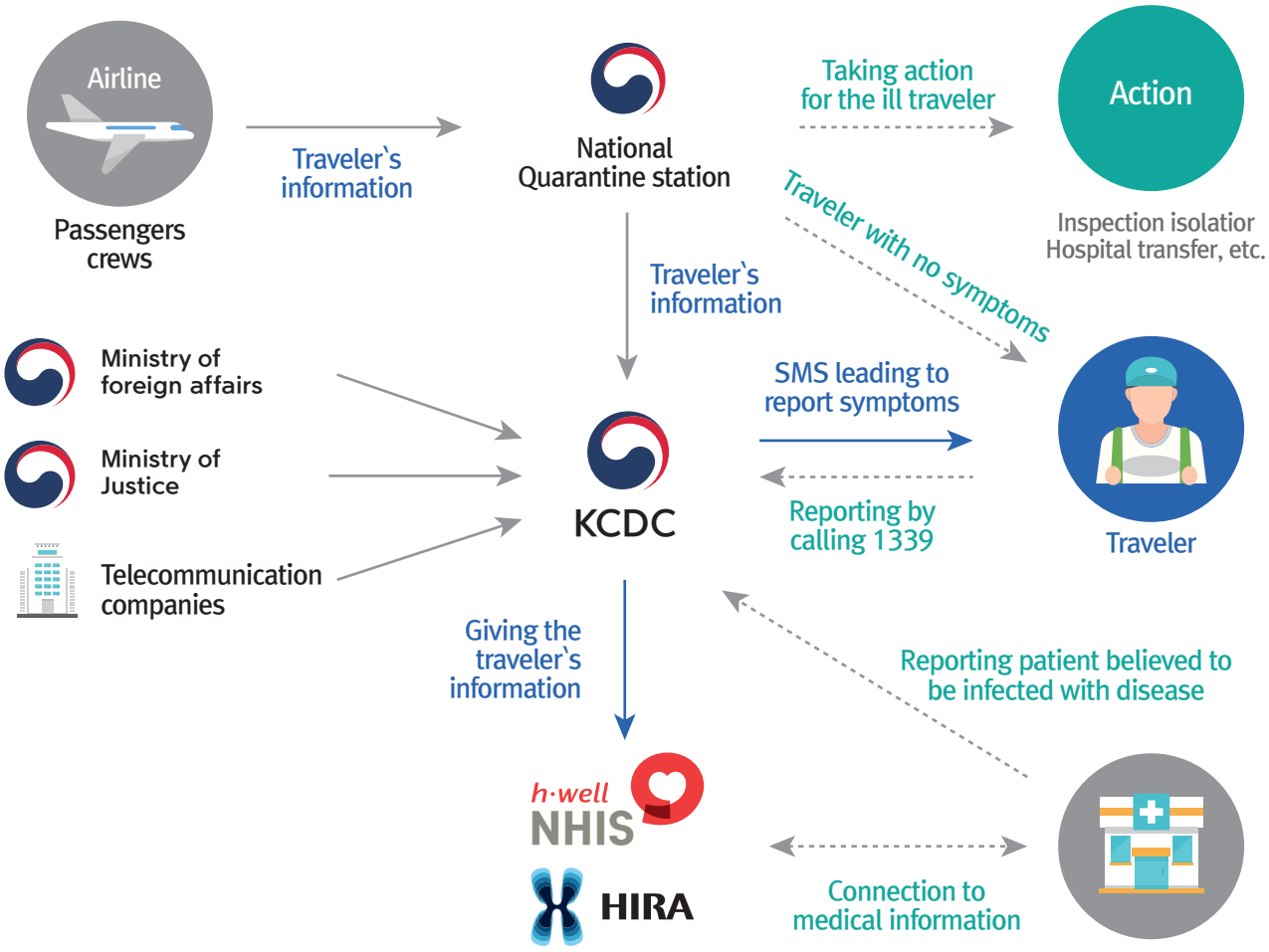
Developed by
Korea Centers for Disease Control and Prevention
For use by domestic residents and foreigners entering Korea
from countries with known occurrences of infectious diseases

04 System Configuration

1. System Concept

The smart quarantine system is designed to fill the loopholes in airport quarantine. By sharing and using data and IT systems of MOFA, HIRA, and other related agencies, it checks the information of entrants from countries affected by infectious diseases and sends text messages to the entrants to report any potential infection. It also shares the information with medical institutions to monitor potential patients during the incubation period since entry to Korea.

The ICT framework of the smart quarantine system is as below:



Smart Quarantine System
(Smart Quaratine Information System)

1) Receive entrants' data from airlines and telecom companies

2) Screen entrants from affected countries and send their data to MOFA (for domestic residents) and MOJ (for foreigners)

3) Collect additional data of entrants from MOFA and MOJ

4) Send mobile text messages to entrants from affected countries and provide their data to HIRA and NHIS

5) Medical institutions share the data via information systems of HIRA and NHIS

2. Systems Connected

- **Passport Information Comprehensive Administration System (MOFA)**

  The pathogen resources deposited, developed and produced by the National Pathogen Resources Bank are to be packed in designated containers and preserved in designated places (amples cabinets, ultra-low temperature freezers and nitrogen tanks).

- **Immigration Information System (MOJ)**

  IIS is governed by the Korea Immigration Service under the Ministry of Justice. This agency is in charge of managing entry and departure of domestic residents and foreigners, domestic stay of foreigners, and other policies and activities regarding foreigners such as nationality acquisition, refugees, and social inclusion.

  In the past, the IIS served as a system only for immigration screening and managing domestic stay of foreigners, which were internally carried out by immigration service employees. Now, its role has expanded to include many sub-systems for simplifying immigration procedures, ID verification, advance passenger information system (APIS) for border control, and provide various services to external agencies and the public.

  As the result, IIS reduced wait times for immigration by over 40% compared to before the system was built.

Developed by
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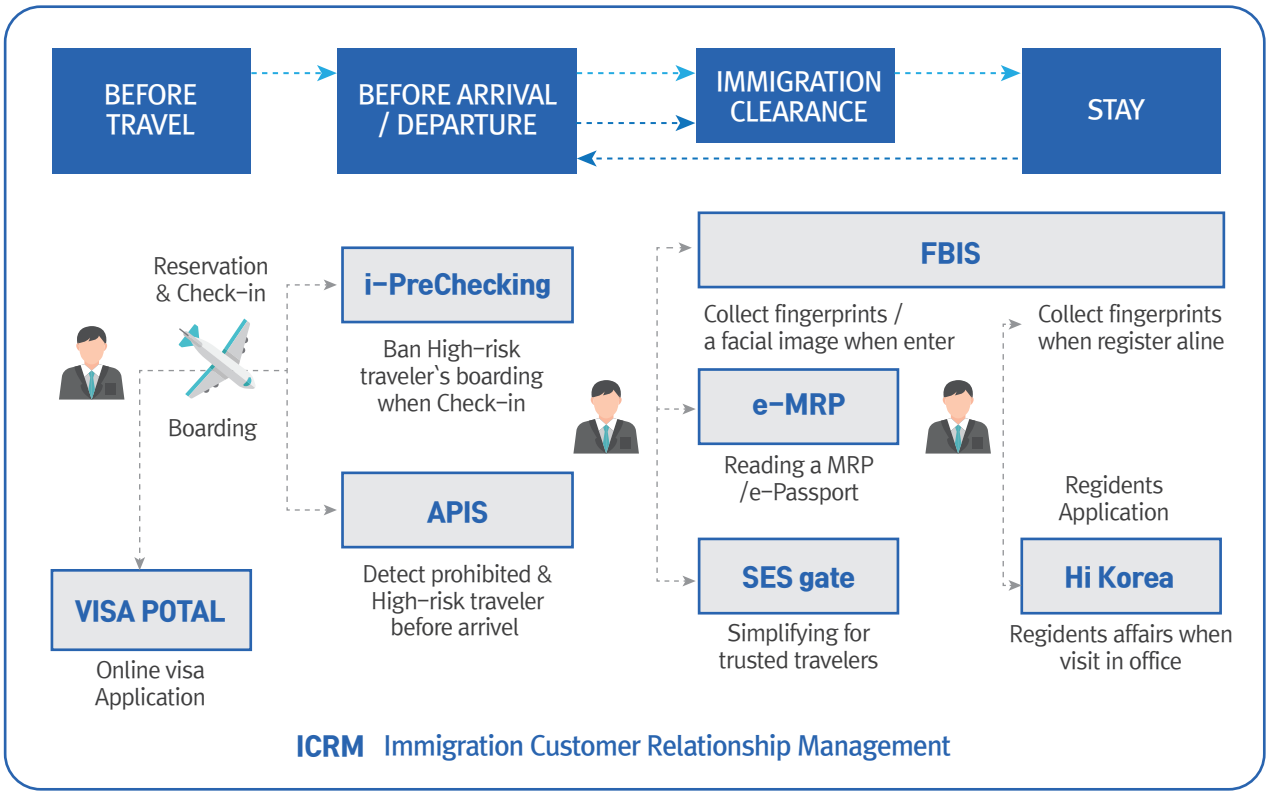
For use by domestic residents and foreigners entering Korea
from countries with known occurrences of infectious diseases

Immigration Information System Process



I-PreChecking (IPC) is a pre-boarding screening system of Korea Immigration Service that determines eligibility of passengers by receiving the passenger list from airlines in the check-in stage to block those denied boarding in advance. Airlines are obliged to provide their passenger lists and the screening result is delivered back to the airlines in less than a minute through the IPC system.

The IPC system was originally designed to prevent the entry of criminals but now it also serves as the first barrier to prevent spread of COVID-19 by checking the countries where inbound travelers to Korea had visited and determining in advance whether to accept or reject entry of those who had stayed in contaminated countries.

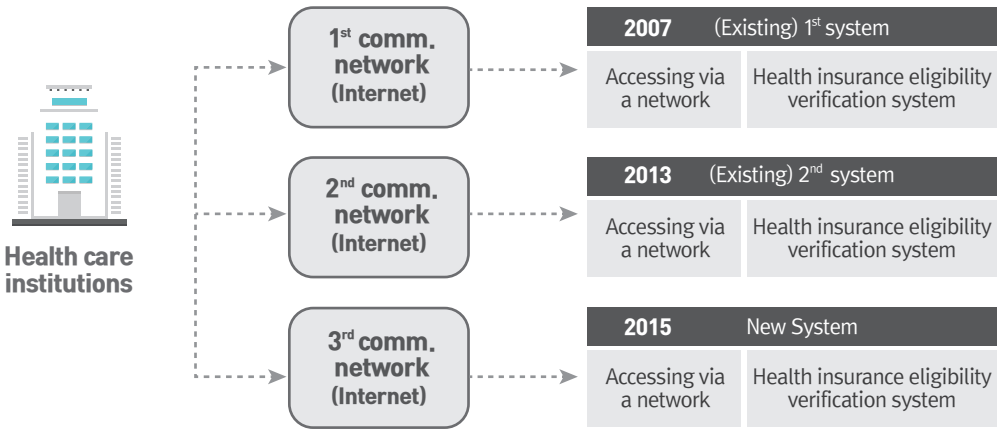
Smart Quarantine System
(Smart Quaratine Information System)

▪ Drug Utilization Review (HIRA)

DUR is a nationwide clinical decision support system that connects the information of all medical institutions and pharmacies to prevent drug misuse or abuse at the prescription stage.

It provides real-time drug safety information to doctors and pharmacists so they can check in advance which drugs must not be used together and prescribe accordingly. Thanks to DUR, medical institutions were able to check incompatible drugs for patients with underlying diseases and provided proper and fast prescriptions for different COVID-19 symptoms.

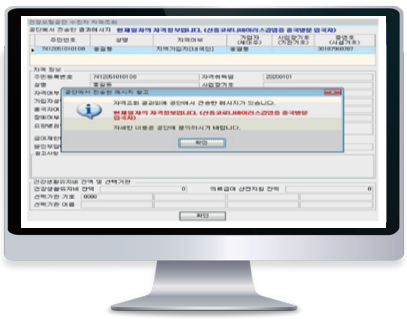
Eligibility Verification System Process



▪ National Health Insurance Eligibility Verification System (NHIS)

The national health insurance eligibility verification system supports medical institutions to check online in real-time the patients' eligibility for national health insurance benefits with only patient name and residential ID, and without the health insurance card.

As the national health insurance eligibility verification system is the basic system that holds personal health information of the citizens, NHIS worked on developing a triple-layered structure by building a third system in a separate location so they can be prepared for force majeure such as natural disasters and epidemic outbreaks or concurrent breakdown of the existing two systems.



▲ Screenshot of Eligibility Verification System

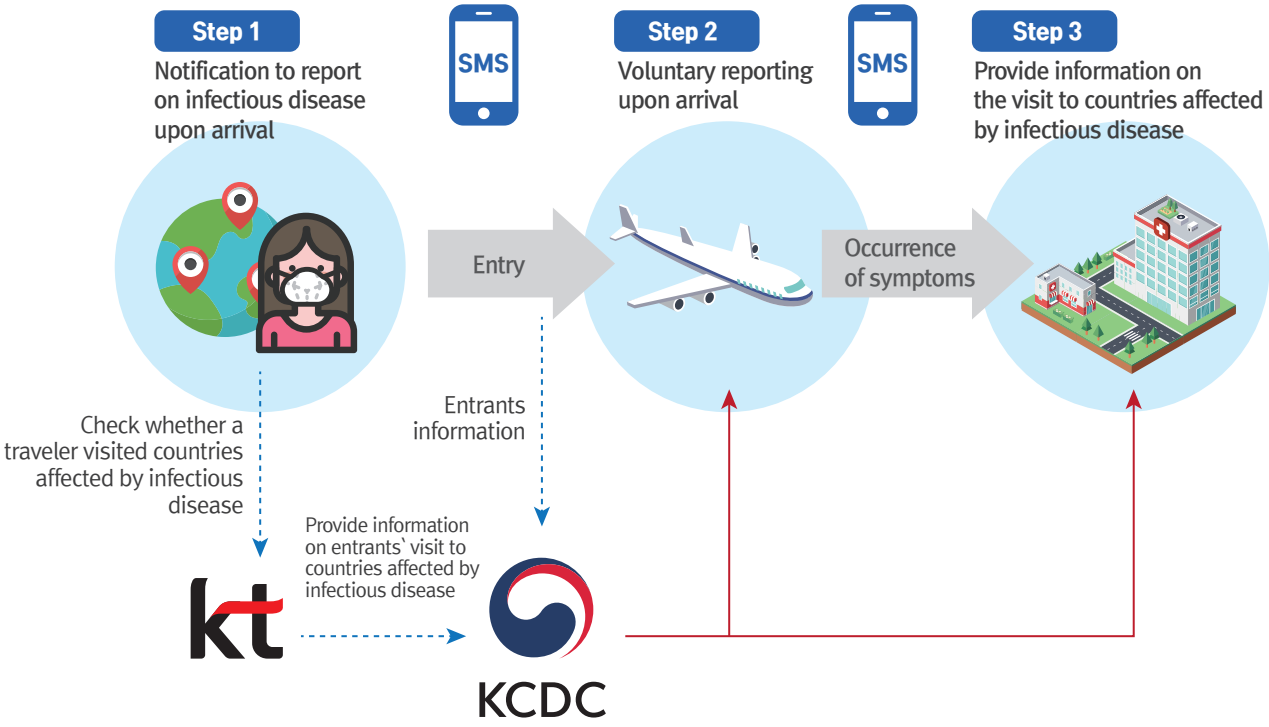
Developed by
Korea Centers for Disease Control and Prevention
For use by domestic residents and foreigners entering Korea
from countries with known occurrences of infectious diseases

▪ Sharing international roaming data use with telecom companies

By linking the international roaming information of telecom companies, the system screens people entering Korea after visiting countries with confirmed cases of infectious diseases and sends them disease information in text messages. When people who travelled countries affected by infectious diseases visit medical institutions, feeling fever or other symptoms, doctors can be notified of their visits to contaminated areas through DUR and can take preemptive measures.

The system allows to identify all countries where people have visited before entry to Korea and even check whether they travelled disease-affected countries and entered via a third country. Using the international roaming data from telecom companies, the government is able to monitor the status of people visiting contaminated areas and entering the country afterward, which significantly contributes to early identification of their travel history to countries with COVID-19 cases and tracing their travel routes.

I International Roaming Information Sharing Process



Smart Quarantine System
(Smart Quaratine Information System)

05 Main Features

The main feature of the smart quarantine system is to prevent imported cases of infectious diseases from foreign countries by screening travelers to contaminated countries and sharing their travel history with medical institutions.

1. Screening travelers to countries affected by infectious diseases

The Korean Ministry of Justice demands airlines to provide inbound passenger lists. While IPC helps check passengers' visit to countries affected by infectious diseases, it could not screen passengers who entered Korea through a third country after visiting such contaminated countries.

To overcome such limitation, the government began to track travelers' roaming data usage abroad, as telecom companies can check their mobile subscribers using roaming service in particular countries on a real-time basis. By integrating the passenger information from airlines, passport information from MOFA, foreigner information from MOJ, and international roaming data from telecom companies, the Korean government can now generate entrants data and screen those who enter the country via a third country.

2. Text alerts to prevent disease and report infection

Based on the entrants data obtained as above, the government screens those who visited contaminated countries and hands out information and notice on the infectious disease outbreak and health state questionnaire to passengers in flight by cooperating with the airlines.

Entrants fill out and submit their health state questionnaire to quarantine inspectors at the entrance gates. The inspectors check their travel history and health state (such as temperature), and send them text message instructions on a regular basis regarding disease symptoms and how to report when the symptoms develop.

I International Roaming Information Sharing Process

Phase	Focus	Requirement
MERS-CoV	13 countries in the Middle East	4 times for 14 days after entry (on the 1st, 6th, 11th, 15th day)
Ebola virus	Congo	4 times for 21 days after entry

Phase	Focus	Requirement
Lassa fever	Nigeria	Once after entry
Plague	Madagascar	Once after entry
COVID-19	Countries with COVID-19 confirmed cases	Once a day for 14 days after entry*

* Not only the entrants receive these text messages but they also have to install Self-Health Check App and check their health status twice a day.

3. Sharing of international travel history of entrants from contaminated areas with medical institutions

The International Traveler Information System (ITS) is used to provide international travel data of entrants to medical institutions three times a day via DUR of HIRA.

Based on the information shared through ITS, medical institutions can check patients' overseas travel history and promptly screen those suspected of infection during consultation if they visited contaminated areas and take proper and preemptive measures and provide selective treatment.

06 Contact information

Institution	Person In charege	Contact
HIRA(Health Insurance Review & Assessment Service) DUR Information Department	Young Rae Cho	young11@hira.or.kr

Drug Utilization Review (DUR)

01 Introduction

Drug Utilization Review (DUR) is a drug use inspection service provided by the Health Insurance Review and Assessment Service (HIRA). It is a system designed to prevent inappropriate drug use by providing necessary information on drug safety* in advance to doctors or pharmacists when prescribing or preparing medicines.

* Information on drug safety: Medication information on drugs to be avoided in combination, by people of a certain age, or if pregnant, should be avoided or caution recommended drugs due to safety reasons; drugs with caution on the amount and the period of use; drugs that are not to be split; drugs to be used with caution for the elderly; cost-effective content-based medications; drugs with recommended caution on content license; drugs with overlapping content; drugs with overlapping medicinal efficacy, etc.

02 Background and Purpose

In June 2003, a patient prescribed with terphenadine and ketoconazole showed difficulty in breathing and received CPR after being admitted to the Emergency Room (ER) but passed away. The need to manage drug safety in the process of prescribing and preparing medicine was raised as this was an unfortunate accident caused by being unaware of the fact that terphenadine and ketoconazole cannot be used in combination. In the past, drug information could be checked by using websites, books, and academic papers, but it was realistically difficult to verify the information or do cross-checks between prescriptions.

Since then, starting with the first stage of the DUR project in April 2008, safety inspections have been run on drugs that should be avoided within the prescription. In 2009, a pilot project was carried out in some regions of Korea (Goyang City, Gyeonggi Province and Jeju Island) for the inspection of prescriptions as a second-stage project.

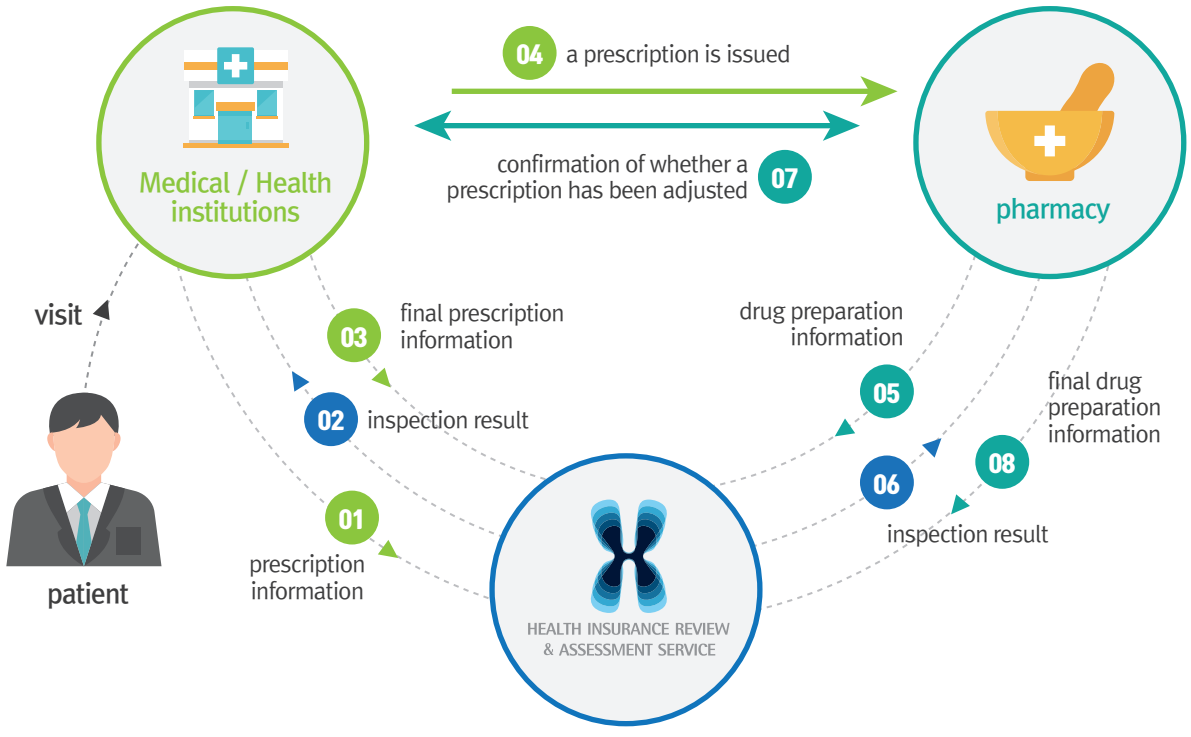
The DUR system was developed by complementing issues from the two pilot projects, and was implemented nationwide in December 2010 by distributing it through companies that create software that screen medical care cost claim. The government is the service for the purpose of confirming adequate medicine information and preventing harm to its citizens' health caused by drug interactions or excessive use of drugs.

03 Pre-requisite

Category	Requirement
Medical Institution and Pharmacy ICT Infrastructure	▪ Systems linking medical institutions and pharmacies across the country (Electronic Medical Record (EMR), Ordering Communication System (OCS), etc.)

04 System Configuration

1. System Process

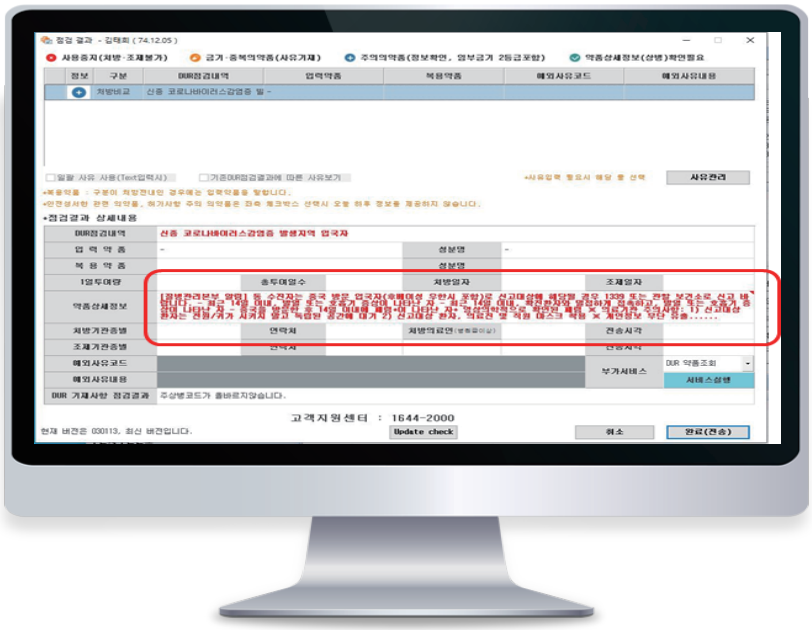


Drug Utilization Review (DUR)

▪ Prescription stage

1. A doctor sends medicine prescription information through HIRA's DUR system in the prescription stage.
2. HIRA inspects the DUR database as well as patient drug information database and provides information regarding the safety inspection results of drugs that cannot be used in combination or important drug information for people of a certain age group as well as overseas travel information of those who visited infectious disease occurring regions in form of a pop-up window.
3. The prescribing doctor adjusts the prescription based on the inspection result and sends the adjusted prescription detail to HIRA's DUR system.
4. Or, if the prescription is necessary due to medical reasons, the doctor provides guidance on proper drug intake to patients to ensure safety, and the final prescription detail with reasons as to why such a prescription was given is filled out and sent to HIRA's DUR system.
5. Final prescription detail is stored in the dose history database of each patients.

▪ Preparation stage



▲

DUR Pop-up Window at Prescription and Preparation Stage

6. A pharmacist sends the medicine information on the prescription to HIRA's DUR system.
7. HIRA inspects the DUR database as well as the dose history database of each patients and provides the pharmacist with the result in form of a pop-up window.
8. Based on the inspection result, if one needs to adjust the prescription, the pharmacist makes a prior consultation with the doctor and sends the adjusted prescription detail to HIRA's DUR system.
9. Or, if it is unavoidable, guidance on proper drug intake is given to the patient, and the final preparation detail with reasons as to why such a preparation was made is filled out and sent to HIRA's DUR system.
10. Final preparation detail is stored in the dose history DB of each patients.

05 Main Features

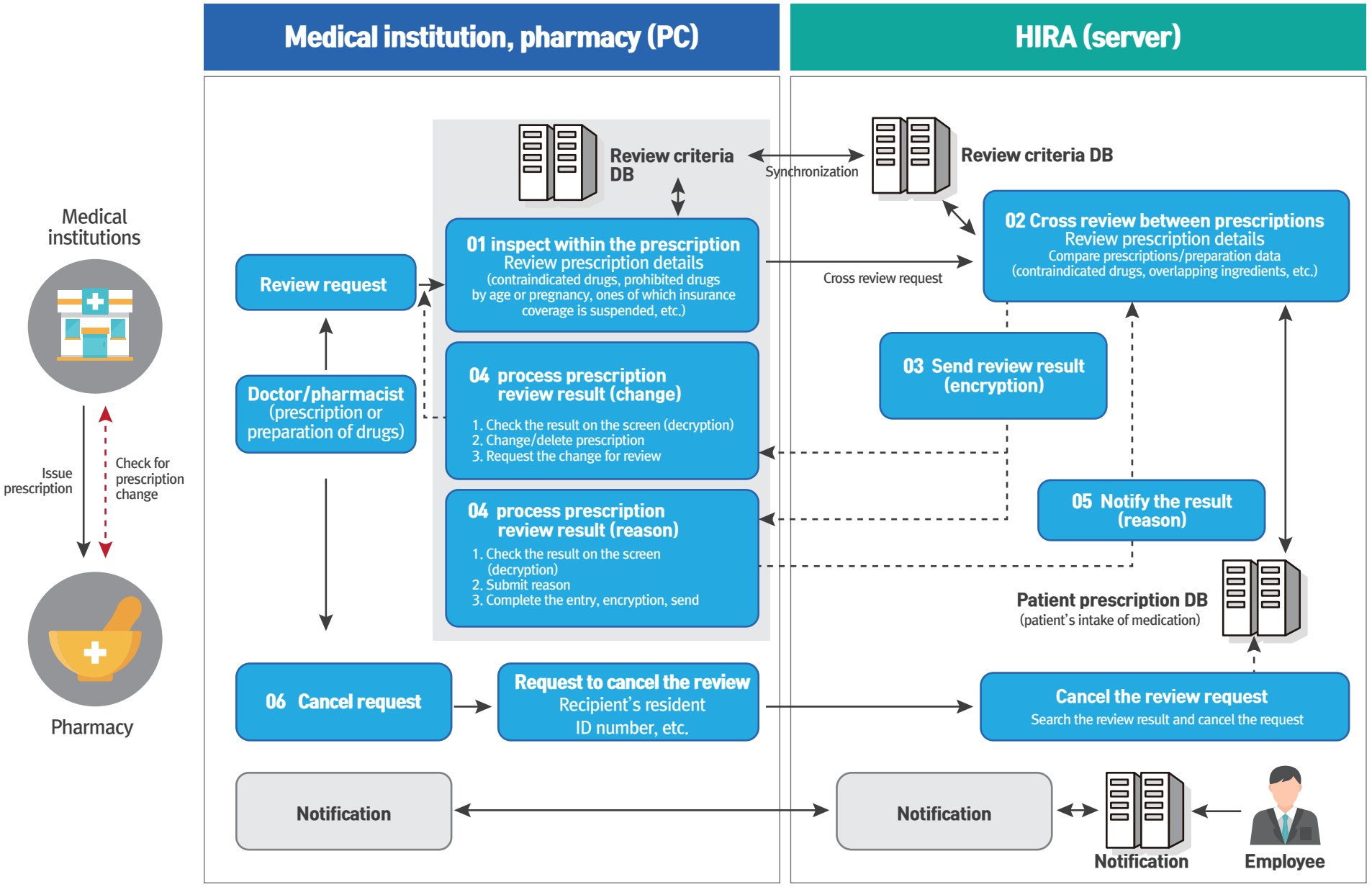
DUR supports doctors' and dentists' adjustment of medicine prescription and preparation by checking safety information of medicine such as overlapping ingredients, or drugs that should be avoided, and so on when a doctor is writing a prescription or preparing medicine, and when a pharmacist is preparing medicine.

In the case of medicines that have been prohibited or that need to be used carefully due to safety concerns according to the safety letters or breaking news distributed by the Ministry of Food and Drug Safety, the doctors and pharmacists nationwide are notified through 'DUR notification' on their computer screen within one hour, and the medicine is prevented from being prescribed or prepared.

06 Contact information

Institution	Person In charege	Contact
HIRA(Health Insurance Review & Assessment Service) DUR Information Department	Young Rae Cho	young11@hira.or.kr

Drug Utilization Review (DUR) Hardware/Software Structure

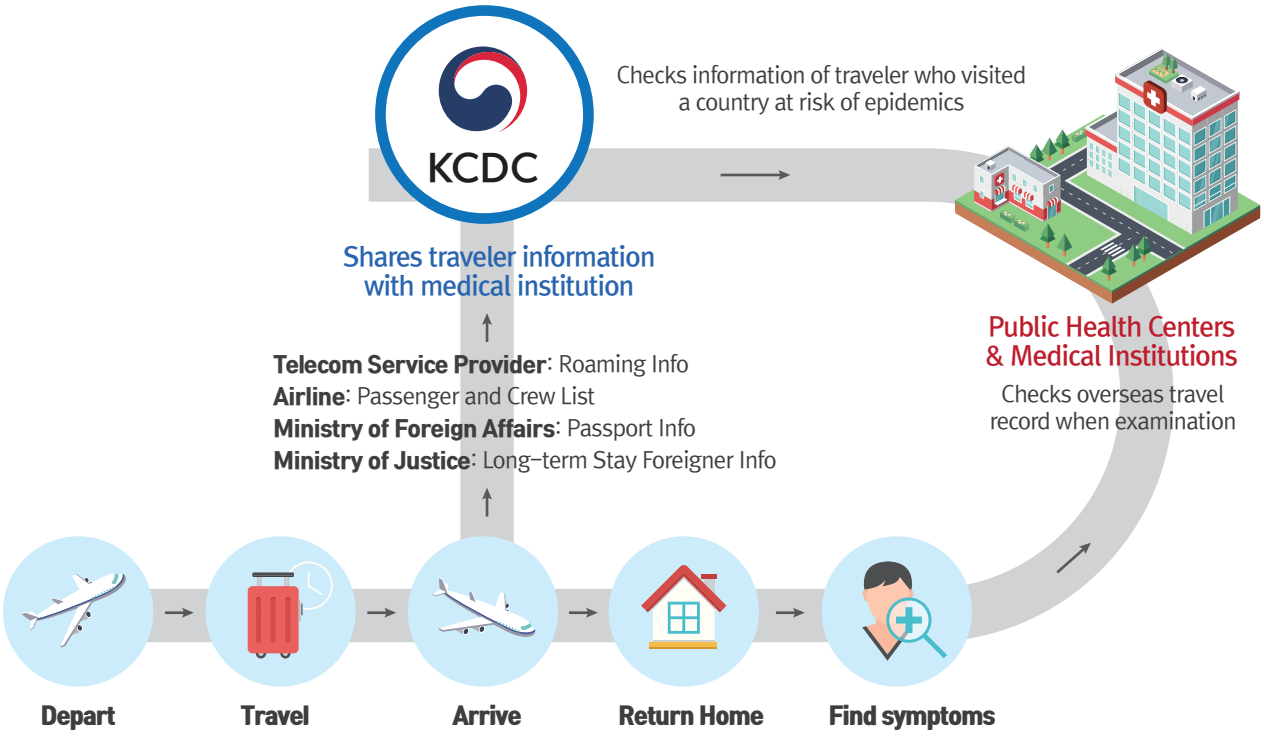


International Traveler Information System (ITS)

01 Introduction

The International Traveler Information System (ITS) allows for checking patients' travel history, i.e., whether they have been to contaminated areas abroad, thereby ensuring agile and early response to infectious diseases introduced from overseas such as COVID-19. Medical institutes do not have to rely on patients' subjective statements to identify if they have visited areas affected by epidemics, and they can mobilize thorough disease control process by precise fact-checking using the ITS.

Powered by the Korea Centers for Disease Control and Prevention (KCDC), ITS collects patients' travel history to countries affected by infectious disease outbreaks from relevant institutions through the Public Information Sharing System (PISS), combines that information with the Drug Utilization Review (DUR) data from the Health Insurance Review and Assessment Service, and makes it available to medical institutions and pharmacies. Institutions that are not on the DUR system may also use the ITS by installing a program.



※ Source : Press release from Korea Centers for Disease Control and Prevention, Health Insurance Review and Assessment Service, and Ministry of Health and Welfare

Developed by
Korea Centers for Disease Control and Prevention
For use by domestic residents entering Korea from other foreign country

02 Background and Purpose

As an aftermath of the 2015 MERS crisis, Korea developed the DUR system to provide information on people coming in from countries with infectious disease outbreaks in real time when prescribing drugs, but there remained crevasses that medical workers may be exposed to risk for infection during reception, examination and prescription, and the patients travel history cannot be checked unless they are given prescriptions.

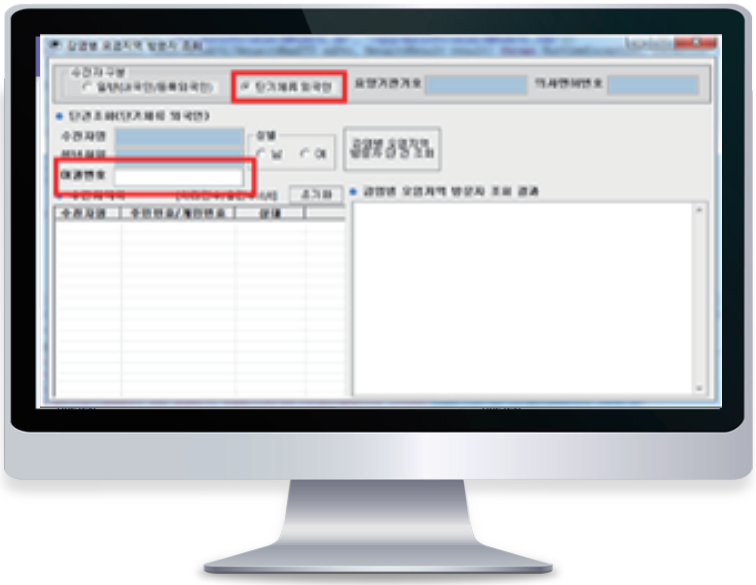
Recognizing that identifying people from countries at risk of infectious diseases early in the reception stage would help minimize medical workers' and other patients' exposure to the diseases and prevent their spread by asymptomatic carriers, the KCDC, in cooperation with the Health Insurance Review and Assessment Service (HIRA), developed the ITS in September 2017, which provides patients' overseas travel history in real time at the reception stage.

ITS uses the existing DUR platform to allow for identifying patients that have been to countries with infectious disease outbreaks as soon as they come to see a doctor and therefore taking necessary measures. Most (97.1% as of February 9, 2020) of the healthcare institutions nationwide, including 72,667 medical institutions and 22,082 pharmacies, are using this system. In particular, the military is also using DUR-linked services, contributing to improvement of the whole nation's disease control capabilities.

Checking Foreigners` Travel History

Information on locals and long-term stay foreigners was available only, until July 1, 2019 when information on short-term stay foreigners was also made available through passport number search

※ Source : Korea Centers for Disease Control and Prevention and Health Insurance Review and Assessment Service



International Traveler Information System (ITS)

Even without policy-driven measures to make use of ITS compulsory or incentives to encourage its use, it was built upon the nationwide user database already developed, the DUR, and the frontline medical workers were more than willing to opt for the system. Its usage rate has risen from 54.1% at the end of January when the COVID-19 just started spreading to almost 100% in early February.

The travel history information service using ITS linked with DUR provides a measure to early identify asymptomatic patients coming in from other countries and take necessary steps to prevent the spread of COVID-19 in the community. It also helps proactively protect medical workers and visitors to medical institutions from exposure to the risk of viral infection.

03 Pre-requisite

Operation of the ITS requires an administrative information sharing platform that encrypts and safely distributes public information between administrative institutions and public agencies.

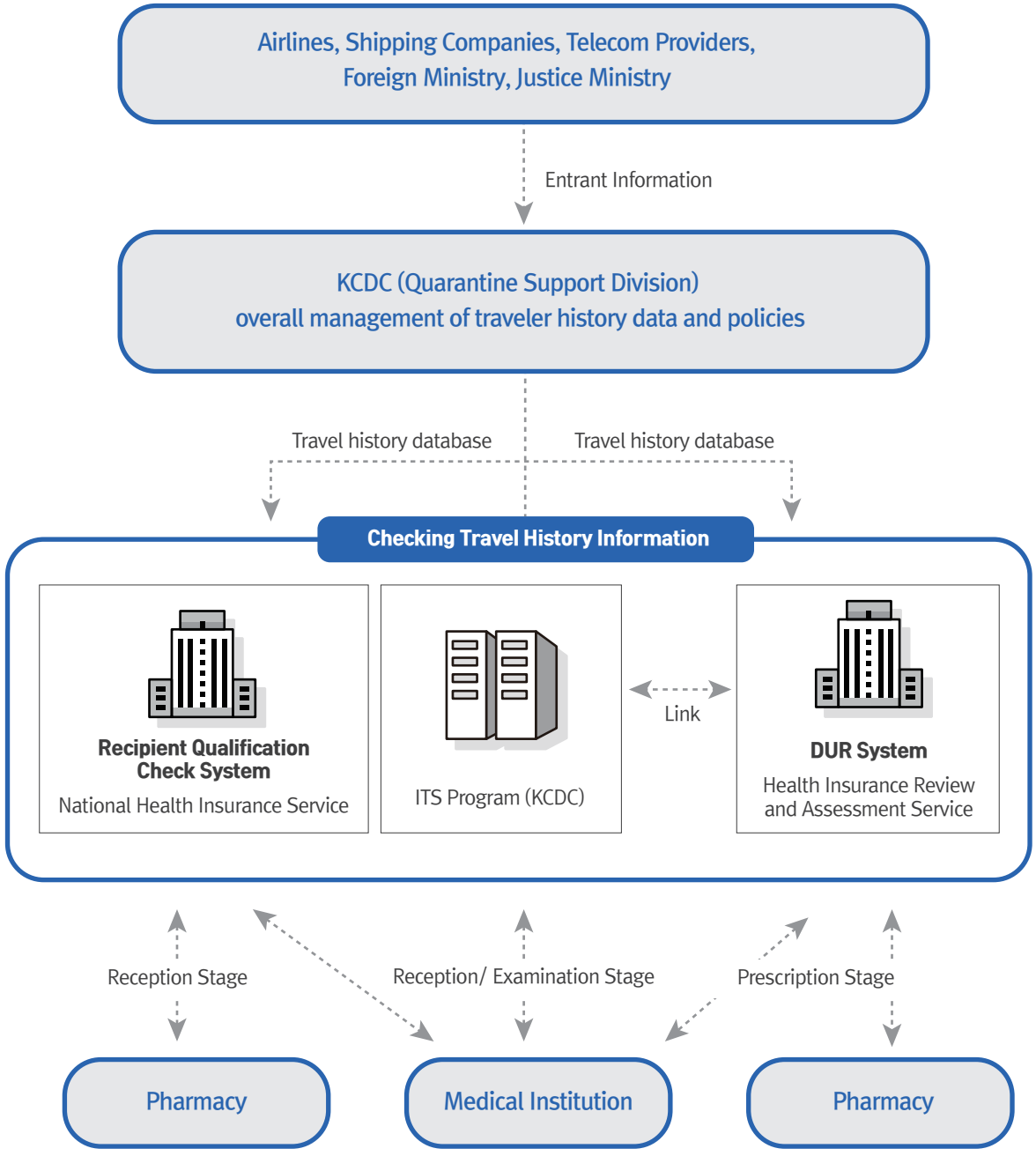
Type	Requirement
ICT infrastructure	▪ Administrative information sharing platform

04 System Configuration

1. System Process

The Ministry of the Interior and Safety's PISS collects information on entrants (name, resident registration number, expiration date of provided information) from airlines, shipping companies, telecom service providers, the Ministry of Foreign Affairs, and the Ministry of Justice. KCDC uses such information to update the traveler history database three times daily. Medical institutions and pharmacies use the DUR or ITS program to check local and foreign visitors' travel history in real time at reception.

Developed by
Korea Centers for Disease Control and Prevention
For use by domestic residents entering Korea from other foreign country



※ Source : Ministry of Health and Welfare

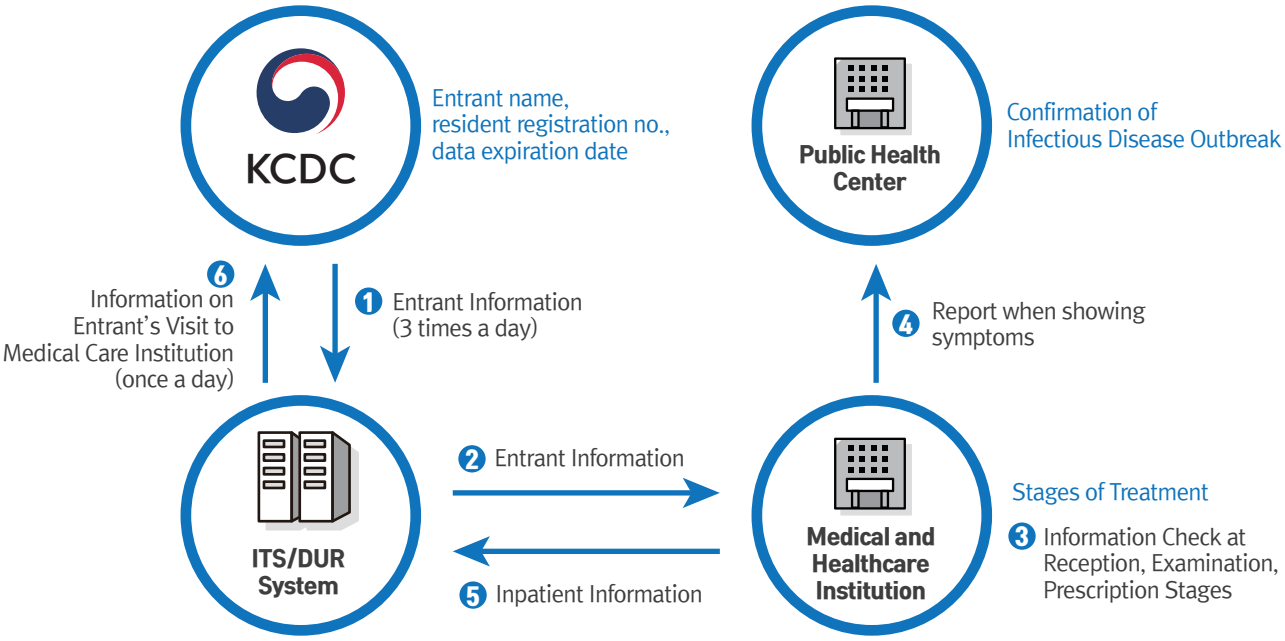
International Traveler Information System (ITS)

2. Software Structure

ITS is linked with DUR, which has been distributed to medical care institutions since December 2010. Using the collected entrants' information (name, resident registration number, passport number, etc.) as the travel history database, the ITS/DUR system provides medical institutions with patients' travel information, if they have visited any country with an epidemic outbreak at the stage of reception.

Given the sensitive nature of the data, data transfers between the Health Insurance Review and Assessment Service's database, the DUR server (including the defense medical information system DUR), and clients are AES encrypted. ITS is offered as the ITS/DUR package to take advantage of the high penetration of DUR but is also available as a standalone software, offering the same information on computers without DUR.

I ITS/DUR Software Service Process



※ Source : Korea Centers for Disease Control and Prevention

Developed by
Korea Centers for Disease Control and Prevention
For use by domestic residents entering Korea from other foreign country

05 Main Features

ITS provides medical workers with patients' travel history information in real time at all stages including reception, examination, and prescription based on the list of entrants from countries with infectious disease outbreaks provided by the KCDC. Such information is provided as a pop-up on the DUR system for 21 days if a patient is from a country concerned or has been in contact with a confirmed patient. The number of their visits to medical institutions is reported to the health authority daily, which serves as basic information for epidemiological surveys like contact tracing.

Example of Pop-up Notice

[Notice from KCDC] This patient is an entrant from/via China (Hong Kong, Macao). If showing fever or respiratory signs (cough, breathing difficulty, etc.), call 1339 or report to the public health center in your area.
※ Cautions
1) Do not transfer or send home reported patients. Have them wait in an isolated place.
2) Have the patients, medical workers and all other employees wear a mask.
※ Use care not to disclose their personal information without authorization or refuse their treatment.

※ Source : Guide to Operation of COVID-19 Screening Stations, Central Disaster Management Headquarters

1. Pop-up information provided at reception stage

When visiting a medical institution, locals and long-term stay foreigners use their resident registration numbers or alien registration numbers and short-term stay foreigners use their passport numbers to check in through the Electronic Medical Record (EMR). Nurses or admin staff at the reception receive patients' travel history information as a pop-up on the ITS linked with the EMR.

2. Travel history information provided at examination and prescription stages

Even after the reception stage, doctors can directly check patients' travel history during examination and prescription. The ITS, linked with the institution's EMR, shows pop-ups about patients' travel history based on the database of imported infectious diseases* and affected countries.

06 Contact information

Institution	Person In charege	Contact
HIRA(Health Insurance Review & Assessment Service) DUR Information Department	Young Rae Cho	young11@hira.or.kr

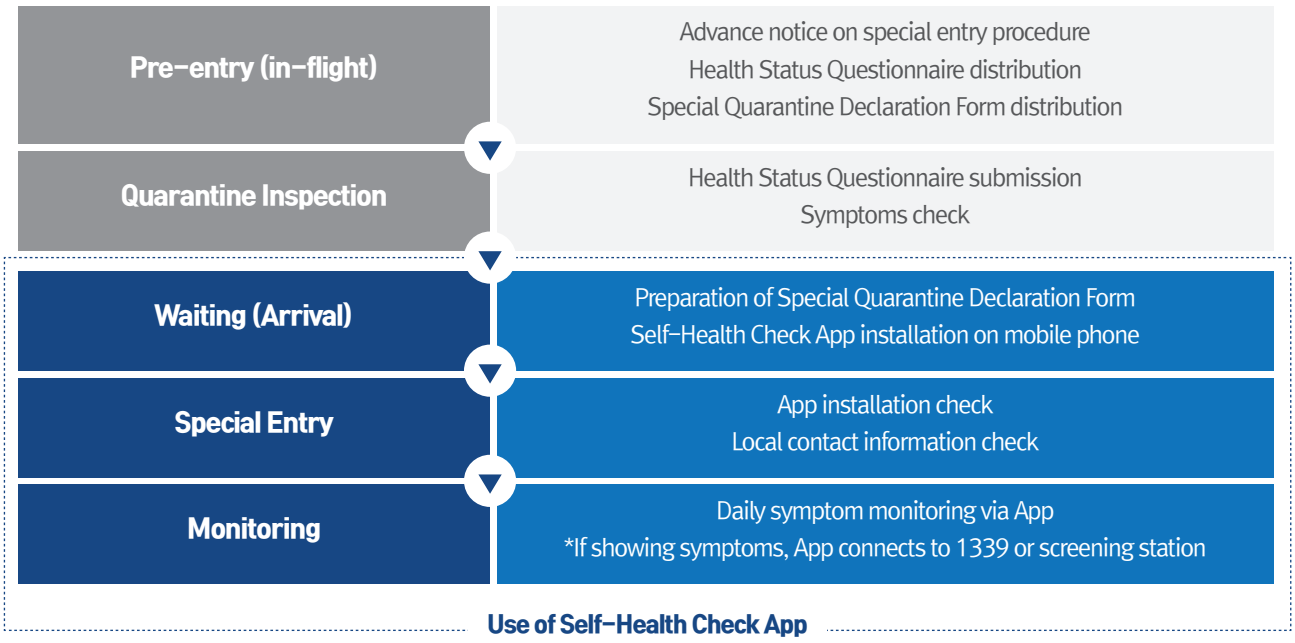
Self-Health Check App for Entrants Under Special Entry Procedure

01 Introduction

Self-Health Check App is an application developed for those who enter the country through special entry procedure* for continuous health monitoring after their quarantine declaration at the airport.
These entrants (users) are required to install this App upon their arrival and mandatorily enter their personal information such as passport number, name, contact number, and address in Korea. They are also required to go through self-health check once a day for 14 days from the day of arrival, and check if they develop any of the major symptoms of COVID-19. If a user develops any symptom, the App automatically connects the user to 1339 (call center of the Centers for Disease Control and Prevention) or the nearest COVID-19 screening station; for any user not responding, follow-up measures are taken, such as call-in from a public official in charge of the area.

* Special entry procedure consists of filling out the special quarantine declaration form, checking body temperature, and checking place of stay and contact information.

Special Entry Procedure and Self-Health Check App Utilization



Using the App, the government can efficiently handle and manage people coming in through the special entry procedure, ultimately leading to preemptive prevention of imported cases of COVID-19.

Allowing personal information collection, including GPS information, and real-time monitoring of health conditions, the App helped build a more active monitoring platform on the entrants for the time period (14 days) as regulated by the government. All information like users' international travel history and symptoms are shared with medical institutions so the information can be checked immediately upon an entrant's visit, improving chances of blocking exposure to infection.

Based on such sharing of collected data, different organizations can collaborate and respond promptly to various cases. It will prevent COVID-19 spread in the communities and any possibility of missing out the golden hour of quarantine.

02 Background and Purpose

At the end of January 2020, China found COVID-19 starting to spread in the community, with reported cases of patients having no travel history or no identified transmission routes. In this respect, the Korean government introduced a special entry procedure (starting February 4, 2020) for those arriving from China to block imported cases of COVID-19. Since then, the number of confirmed cases continued to increase in countries other than China, and the Korean government decided to extend application of the special entry procedure to people coming in from Hong Kong and Macau (starting February 12, 2020), Japan (starting March 9, 2020), and Italy and Iran (starting March 12, 2020). However, as the number of confirmed patients in Europe and the U.S. increased exponentially and the disease declared as a global pandemic, the Korean government expanded the special entry procedure to all arrivals (starting March 19, 2020) to prevent inflow of the virus.

Judging that all inbound travelers cannot be managed, the health authorities have decided to develop and implement a special entry Self-Health Check App so all inbound travelers can check their symptoms by themselves and report their conditions to the authorities. The service is designed to quickly identify and respond to the symptoms for tracking and managing inbound travelers.

Self-Health Check App for Entrants Under Special Entry Procedure

03 Pre-requisite

Rather than being built as a standalone system, the Self-Health Check App for special procedure entrants requires link to the immigration control system that identifies passport information of entrants, the integrated disease control system for managing their symptoms, the International Traveler Information System (ITS) that provides travel records, and the Drug Utilization Review (DUR) system that allows medical institutions and pharmacies to check travel information of patients.

Type	Requirement
System Interconnection	▪ Integrated disease control system, immigration control system, Drug Utilization Review (DUR), and International Traveler Information System (ITS)

Also, the App requires connection to data such as passport information, passenger information, places of departure and transit information, roaming information and medical institution information.

Type	Requirement
Data Used	▪ Passport information, list of passengers on board, departure and transit country information, roaming and other communication information

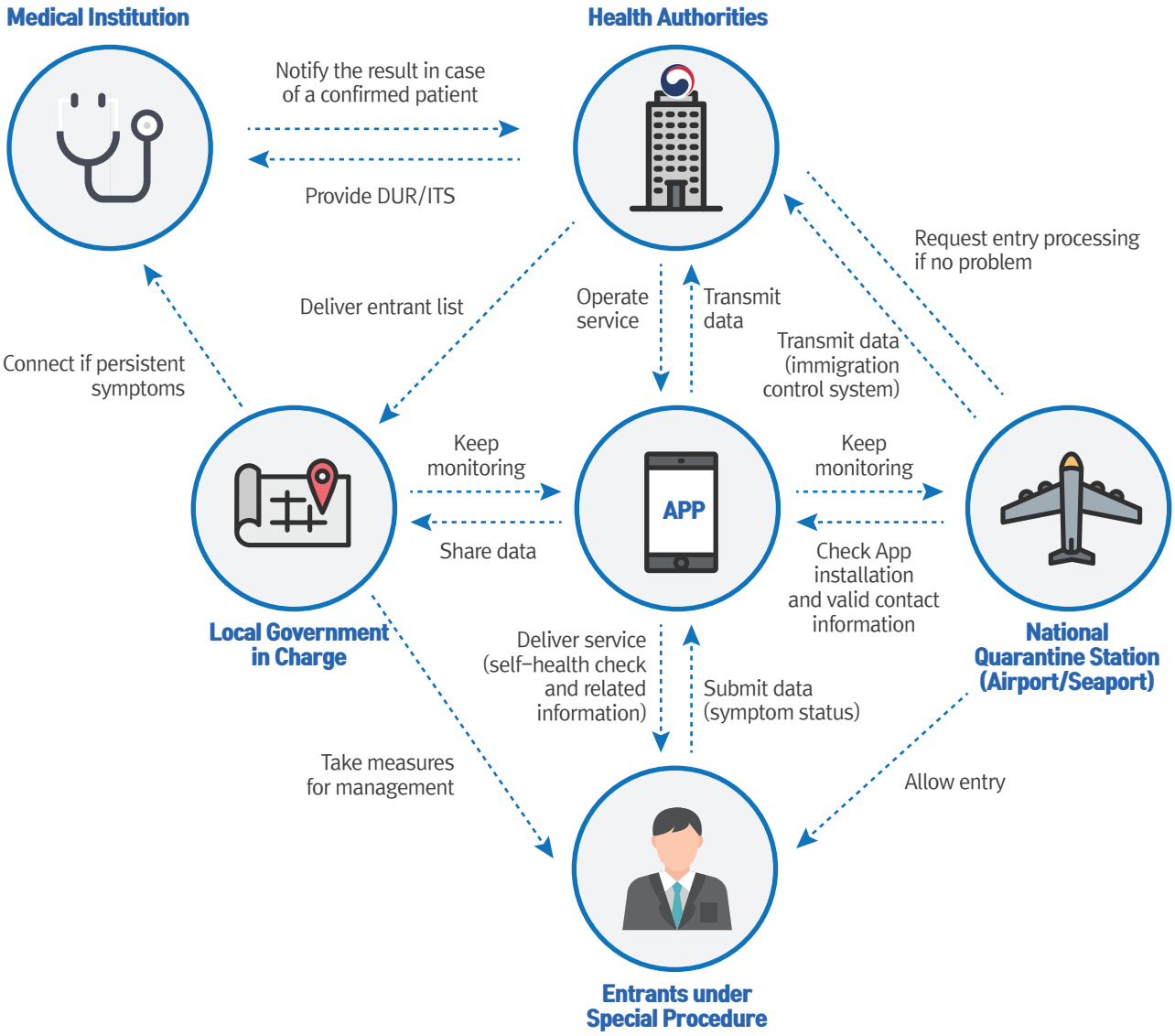
04 System Configuration

1. System Process

The special entry procedure, including the Self-Health Check App, is operated upon cooperation from the health authorities, airport/seaport quarantine stations, local governments, medical institutions, and particularly, the entrants.

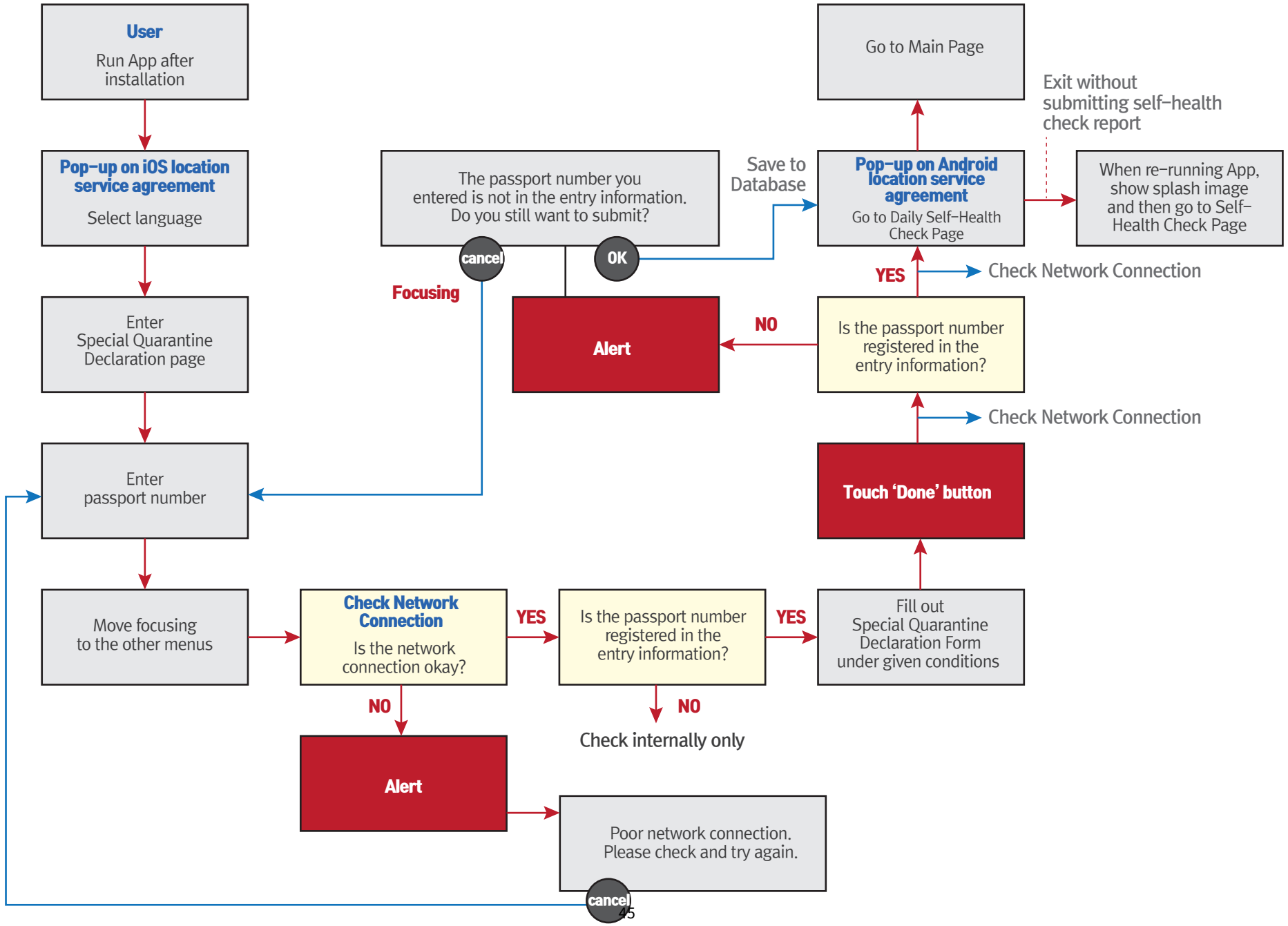
The first thing they do is secure accuracy of the information of entrants during the immigration procedure. This is done by comparing the information filled out on the Special Quarantine Declaration Form to the information entered in the App, and by going through mobile authentication of the contact information. The information collected at this stage is entered into the integrated disease control system. It is also sent to nationwide medical institutions through ITS within DUR in case the entrants may visit local medical institutions during the incubation period.

Managed by Ministry of Health and Welfare
For use by Entrants under Special Entry Procedure



The list of entrants are delivered to each local government in charge, and the local governments continue monitoring of the entrants through the App. Any data added to the App by an entrant (user), such as symptoms, are sent to local governments and health authorities in real-time. If no information is entered, the health authorities will have local governments take following measures such as re-notification, fixed-line phone calls, and GPS tracking.

Self-Health Check App Service Flow Chart



Self-Health Check App for Entrants Under Special Entry Procedure

05 Main Features

The Self-Health Check App has features like special quarantine declaration for entering personal information of entrants (users); daily self-health check for checking symptoms; information on nearby COVID-19 screening stations and 1339 Call Center; and information on COVID-19 code of conduct.

1. Special Quarantine Declaration

After installing the App, users are required to enter personal information such as passport number, name, mobile phone number, and local address. In particular, the entry field for mobile phone number must be filled out, with roaming numbers or phone numbers of family members and relatives who can be reached in Korea. When users agree that their personal and location information be provided and used, the special quarantine declaration is completed. Then they are finally allowed to enter the country after checking on site (at the airport) whether the App has been successfully installed on mobile phones, if all required fields are filled out, and if their contact numbers are valid through mobile authentication.

2. Daily Self-Health Check

Users are required to conduct self-health check for 14 days from the arrival date. They check if they develop any key symptoms* (yes/no) and submit daily report (by 24:00). The results are automatically transferred to the local public health centers (local governments) and KCDC. If a user chooses one or more symptoms, he/she is first guided to 1339; if a user chooses symptoms for two days in a row, the App checks if the user has visited the COVID-19 screening station. Users receive alarm at 10 am every morning to notify their conditions. For those who do not provide information, the App sends notice again between 2~4 pm. If a user does not report conditions or symptoms for three times or more, the health authorities will make contact by wire. If the user is not reached, the Ministry of Interior and Safety, local governments, and the National Police Agency track the user's location and make direct visits.

I Screenshot of the Self-Health Check Page

[Daily Self-Health Check] [Submit Report]

3. Information on nearby COVID-19 screening stations and 1339 Call Center

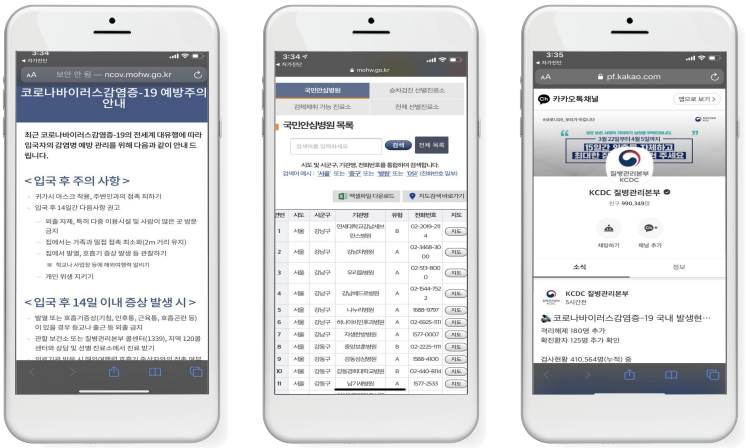
Users can find nearby COVID-19 screening stations that they can visit from their current locations. The App also provides the status and contact information of the COVID-19 screening stations. It is also connected to KCDC's 1339 call center and KakaoTalk (popular SNS messenger service in Korea) channel, allowing users to get answers to their questions about COVID-19 symptoms and diagnoses.

4. More functions

The App provides more information on how to prevent COVID-19 infection, such as post-entry precautions, code of conduct to follow when symptoms develop within 14 days of arrival, major symptoms of COVID-19, and personal hygiene requirements.

* Chinese (Simplified/Traditional), English, Japanese, German, Russian, Spanish, Vietnamese, Arabic, Indonesian, Thai, French, Malay, Italian, and Portuguese

I Screenshot of Guide to 1339 and More Functions



[COVID-19 Prevention Guidelines] [Screening Station Information] [KCDC`s KakaoTalk Channel]

06 Contact information

Institution	Person In charege	Contact
Ministry of Health and Welfare	Jong-duk Kim	kjd0409@korea.kr

Walk-Thru
(COVID-19 Walk-Through Screening Center)

01 Introduction

A COVID-19 walk-thru screening station is a one-person, walk-through screening booth also known as ' Infection Safety Clinic' or "SAFETY" (or "SAFETY GUARD"). A Walk-Thru screening booth is about the size of a public phone booth (about 2m x 0.6m) - enough to fit in one person, and manufactured from a durable transparent resin plates with two openings in the booth for gloves to be attached for healthcare professionals to interact with the test subjects.

The healthcare professionals examine the subject's symptoms using a two-way speaker phone installed inside the booth. The examination itself is normally completed within one minute but with another 5 minutes needed to disinfect the small screening area similar to that of a phone booth - allowing about 10 test subjects to be screened per hour.

02 Background and Purpose

Korea had previously utilized negative pressure tents to screen test subjects for MERS-CoV and tuberculosis, but in the case where multiple screenings were needed, the disinfection process took an additional 30-40 minutes which greatly hindered the efficiency of the testing. It was also difficult for healthcare professionals to test proactively as they were directly exposed to the test subjects' droplets and aerosol.

In the case of a negative pressure tuberculosis phlegm collection booth, the testing was limited to collection of lower respiratory specimens using sputum coughed up by the test subject, while upper respiratory specimen collection using a cotton swab by a healthcare professional was not possible.

Walk-Thru combines technology from negative pressure phlegm collection booths and glove boxes to completely isolate healthcare professionals from the subjects for safe and rapid examination.

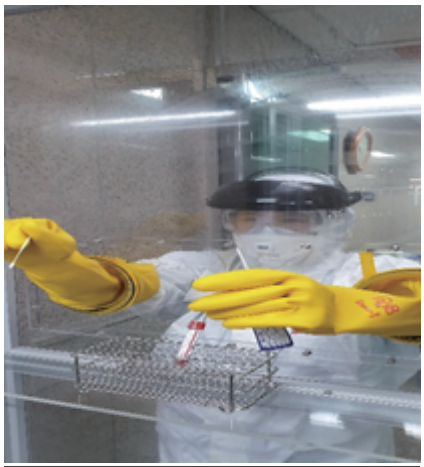
Managed by Busan Nam-gu Health Center
(best practice recommended by healthcare professionals)

For use by COVID-19 test subjects
(individuals suspected of infection or designated for testing), healthcare professionals at screening stations

For conventional examination methods, healthcare professionals needed to wear “Level D” personal protective equipment for an extended time, leading to increased physical exertion and constant sweating. Walk-Thru greatly reduces the inconvenience of healthcare professionals by eliminating the need to change into prohibitive personal protective equipment (PPE) and reduces the physical level of exertion. Previously, more than 30 minutes (including time required for disinfection) was needed to examine one person, but the examination time now has been reduced to an average of 10 minutes by utilizing a negative pressure phlegm collection booth, which is 1/10 the size of a normal negative pressure tent. Additionally, a "glovebox negative pressure booth", further reduces the time needed for disinfection as contact is minimized with the addition of a glove box.

Shape of glovebox negative pressure booth and basic method for sample collection

Glovebox negative pressure booth (healthcare professional view, front)



Collection of samples in a glovebox negative pressure booth

Glovebox negative pressure booth (subject view, side)

Walk-Thru
(COVID-19 Walk-Through Screening Center)

03 System Configuration

1. System Process

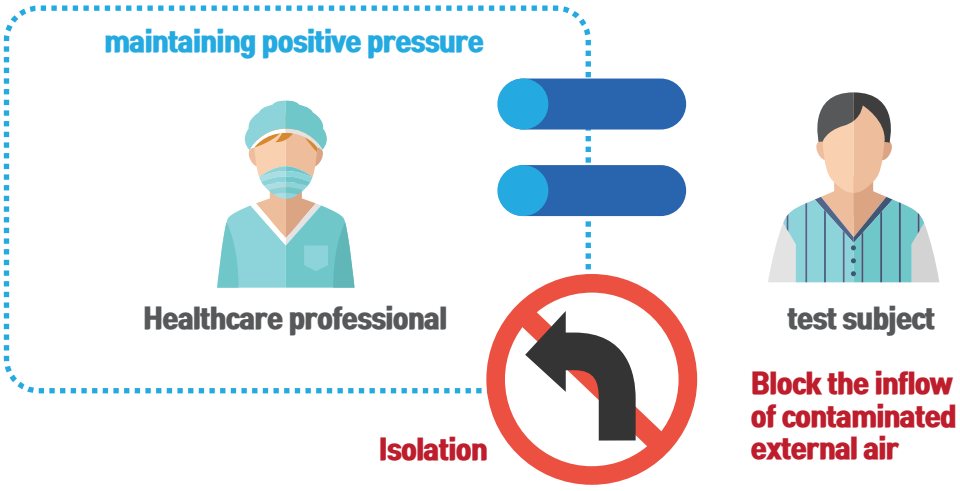
There are two types of Walk-Thru booths. “Type 1” maintains positive pressure* and is designed for health-care professionals to operate inside the booth. “Type 2” maintains negative pressure** and is designed for test subjects to be tested inside the booth. Both types have gloves attached to two holes on the walls made of acrylic glass, which are designed to collect samples without direct contact with the subject.
This has the advantage of being able to safely examine the screening subject without wearing “level D” personal protective equipment.

* Positive pressure: Maintaining the air pressure higher than the atmospheric pressure to prevent the internal inflow of contaminated air.

** Negative pressure: Maintaining the air pressure lower than the atmospheric pressure to prevent internal air from escaping.

- Healthcare Professional Booth (Type 1)

  The internal air pressure is kept higher than the atmospheric pressure* which immediately pushes out any virus that enter the internal area. The testing area for the healthcare professional is completely isolated from the testing subject to prevent secondary infection of the healthcare professionals or other patients.



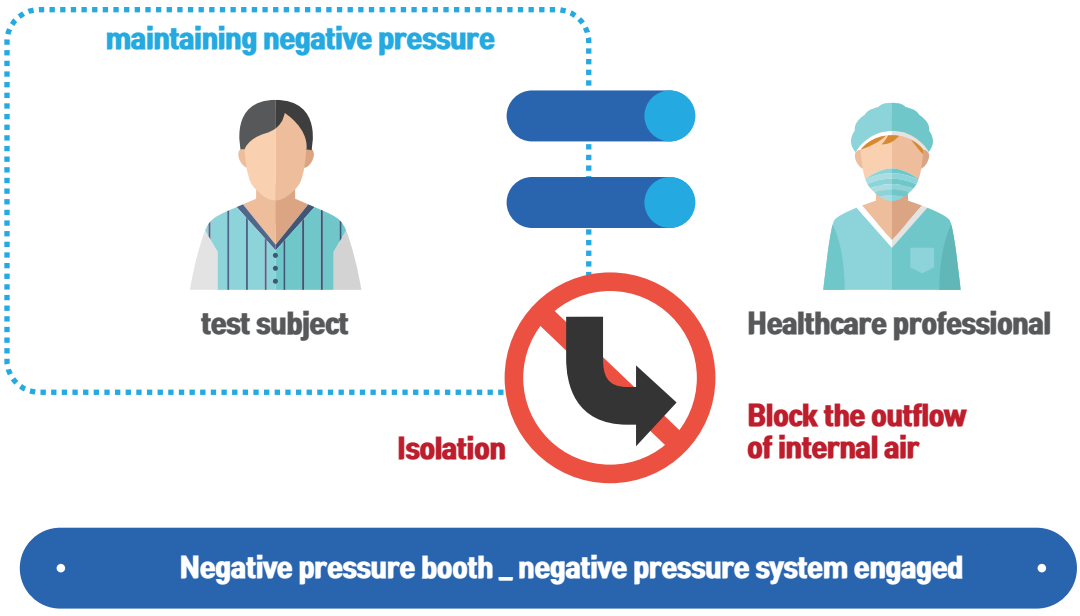
• Positive pressure booth _ positive pressure system engaged •

Managed by Busan Nam-gu Health Center
(best practice recommended by healthcare professionals)

For use by COVID-19 test subjects
(individuals suspected of infection or designated for testing),
healthcare professionals at screening stations

- **Test Subject Booth (Type 2)**

  During the examination of the test subjects who have entered the booth, healthcare professionals outside of the booth place their hands inside the glove holes and proceed with the sample collection. In order to prevent the virus from leaking out, the interior air pressure is kept lower than atmospheric pressure to prevent external leakage of the internal air, and the booth is disinfected after each examination.



04 Main Features

1. Improving the safety of healthcare professionals by utilizing air pressure difference

Healthcare professionals who are screening test subjects can be protected from external infection by utilizing the air pressure difference to control the direction of the airflow. There are two types of booths used to house either the healthcare professionals or the screening subjects according to internal pressure differences.

Walk-Thru
(COVID-19 Walk-Through Screening Center)

2. Increasing the efficiency of testing

The healthcare professionals do not need to change into a prohibitive protective suit and can take samples more efficiently as only the gloves need to be disinfected or replaced after each examination.

Examination Process

Completion of Questionnaire | Registration | Examination | Specimen Collection

❶ **Completion of Questionnaire**
The test subject receives a questionnaire from the information desk, which needs to be filled out.

❷ **Registration**
Registration is completed using a tablet that is placed in front of the screening waiting room. Based on the results of the questionnaire, the subjects who need to be examined* receive an examination kit and wait in front of the Walk-Thru booth.

* (Targeted Subjects)
1. Free examinations:
   Subjects suspected to be infected who are under self-quarantine, or who may have come into contact with a confirmed infectious person or from a high-risk area
2. Paid examinations:
   Subjects with no visible symptoms, with no particular connections with previous infections; These voluntary examinations are charged a 160,000 won examination fee, but the examination fee is refunded if the test results return as positive for COVID-19.

Managed by Busan Nam-gu Health Center
(best practice recommended by healthcare professionals)

For use by COVID-19 test subjects
(individuals suspected of infection or designated for testing),
healthcare professionals at screening stations

❸ Examination

Healthcare professionals interact with the screening subjects, who have already received (without contact with another person) an examination kit, using a built-in speaker phone.

❹ Sample Collection

The healthcare professional uses cotton swabs inside the examination kit to collect samples of the patient from the nose and throat, and returns the cotton swabs to the examination kit.

❺ Submission

The subject submits the examination kit (which contains the collected samples) outside the booth.
The samples are analyzed by the Institute of Health and Environment or a designated COVID-19 inspection agency, over an eight-hour (at minimum six hours) period using PCR* testing. The subjects are notified when the test results become available.

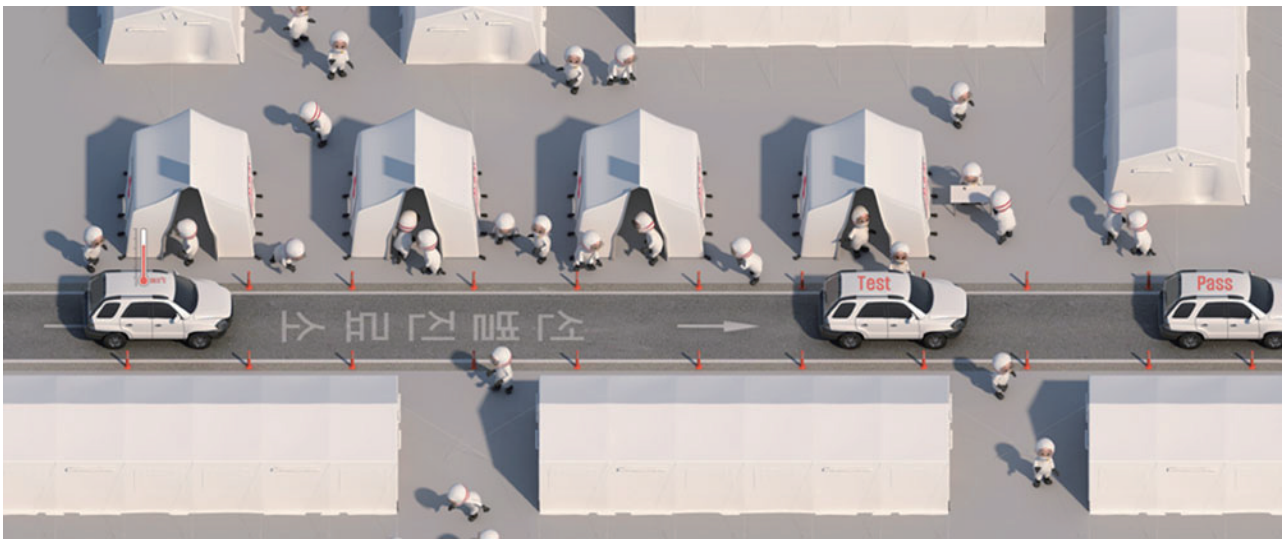
* PCR (Polymerase Chain Reaction): a method of amplifying targeted genes (DNA)

06 Contact information

Institution	Person In charege	Contact
Nam-gu Health Center, Busan Mertropolitan City	Ahn Yeohyun, M.D	premed99@korea.kr

COVID-19 Drive-Thru Screening Station

01 Introduction



The Drive-Thru screening is one way of sample collection and screening methods that is, just like the Walk-Thru screening, designed to ensure safety of both the medical workers and test subjects, while increasing the efficiency of sample collection and consultation. Taking advantage of the ventilation of open spaces such as parking lots and the subject isolation in closed spaces like inside of cars, they go through the reception, consultation, sample collection, disinfection, and education steps for each driver. The total amount of time required for the whole screening process is around 10 minutes, and it is possible to efficiently operate one Drive-Thru screening station with only minimum four to maximum eight workers.

02 Background and Purpose

The existing screening stations require a waiting room for visitors, a consultation room, and temporary isolation spaces for suspected patients, which requires a wide area to go under physical management that inevitably leads to a need for a relatively large number of resources (workers, disinfection and protection supplies, sample collection and disinfection time).

Managed by Proposed by Medical Professionals

For use by People suspected of infection and test subjects; medical workers at screening stations

In addition, there is a high risk of cross-infection when coming into a contact with a confirmed patient while waiting. Therefore, measures were needed to effectively block the risk of infection in the screening stage while increasing the effectiveness of screening and testing.

The Korean Society of Infectious Diseases asked for ideas on efficient screening and testing methods through SNS, and Doctor Kim Jin-yong, Director of the Infectious Medicine Department of the Incheon Medical Center, proposed a COVID-19 Drive-Thru screening method that uses the drug distribution method in the event of a biological terrorist attack. The Drive-Thru screening method, which focuses on minimizing the virus exposure time outdoors, was deployed as an official screening method after internal discussions at a number of local governments and COVID-19 designated hospitals. Currently, 77 Drive-Thru screening stations are in operation across the country, with the first one installed in the Kyungpook National University Chilgok Hospital.

The Drive-Thru screening is certainly a remarkable way, particularly considering the fact that it prevents cross-infection, minimizes the risk of medical worker infection and streamlines sample collection. However, it requires more resource input (human and material resources) than the Walk-Thru method, as well as fatigue management of workers who have to work outdoors facing cold weather, heatwave or strong wind. The Korea Centers for Disease Control and Prevention (KCDC) recommends that even at Drive-Thru screening stations, workers must wear level D personal protection equipment and avoid working overtime, not more than four hours. Particularly to prevent medical workers' risk of exhaustion caused by outdoor environmental factors, KCDC recommends each worker take one to two-hour shift.

03 Pre-requisite

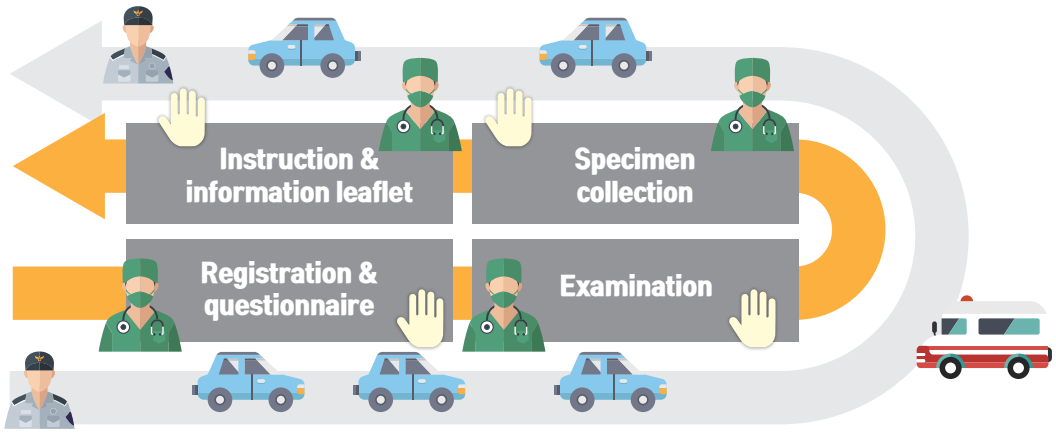
This method requires installation of open tents (or containers) and large spaces for parking and vehicle movement. It also requires a team of 4 to 8 consisting of at least one administrative worker, a doctor, a nurse, and a disinfection/education worker for each stage, with extra workers for shift rotation when the team gets exhausted from long-time screening work. As for screening subjects, they must have a car to drive to the station and a mobile phone to communicate with the medical workers. Since non-contact screening is key, subjects are also recommended to use electronic payment and the online reservation system to efficiently utilize the screening time.

COVID-19 Drive-Thru Screening Station

04 System Configuration

1. Screening Procedure

The operational procedures and manuals are mostly identical (4 stages) to those of other screening stations. They are ① registration, ② consultation, ③ sample collection (from upper and lower respiratory tract) , and ④ disinfection and education. The four stages can be simplified into two depending on the situation. Note should be taken that subjects visiting Drive-thru screening stations with a guardian or a fellow passenger in car will not be able to get the tests; instead, they are advised to use nearby screening stations installed in public health centers.



Type	Requirement
Note	▪ Screening and testing unavailable for subjects visiting with other passengers in car (recommended to use nearby screening stations in public health centers)
[Stage 1] Registration	▪ Subject receives and fills out questionnaire
[Stage 2] Consultation	▪ Temperature check and consultation with doctor (subject sent home when no symptoms) * Doctor decides whether to collect sample after checking the subject's international travel history, contact with other confirmed patients and temperature
[Stage 3] Sample Collection	▪ Sample collected from upper and lower respiratory tract
[Stage 4] Disinfection and Education	▪ Result to be notified at a later time

Managed by Proposed by Medical Professionals

For use by People suspected of infection and test subjects; medical workers at screening stations

05 Main Features

The Drive-Thru screening method focuses on increasing the efficiency of sample collection and reducing the risk of cross-infection between subjects and medical workers by minimizing the screening and disinfection areas, as compared to the screening stations installed and operated to cope with the Middle East respiratory syndrome coronavirus (MERS). At screening stations, in general, it takes 30 minutes for a single subject screening case (two cases per hour) (registration, consultation, sample collection, disinfection, and education). On the other hand, the Drive-Thru method can handle each screening case within 10 minutes (six cases per hour), and the daily number of screening cases may reach as many as 60 on a 10-hour basis. The Seoul Metropolitan Government has set up Drive-Thru screening stations using large vehicle parking lots, allowing up to 1,000 people to get tests in a day; In Goyang City, a total of 1,319 people visited the Drive-Thru screening station in a week and the daily average number of screening cases was 188, as an official said.

Sample Collection at Drive-Thru Screening Stations

Time consumed	Total 10 minutes (registration, consultation, sample collection, disinfection, and education)
Number of samples collected per hour	6 in Drive-Thru stations vs 2 in other stations
Number of samples collected per day	**6/hr x 10hr/day = 60**

* Source: KCDC Daily Briefing on COVID-19, March 4, 2020

06 Contact information

Institution	Person In charege	Contact
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Developing Test Kits and Diagnostic Reagents Based on Artificial Intelligence (AI)

01 Introduction

Seegene, a Korean company specialized in molecular diagnosis, has developed AI-based test kits for detecting COVID-19 infection. As the world's first molecular diagnostic kits developed by using AI automation systems, these kits diagnose cerebral meningitis and sexually transmitted diseases. At the same time, they are high multiplex real-time PCR kits that perform both single and multiple detection of viruses.
With the accrued experiences and know-how of developing test kits and AI algorithms, the company significantly reduced the developing cost and time by a hundredth, only taking 3 hours to develop the kits, which would normally require 100 experts working for 3 months.

The AI-based test kits allow for accurate and fast detection only through a single test, which led to drastic reduction of time required for each testing from 24 hours to 6 hours, further containing the domestic spread of COVID-19.

02 Background and Purpose

When COVID-19 started spreading fast in Wuhan, China, and even before it was widespread in Korea, Seegene predicted in advance the inevitable spread of COVID-19 in Korea,. Even though Seegene had yet to obtain the KFDA approval, it was concerned that the situation would get worse and started developing the test kits on January 16, 2020, even when there was not a single confirmed case in Korea.
Behind the fast and successful design of diagnostic reagents and development of test kits for COVID-19 was the US National Center for Biotechnology Information(NCBI)'s COVID-19 genome sequence data, released on January 2, 2020, Seegene's accumulated data and know-how with test kit development for the last two decades, as well as the high-capacity computers that perform almost like super computers and the AI algorithms,
The government support also played a part. While it usually takes about 12 months from a product development to approval, the Korean Ministry of Food and Drug Safety decided emergency use authorization (EUA) on Seegene's test kits on February 12, 2020. By then, Korea had 28 confirmed cases with no deaths.
Backed up by the AI automation system that helped fast, two-week development and the policy measure that gave emergency use authorization, the test kits were finally approved for use within a week and in full use for COVID-19 detection in Korea.

Developed by Seegene
For use by COVID 19 Test Subjects

03 Pre-requisite

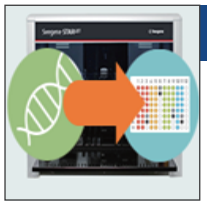
Type	Requirement
Automation Equipment	▪ Company's own automation equipment that helps fast and accurate collection of test results from patients, clinics and labs
Integrated Platform	▪ An integrated platform that provides services to hospitals of all sizes at a reasonable price

Developing Test Kits and Diagnostic Reagents Based on Artificial Intelligence (AI)

04 System Configuration

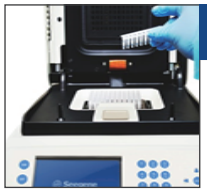
1. Molecular Diagnostic Automation Equipment

Seegene owns the molecular diagnostic equipment based on OEM partnership. Working with the equipment are the automated system comprised of DNA extractor, automatic PCR reagent sprayer, automatic electrophoresis, POCT, Real-time PCR, De-capper and reagents.



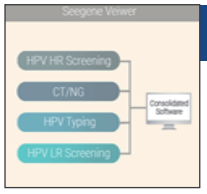
Step 1 PCR Setup

From the automatic extraction of nucleic acid to PCR set-up, all processes are automated to lessen the amount of manual work time and chances of contamination, as well as improve testing speed.



Step 2 Real-time PCR Testing

Real-time PCR testing allows 5 different fluorescent channels to be used at the same time, and multiplex testing is made possible with only one clinical sample.



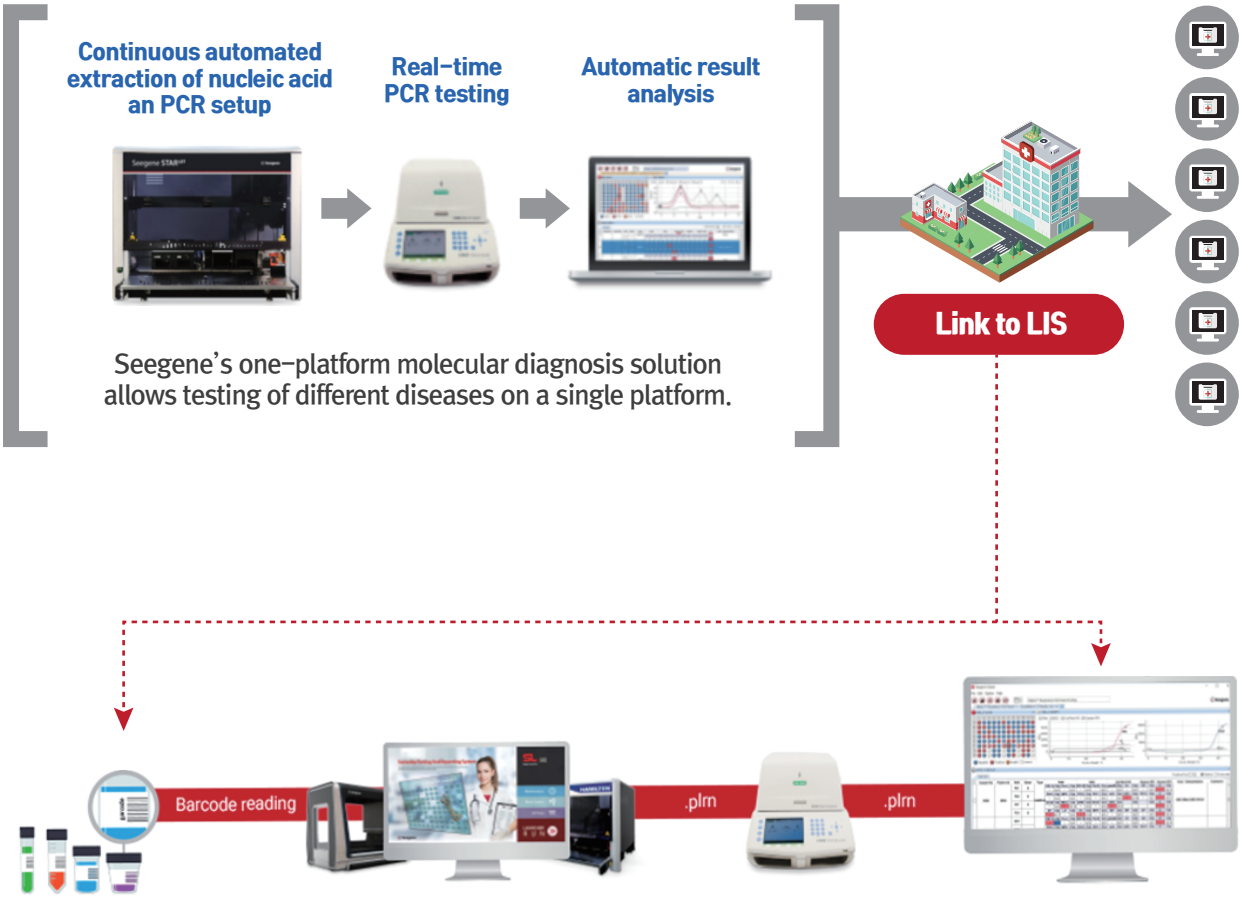
Step 3 Automatic Result Analysis (Seegene Viewer)

The company also has software (Seegene Viewer) that automatically analyzes test results, which makes quick and accurate testing possible.

2. All-in-One Platform

Seegene has a one-platform molecular diagnosis solution that can simultaneously process all different kinds of molecular tests, including respiratory, digestive infectious diseases as well as drug resistance, cancer, and genetic disorders.
It is an all-in-one automation platform equipped with tubes that collect different samples, PCR setup that performs multiple functions, real-time PCR, and software that analyzes results automatically.
The one-platform molecular diagnosis solution achieves quick and easy workflow of molecular diagnosis with its simple testing platform and is also linked to the Laboratory Information System (LIS) for data management.

Developed by Seegene
For use by COVID 19 Test Subjects



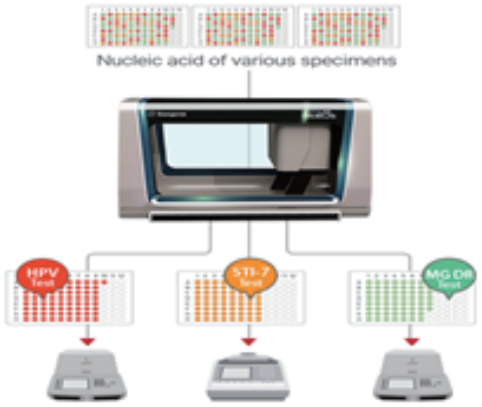
05 Main Features

These test kits detect COVID-19 infection. It enables early diagnosis through simultaneous testing of disease-related DNAs and identifies not only the infection but also the level of infection, allowing for treatment and care that is customized to each patient.

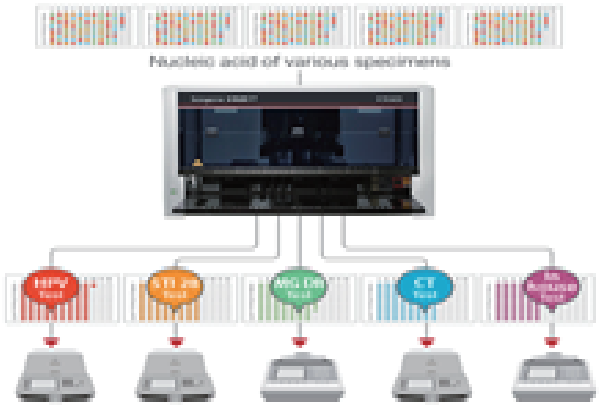
Developing Test Kits and Diagnostic Reagents Based on Artificial Intelligence (AI)

1. Automatic Categorization (PCR setup solution)

The PCR setup solutions automatically categorize randomly plated samples and preps for simultaneous running of different tests. Using Seegene's launcher, up to 3 to 5 PCR plates can be set up for testing. One-time testing can process maximum 5 different PCR setups at the same time, reducing the testing time while increasing the number of samples tested.



NIMBUS automatically categorizes up to 3 PCR plates



STARlet automatically categorizes up to 5 PCR plates

2. Real-time PCR Technologies

Real-time PCR technologies use 5 different fluorescent channels at the same time and allows multiplex testing with one clinical sample. Using the thermal circulation equipment, results can be obtained within 30 minutes, and measuring the energy of fluorescent substances from each individual well ensures accurate and speedy test results.

One-time testing can identify results from up to 5 channels, with multiple results from each channel, and a single computer can handle extended control of up to maximum 4 CFX96's.

DPO™ Technology
A primer technology that accurately amplifies multiple targets

TOCE™ Technology
A signal technology that detects multiple targets at the same time

MuDT™ Technology
A technology that analyzes multiplex Ct values using real-time PCR

3. Automatic Analysis of Test Results

Multi-dimensional, different MDx test results can be obtained through a single integrated software without having to use different analyzing device for each test.
There is an optimized interface for analyzing simultaneous multiplex molecular test results on different samples, enabling intuitive reading of multiple sets of results and locating 96 plates. The user interface (UI) also provides multiplex Ct values and melting curve values for each channel in form of graphs. It can be linked to the LIS for data accumulation and management.

All kind of Seegene's high multiplex real-time PCR products


Automated results analysis

AI-driven COVID-19 X-RAY and CT Image Screening Solutions

01 Introduction

As the worldwide spread of COVID-19 continues, medical artificial intelligence (AI) solution developers, VUNO, LUNIT, and Medical IP, have released free AI-driven chest X-ray and CT image reading solutions. They are 'VUNOMED Lungquant' and 'VUNOMED Chest X-ray', 'LUNIT Insight CXR' and 'MEDIP COVID19', which are available at all times on each company's official website.

These solutions are AI software that assist doctors' diagnosis by analyzing X-ray and CT images and detecting major lung abnormalities, such as pneumonia. They can be used at any stage, from screening of patients suspected of COVID-19 infection to monitoring of confirmed patient conditions and retrospective studies.

02 Background and Purpose

It is difficult to accurately examine the internal organs and lesions of the human body using tomographic images from chest X-ray and CT, which are usually the first ones to be checked for COVID-19 diagnosis. Not only does it take a long time to read, but the possibility of errors is very high.

To reduce the burden on medical workers and effectively restore patients' health, the AI solution developers came up with solutions that can quickly and accurately read chest X-rays and CT scans using AI.

03 Pre-requisite

2D CT and X-ray medical images processed through the graphics processing unit (GPU) are stored in the picture archiving and communication system (PACS). The stored data form AI algorithms through deep learning to analyze and read medical images.

Type	Requirement
PACS	▪ A system (PACS) that converts the results of radiography taken by X-ray and CT into digital images and stores them in a mass storage device is required.
Medical Data	▪ Hospitals need to provide data of suspected and confirmed COVID-19 patients.

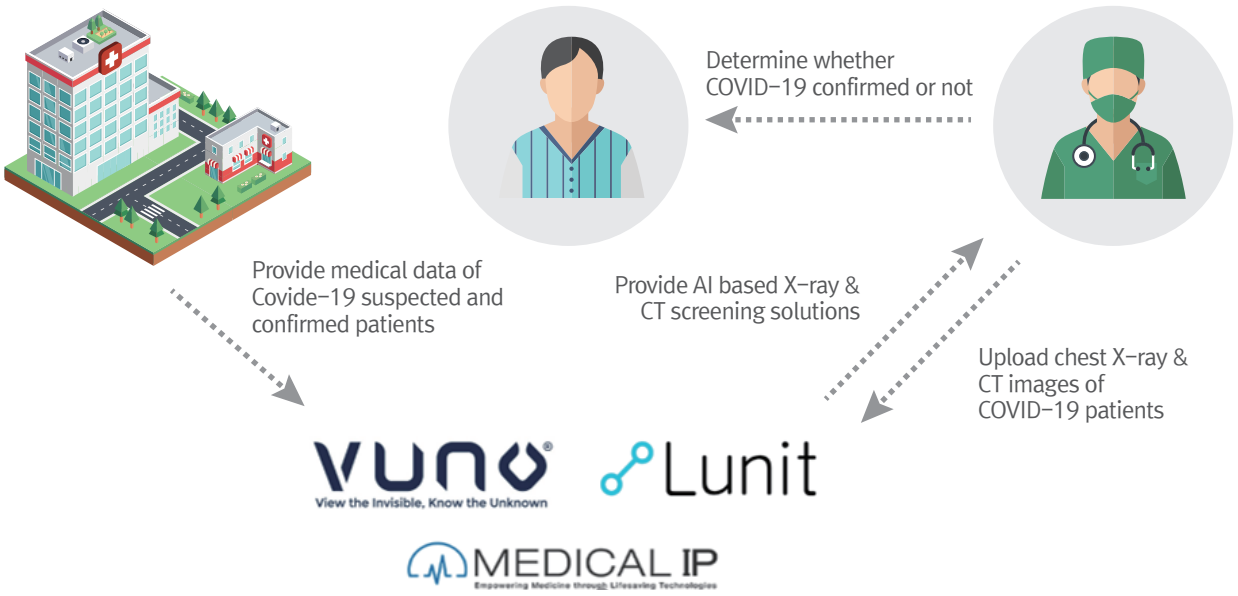
Developed by VUNO, LUNIT, MEDICAL IP
For use by Locals and Foreigners

Type	Requirement
AI Algorithm	▪ COVID-19 confirmation assistance should be made using AI algorithms based on deep learning of medical data.
GPU	▪ Service performance can be improved through use of 3D graphic processor (GPU) that computes 2D medical images of X-ray and CT as 3D data.

04 System Process

The AI-driven COVID-19 X-ray and CT image screening solutions are available in real-time on the official websites of VUNO, LUNIT, and Medical IP. It only takes less than 5 seconds for an X-ray image upload, and less than a minute for a CT image upload to get the result.

The medical chest X-ray and CT image reading service is an artificial intelligence software that assists doctors in diagnosing major lung abnormalities. It is operated based on the AI algorithms formed through deep learning with medical data that are collected from partner hospitals.



AI-driven COVID-19 X-RAY and CT Image Screening Solutions

05 Main Features

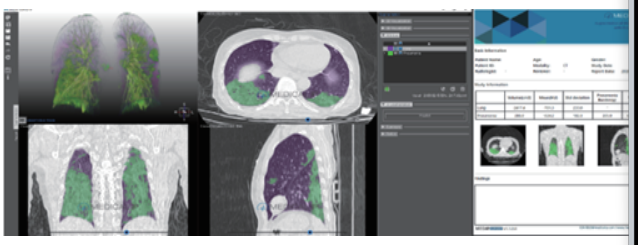
For any respiratory symptoms, CT, X-ray, and other lung images are essential tests for diagnosing pneumonia, determining severity, and monitoring treatment and progress. In order to effectively obtain these images and increase the value of information, diagnostic radiology that helps judge intuitively the inside of the patient's body is being actively used to solve the COVID-19 problems.

1. Medical IP

Medical IP's AI medical image analysis software converts 2D medical images such as X-rays, CTs, and MRIs into 3D, allowing more accurate identification of organs and lesions inside the human body that are difficult to discern using tomography images.

This COVID19 software, developed based on this technology, can analyze symptoms of pneumonia by percentage (%) and weight (g) using CT images, enabling accurate screening of COVID-19 patients whose severity level of pneumonia cannot be easily determined through 2D CT images only.

▼ Screenshot of MEDIP COVID19



[Quantification Process of COVID-19 Lesions]

▲ MEDIP COVID19 Download Page

This system can be downloaded for free from the Medical IP website (http://medicalip.com/mobile/shop/-covid19.php) and is currently being used in 1,024 medical and research institutions around 39 countries.

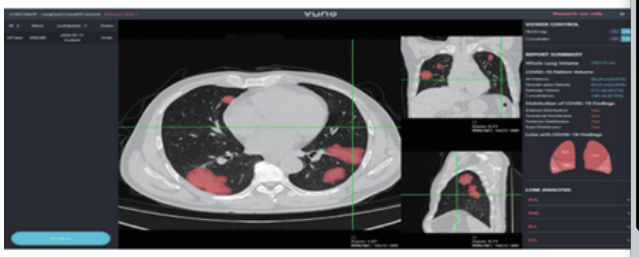
Developed by VUNO, LUNIT, MEDICAL IP
For use by Locals and Foreigners

2. VUNO

VUNO's AI-driven chest X-ray and CT image screening assistance solutions, which are optimized for COVID-19, show the result in less than 5 seconds for a chest X-ray image upload and in less than a minute for a CT image upload. VUNO is the world's first to unveil the integrated chest CT and X-ray solutions that help COVID-19 diagnosis.

These solutions analyze patient's chest CT images to provide lesion distribution and volume information, or detect major findings caused by COVID-19 from chest X-rays. This way, it suggests whether the conditions are normal or not and therefore, helps diagnose suspected patients and observe changes in the conditions of confirmed patients in an efficient manner.

▼ Screenshot of VUNO X-ray and CT Image Screening Solution



[Diagnosis through X-ray, CT image screening]

▲ VUNO X-ray and CT Image Screening Solution Download Page

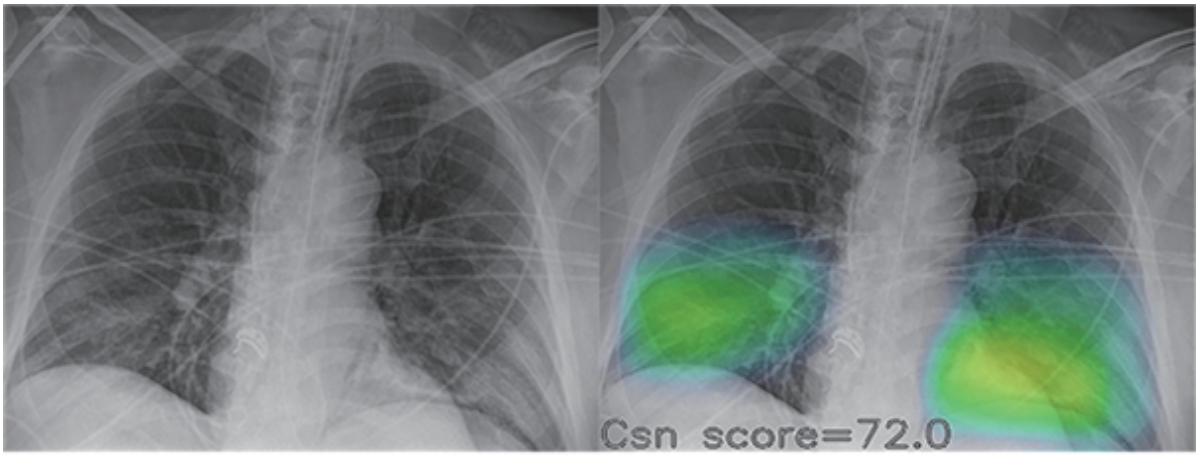
This system is available at the VUNO website (https://covid19.vunomed.com/).

AI-driven COVID-19 X-RAY and CT Image Screening Solutions

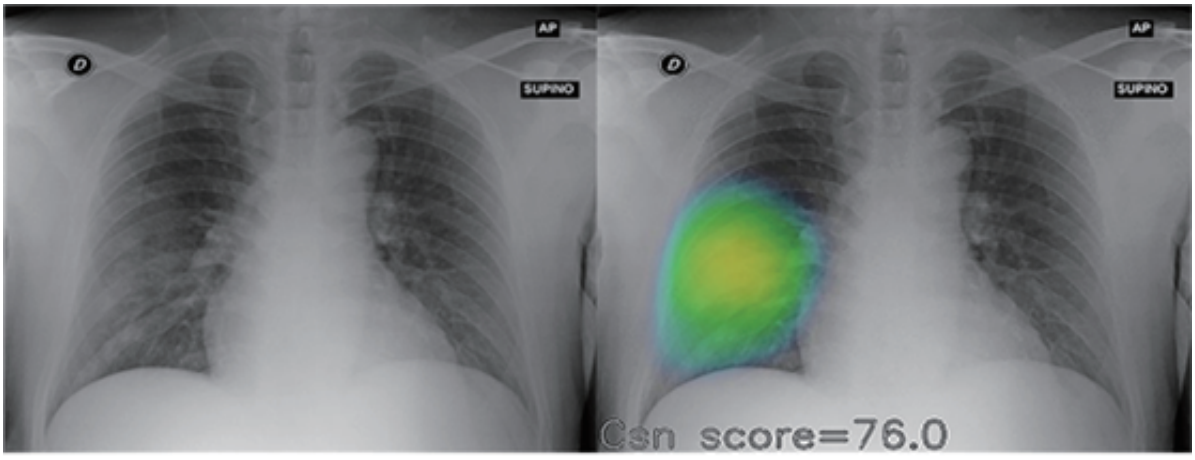
3. LUNIT

LUNIT's software is very useful in analyzing COVID-19 X-ray and CT images. Its AI algorithms help doctors by conducting fast analysis of chest X-ray images and detecting major lung abnormalities in just a few seconds with the accuracy rate as high as 98%. LUNIT Insight CXR has analyzed more than 3 million chest x-ray images from 80 countries worldwide.

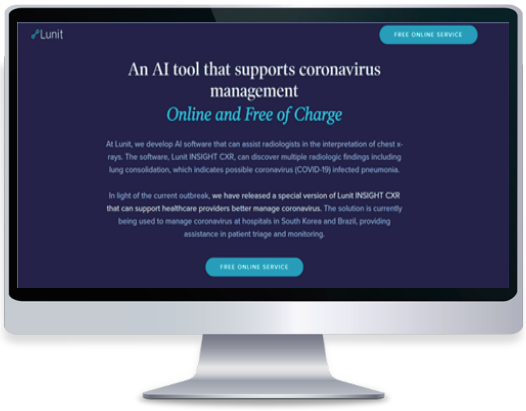
▼ Screenshot of LUNIT Insight CXR



Case 01 These are simple chest photos of a patient undergoing ICU treatment, showing ground glass opacity distributed at the base of both lungs. Even with the complex positioning of various catheters and monitoring equipment, LUNIT Insight CXR accurately detected the lung lesions. (Abnormality Score: 72%)



Case 02 This is a case where pulmonary consolidation and ground glass opacity are found at the same time across the right mid-lower lung field, and the lesion was accurately detected by LUNIT Insight CXR. (Abnormality Score: 57%)



▲
LUNIT Insight Download Page

This system is available online for free at the LUNIT website (https://www.lunit.io/ko/covid19/).

06 Contact information

Institution	Person In charege	Contact
VUNO	Kyuhwan Jeong	hello@vuno.co
Medical IP	Sangjun Park	contact@medicalip.com
LUNIT	Minhong Jang	contact@lunit.io

ICT utillizing cases tackling against **COVID-19** pandemic of Korea

Epidemiological Investigation Stage

COVID-19 Epidemiological Investigation System

01 Introduction

The COVID-19 Epidemiological Investigation System is a system that automates the process of contact tracing for COVID-19 confirmed patients. Geospatial information on the travel routes of confirmed COVID-19 patients can easily be visualized on a map that is embedded on the platform, and also provides related statistical information. For this to be possible, smart-city technologies that collect and process large-scale city data sets - such as the analysis tool 'Smart City Data Hub' - are used.

02 Background and Purpose

The Korea Centers for Disease Control & Prevention (KCDC) previously conducted epidemiological investigations through direct interviews with confirmed patients. After the interview, additional information needed to be gathered from other related persons and organizations. However, this process was time-consuming because of the delays in communication, and accuracy issues arose due to hand-written documentation.

KCDC had recently struggled with the overwhelming workload triggered by the large-scale transmission of COVID-19 in Daegu. This prompted a need for the rapid introduction of an automated system that could analyze massive amounts of contact tracing and surveillance data in a rapid and accurate manner.

The purpose of building this system was to stop the spread of COVID-19 by identifying the travel routes of confirmed patients, and to analyze the collected data to establish preventive measures against different epidemics.

Managed by Ministry of Land Infrastructure and Transport and Korean Centers for Disease Control and Prevention

For use by confirmed COVID-19 patients and epidemiology (contact tracing) experts

03 Pre-requisite

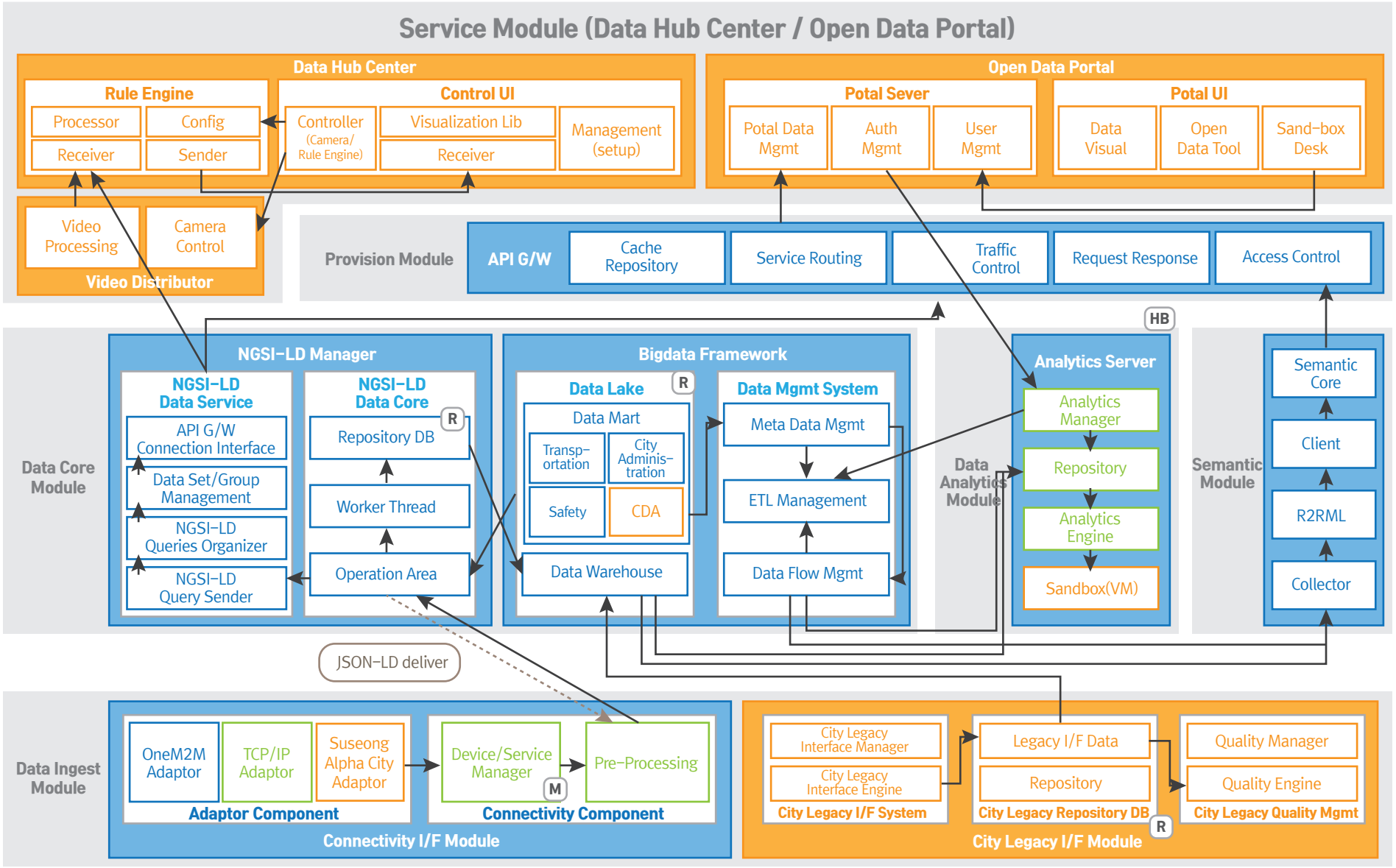
The reason it was possible to quickly develop a system to automate the process of contact tracing of COVID-19 patients was because of an existing big-data analysis platform. The early development and adoption of this system was possible by utilizing the 'Smart City Data Hub' developed under the National Strategic Smart City Program (DEAP CITY Program) initiated by the Korea Agency for Infrastructure Technology Advancement (KAIA). The system requires data from individuals regarding the time, travel routes, and location of confirmed patients, and public data on the information about public transportation and the status of screening stations.

* DEAP CITY Program (Digital Empowered Agile Progressive CITY Program): As one of the 8 major projects of the Korean government, the program was funded by the Ministry of Land, Infrastructure, and Transport (MOLIT) and the Ministry of Science and ICT (MSIT). It is an R&D project to develop an advanced Smart City model for application to actual cities in Korea. (http://www.smartcities.kr)

**Smart City Data Hub: An analysis tool for large-scale city data, it analyzes the big data related to various areas such as transportation, energy, environment, and safety in real-time and uses them to realize smart city services.

Type	Requirement
Private Data	▪ Travel and location information of confirmed patients ① Geospatial information on travel routes of confirmed patients (provided by telecom providers) ② Geospatial information on sites visited by confirmed patients (provided by credit card companies)
Public Data	▪ Information on status of confirmed COVID-19 infections, suspected infections, self-quarantined persons, COVID-19 testing, COVID-19 screening stations, public transportation, and medical facilities.
Public Data	▪ Smart City Data Hub

System Configuration of the Smart City Data Hub



* Source: Korea Agency for Infrastructure Technology Advancement (KAIA)

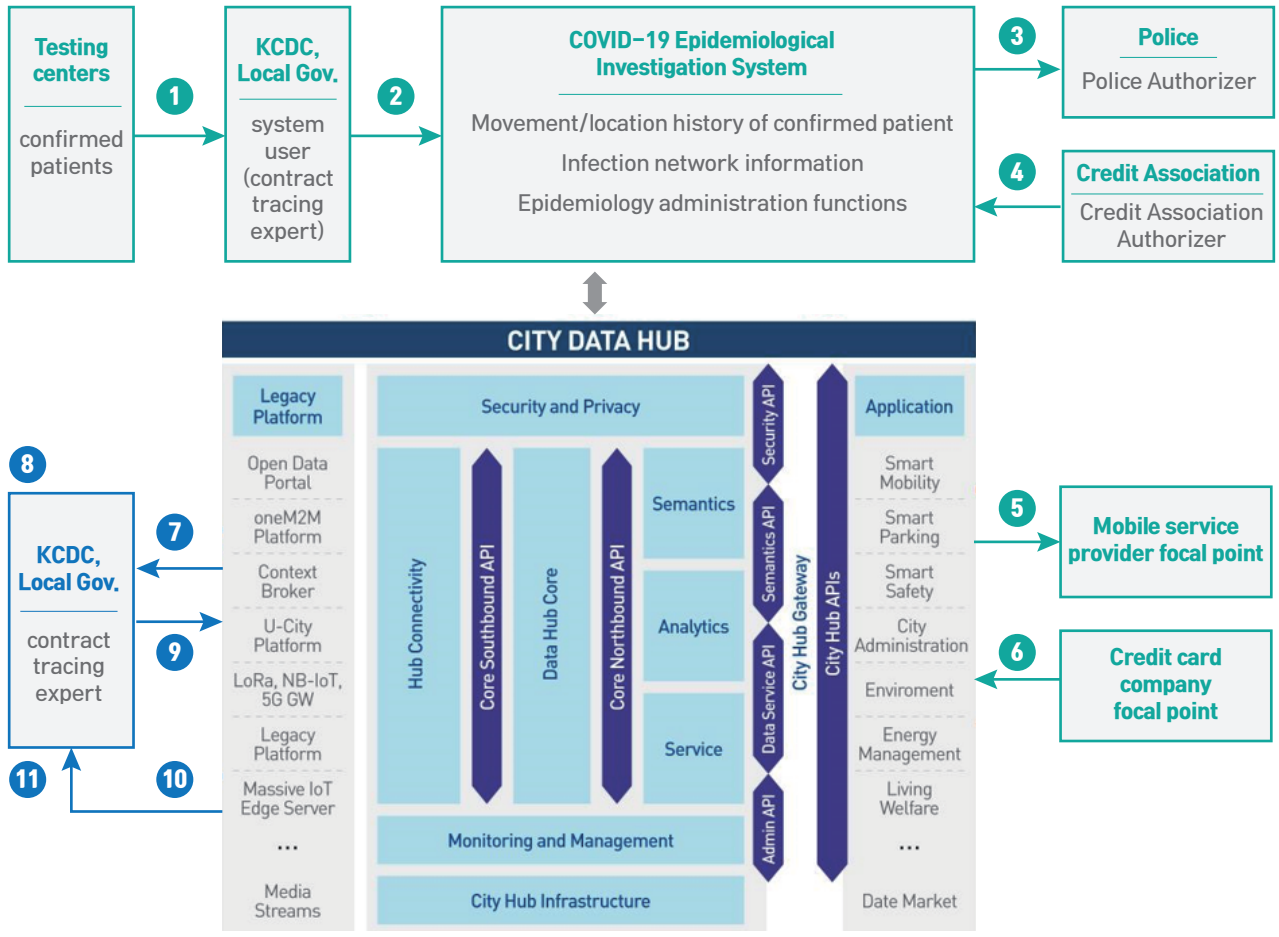
COVID-19 Epidemiological Investigation System

04 System Configuration

1. System Process

Once a patient is confirmed with COVID-19, KCDC requests contact tracing related information from the system; the requested information is provided after obtaining the consent for utilization of personal information from the police and the Credit Finance Association of Korea. Domestic mobile service providers and credit card companies provide this personal information of the confirmed patients based on police approval. The system provides the result of analyzed data of the travel routes of confirmed patients and hotspots by processing and analyzing the information input into the system.

COVID-19 Epidemiological Investigation System

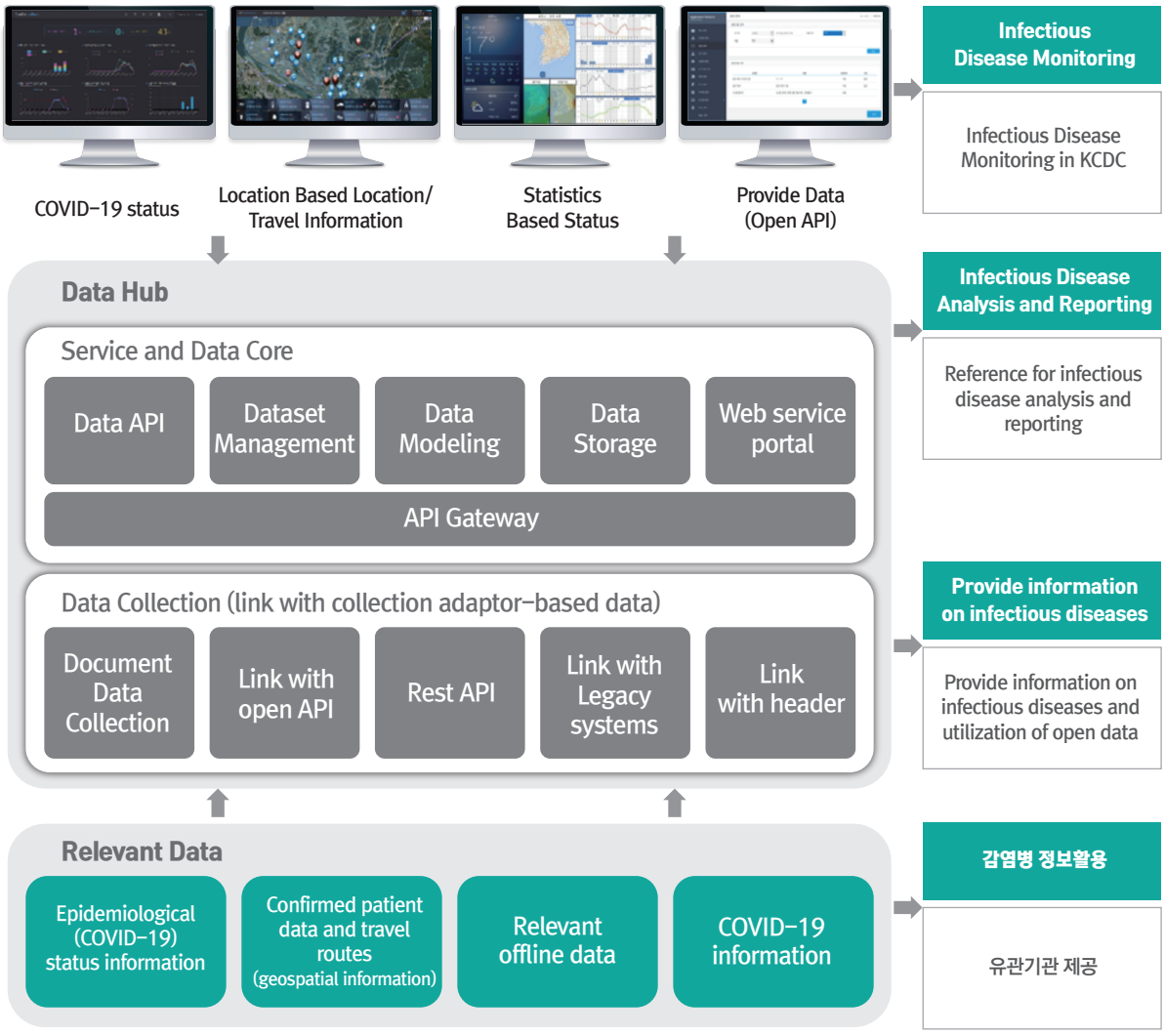


Managed by Ministry of Land Infrastructure and Transport and Korean Centers for Disease Control and Prevention

For use by confirmed COVID-19 patients and epidemiology (contact tracing) experts

1. Infection confirmed
2. Request for information
3. Request for authorization
4. Authorization
5. Request for information (SMS)
6. Provide information on confirmed patient
7. Provide movement history
8. Confirmation of movement history based on contact tracing interview
9. Final confirmation of movement history
10. Infection network information
11. Identification of transmission vector based on contact tracing confirmation

2. Hardware, Software Structure

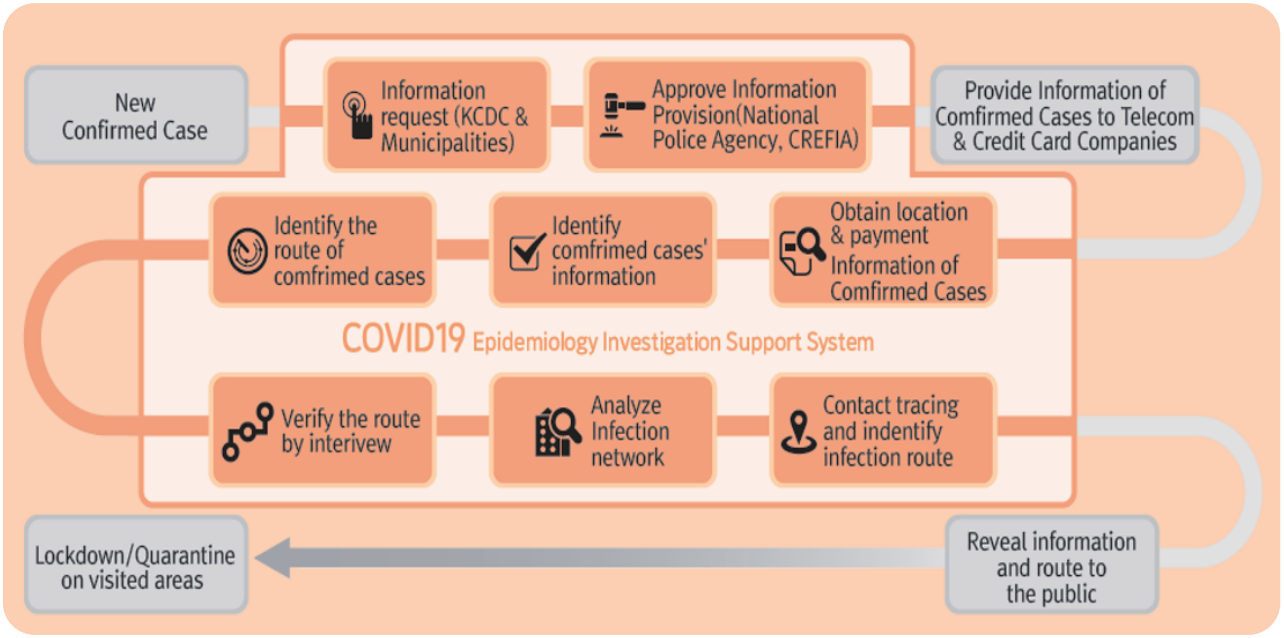


COVID-19 Epidemiological Investigation System

05 Main Features

This system supports contact tracing by identifying the travel routes of confirmed patients as well as persons who have been in contact with the confirmed patients, and conveys this information to the KCDC. Additionally, by processing big data, KCDC uses the processed information to recommend preventive measures against COVID-19.

Epidemiological Investigation Support Flowchart

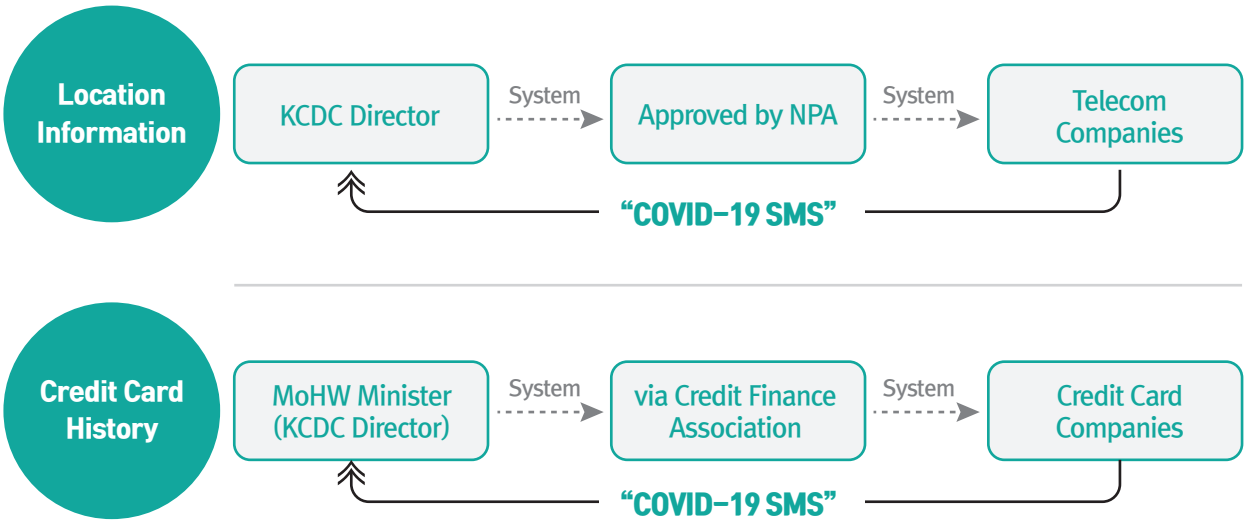


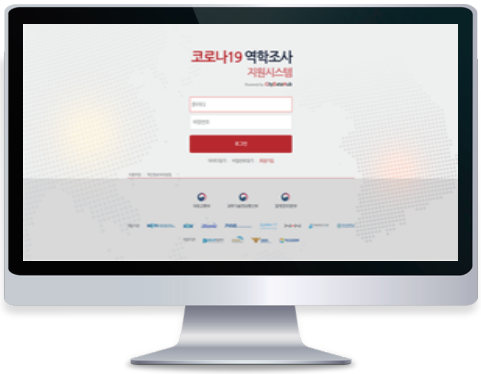
1. Identifying travel routes of confirmed patients and people who have come into contact

The COVID-19 Epidemiological Investigation System identifies the path of confirmed patients quickly by executing real-time analysis of the movement history and credit card usage data of the confirmed patients. With the cooperation of the police, 3 major telecom companies, and 22 credit card companies, the system identifies the transmission path and hotspots by analyzing the provided geospatial information.
(* Time required for epidemiological investigation was reduced from maximum 24 hours to 10 minutes after automated epidemiological analysis.)

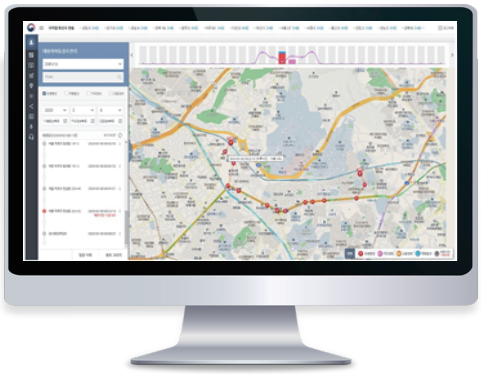
Managed by Ministry of Land Infrastructure and Transport and Korean Centers for Disease Control and Prevention

For use by confirmed COVID-19 patients and epidemiology (contact tracing) experts





▲ System Log-on



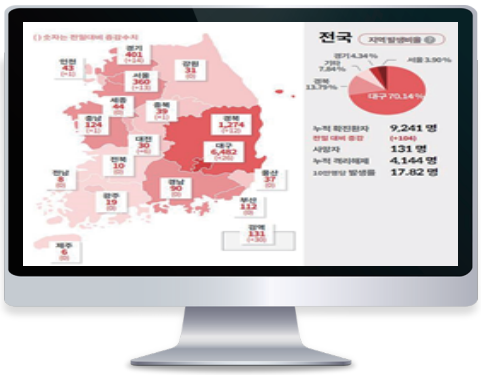
▲ Example of Patient Travel Route Information

2. Providing information on the infection network

By utilizing the system, it is possible to conduct real-time analysis of big data related to the travel routes of the confirmed patients and locations visited. It also examines the hotspots and causes of transmission through various statistical analyses. This analyzed data is provided to KCDC for the purpose of establishing preventive measures. Furthermore, it identifies the facilities and transportation systems that need to be quarantined or shut down.

COVID-19 Epidemiological Investigation System

▲ System Operation and Statistical Analysis



▲ Confirmed Patient Stats Analysis

3. Managing the epidemiological investigation

As the movement history of the confirmed patients is personal information, access to the system is highly restricted. The investigator manages the data collected and analyzed through the system and verifies the optimized information for transporting infected patients by viewing the panel showing the quarantine status and availability of hospital beds. Geo-fencing, the function for tracing self-quarantined persons, is also available in the system, providing a convenient way to manage other aspects of the epidemiological investigation as well.

06 Implications

1. Legal basis for sharing personal information for emergency response

As the epidemiological investigation provides personal information to the public, strict measures for privacy protection must be followed. Utilizing personal information from confirmed patients in the 'COVID-19 Epidemiological Investigation System' is based on a law (Infectious Disease Control and Prevention Act) that has been revised subsequent to the 2012 MERS-CoV outbreak in Korea. According to this law, health authorities can request personal information from police agencies and use them without the direct consent of an individual.

Managed by Ministry of Land Infrastructure and Transport and Korean Centers for Disease Control and Prevention

For use by confirmed COVID-19 patients and epidemiology (contact tracing) experts

2. Close communication and cooperation with the private sector

One of the reasons why Korea was successful in dealing with COVID-19 from the beginning is because of the lessons Korea learned from the 2012 MERS-CoV outbreak. The 3 main telecom companies provided the most important information, which is telecommunication data used for compiling contact tracing information. As we could see in the case of the first MERS-CoV confirmed person and the super-infection case in Daegu, monitoring is especially challenging if people infected with the virus hide information or lie during the epidemiology investigation. Smartphone big-data provided by telecom companies has become one of the main assets for contact tracing.

As we can see from the two cases above, Korea was able to develop an epidemiological investigation system in a relatively short period by revising the law and cooperating closely with the private sector.

07 Contact information

Institution	Person In charege	email
KAIA (Korea Agency for Infrastructure Technology Advancement)	Kwangbok Jeong	traffic1@kaia.re.kr

Global Epidemic Prevention Platform (GEPP) for Digital Tracing

01 Introduction

The global epidemic prevention platform (GEPP) is designed to identify transmission routes of infectious diseases and find those who are exposed to potential risks of infection by using mobile location data both at home and abroad. GEPP first traces travel routes of individuals based on the mobile phone data usage within Korea and under international roaming services, and combines them with maps showing areas with local and international confirmed cases of infectious diseases (including the areas where confirmed patients visited) to determine each individual's potential exposure to the virus.

By using GEPP, the government can send text alerts to all Korean citizens about the risk of infection, medical institutions can check their patients' potential infection through Drug Utilization Review (DUR), and quarantine authorities can track travel routes of confirmed patients and identify the source of infection through contact tracing.

02 Background and Purpose

GEPP was built as part of developing measures to respond to the import of novel infectious diseases to Korea since the MERS-CoV outbreak in 2015.

When the MERS-CoV patient no. 1 was left unscreend because he entered Korea via a third country, the government needed measures to check people's travel history to countries with confirmed cases of MERS-CoV. It also had to find ways to provide information on MERS-Cov for the citizens and medical institutions to become aware of the disease.

In addition, there needed schemes to trace the source of infection and contacts when an infectious disease is imported to Korea with increasing number of confirmed cases, when a confirmed patient fails to report travel routes intentionally or unintentionally, and when epidemiological investigation is impossible because a patient is confirmed positive after death.

Hence, in 2016, the Korea Centers for Disease Control and Prevention (KCDC) and the Ministry of Science and ICT (MSIT) joined hands with a local telecom company, KT, and launched a program to develop digital tracing technology based on mobile data usage of mobile phone subscribers. This technology has been actively used in identifying confirmed and potential patients' travel routes, sites of infection, and contacts since the beginning of COVID-19 outbreak in Korea.

Developed by KT, KCDC, MSIT
For use by all domestic residents,
medical institutions, KCDC and local governments

03 Pre-requisite

The government had to provide legal grounds to GEPP using mobile subscribers' personal information held by telecom companies. As a result, the Korean government amended the Infectious Disease Control and Prevention Act in 2015, allowing the government to collect personal information of those confirmed or suspected of infection without their consent.

Type	Requirement
System Interconnection	▪ Smart quarantine system, telecom companies' systems, DUR system
Data	▪ Local mobile data use, international data roaming signals, information about countries with infectious disease outbreaks
Legal Ground	▪ Infectious Disease Control and Prevention Act

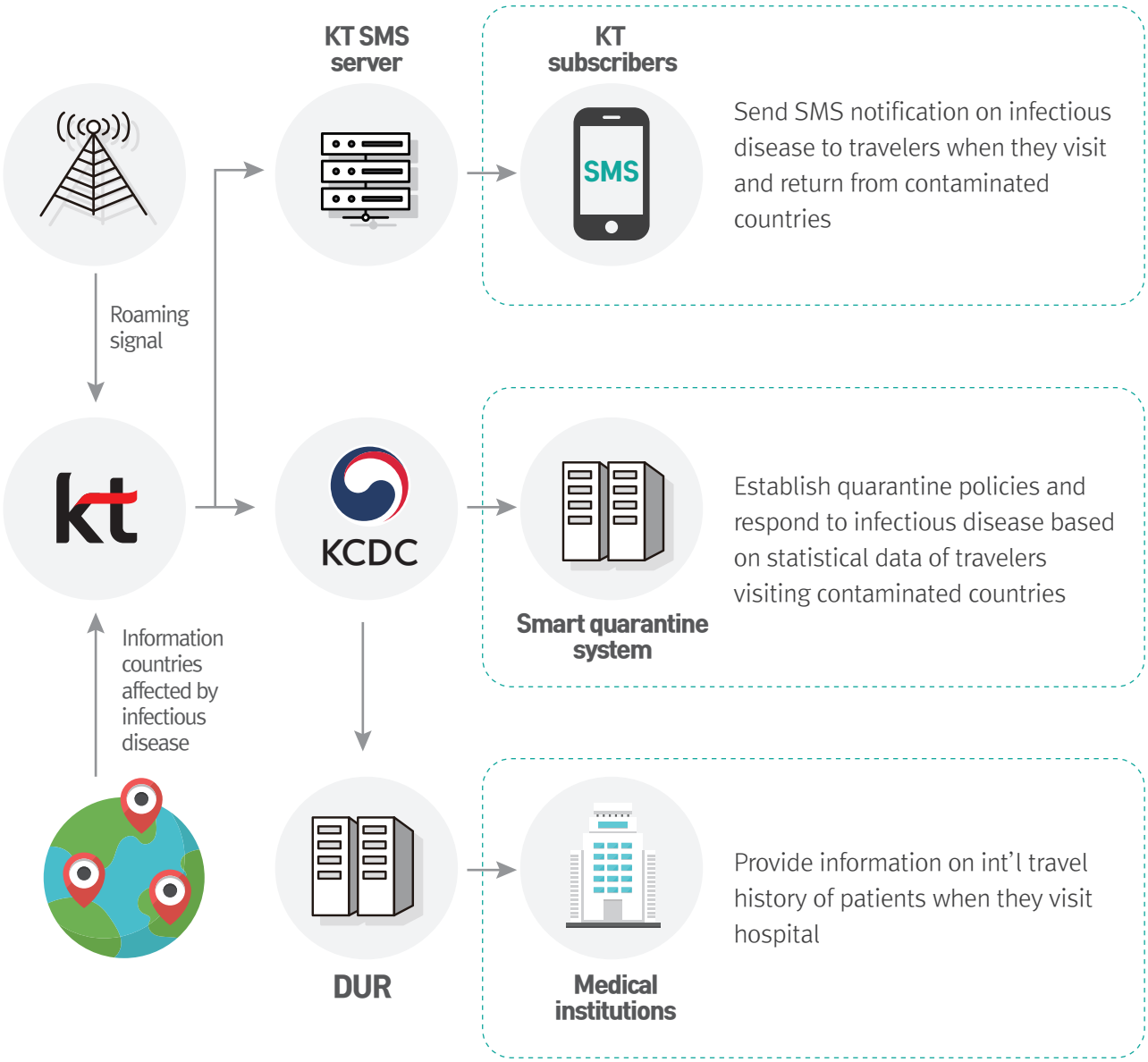
04 System Configuration

1. Service Concept (Process)

Based on the roaming data received from overseas telecom companies, KT identifies subscribers who visited contaminated areas, combines the data with the information provided by the government on countries affected by infectious diseases to verify their visits to such countries. KT sends mobile text alerts to those visiting contaminated countries, informing them about the infectious disease outbreak in their destinations and provides KCDC the information of the subscribers visiting the contaminated countries.

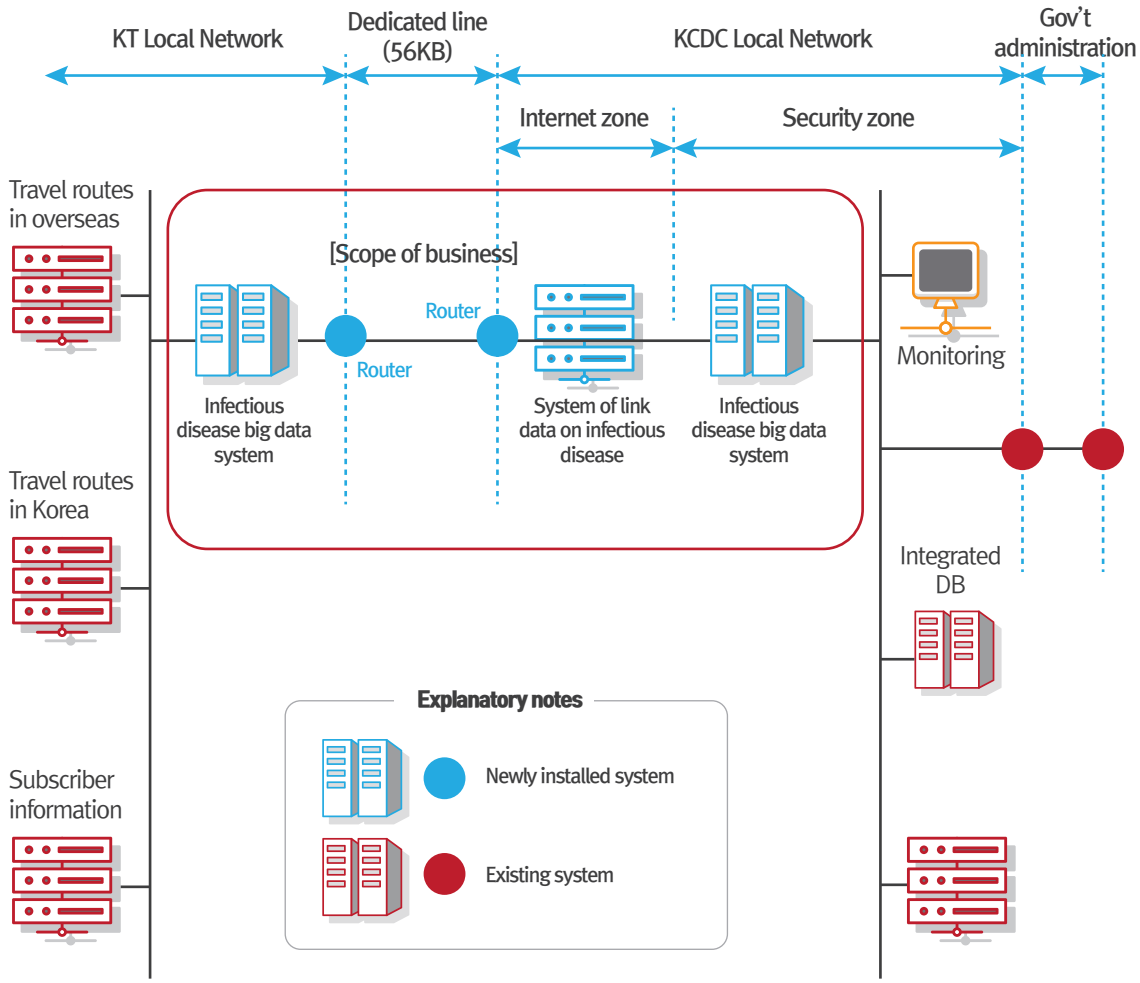
When subscribers return to Korea before the maximum disease incubation period is over after visiting a contaminated country, signals are sent to telecom companies informing their roaming is terminated. The same information is also sent to KCDC, which is then shared with medical institutions via DUR so they can check people visiting medical institutions have been to contaminated countries before.

Global Epidemic Prevention Platform (GEPP) for Digital Tracing



Developed by KT, KCDC, MSIT
For use by all domestic residents,
medical institutions, KCDC and local governments

2. Hardware, Software Structure



KT has already established a system that identifies movement routes of subscribers in Korea and overseas. As it has to use detailed travel routes of all subscribes, it extracts data through a Hadoop-based big data analysis system and sends the extracted data to KCDC. Korea also has a system that works based on the e-government framework so such data can be used.

Global Epidemic Prevention Platform (GEPP) for Digital Tracing

05 Main Features

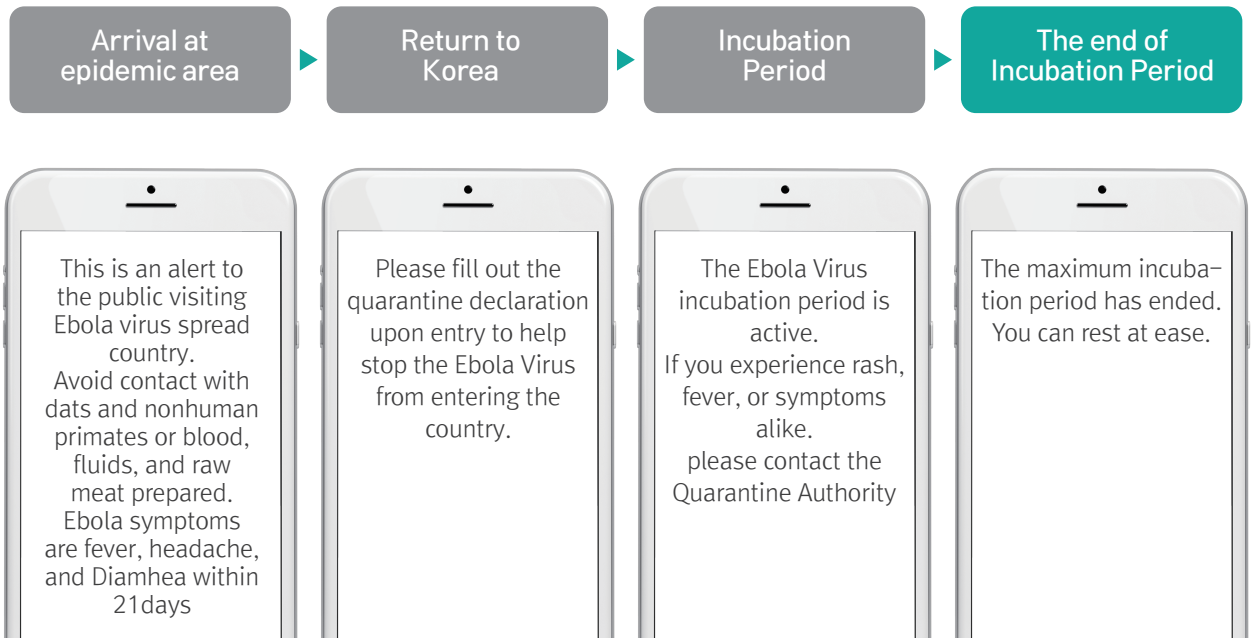
GEPP uses mobile communication data to send text message alerts to people on potential risk of infection, and informs medical institutions through DUR whether an inpatient had visited contaminated countries. GEPP also allows digital tracing of people confirmed or suspected of COVID-19 infection.

1. Mobile text alerts on potential virus contact

People who are identified, using mobile communication data, as having visited to contaminated areas of home and abroad receive mobile text message alerts on potential risks of infection during the incubation period. They are informed about the disease and what to do when symptoms develop.

※ Cell Broadcasting System (CBS) is used to provide current location-based information.

I Infectious Disease Text Alerts by Situation



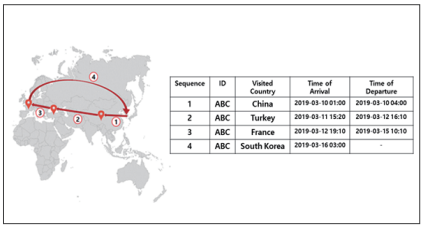
Developed by KT, KCDC, MSIT
For use by all domestic residents,
medical institutions, KCDC and local governments

2. Notification on inpatients` visit to contaminated areas

Medical institutions can find inpatients' travel history to contaminated areas via DUR.

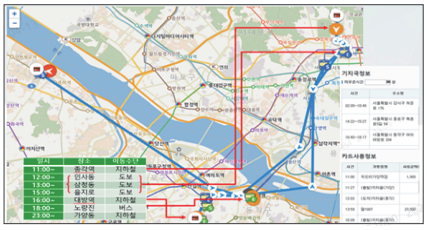
3. Digital Tracing of confirmed and suspected patients based on travel routes

KCDC can check local and international travel routes of patients confirmed of disease infection using their mobile data use. For infection hotspots, KCDC checks information of people who stayed there for a certain period of time and uses the information for quarantine activities.

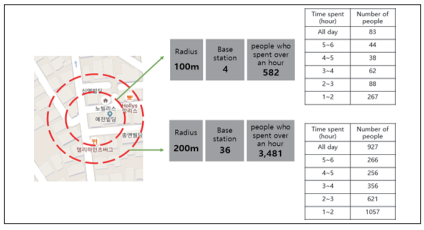


Sequence	ID	Visited Country	Time of Arrival	Time of Departure
1	ABC	China	2019-03-10 01:00	2019-03-10 04:00
2	ABC	Turkey	2019-03-11 15:20	2019-03-12 16:10
3	ABC	France	2019-03-12 19:10	2019-03-15 10:10
4	ABC	South Korea	2019-03-16 03:00	-

▲ Tracing international travel routes



▲ Tracing local travel routes



▲ Hotspot contact tracing

06 Contact information

Institution	Person In charege	email
KT (SDGs Planning Team)	Lee Jong-il	theos@kt.com
KT (AI Initiative Team)	Ko Hoon-seok	hunseok.ko@kt.com

ICT utillizing cases tackling against **COVID-19** pandemic of Korea

Patient and Contact Management Stage

Self-Quarantine Safety Protection App

01 Introduction

Self-Quarantine Safety Protection App was developed to effectively support and manage the monitoring of people under self-quarantine in the efforts of containing the spread of COVID-19. This app has been developed in two types to support both the citizens under self-quarantine (as users) and assigned government case officers (as managers), and it operates in a one-to-one manner.

A user conducts self-health check twice a day through the app, and the results are automatically delivered to the assigned case officer. Also, the information about the user's location is managed based on the Geographic Information System (GIS). If the user leaves the quarantine area, a notification is sent to the user and the assigned case officer at the same time, allowing the officer to respond and handle the situation immediately.

02 Background and Purpose

Initially, the government had been managing people under self-quarantine for COVID-19 mainly through the Central Disease Control Headquarters in the Korea Centers for Disease Control and Prevention (KCDC) and each local government's public health centers.

However, when the number of confirmed patients exceeded 600 (as of February 12, 2012), the supervision was transferred to the Ministry of the Interior and Safety and local governments to better manage the people under self-quarantine.

For more smooth monitoring, the Ministry of the Interior and Safety has come to develop and implement the Self-Quarantine Safety Protection App that considers both the citizens as users and assigned case officers as managers.

03 Pre-requisite

The Self-Quarantine Safety Protection App is operated on a server to protect personal information and strengthen security. The server is operated in the national data center to prevent leaking of personal information. It is also necessary to stabilize GPS information on different mobile brands and operating systems.

Managed by Ministry of the Interior and Safety
For use by People under self-quarantine (users)
and assigned case officers (managers)

Type	Requirement
Operation Environment (HW, SW)	▪ Composition of WAS, WEB, DB, Push Server * Managed and operated by the National Information Resources Services
Required information	▪ Information of people under self-quarantine, quarantine area, location and status of self-quarantined subjects, assigned government case officers, and KCDC managers for COVID-19

04 System Configuration

1. Service Concept

This smart phone app provides health check information and the results, health status monitoring service and location-based service to manage cases if any patient leaves the quarantine area.

Self-Quarantine Safety Protection App Service

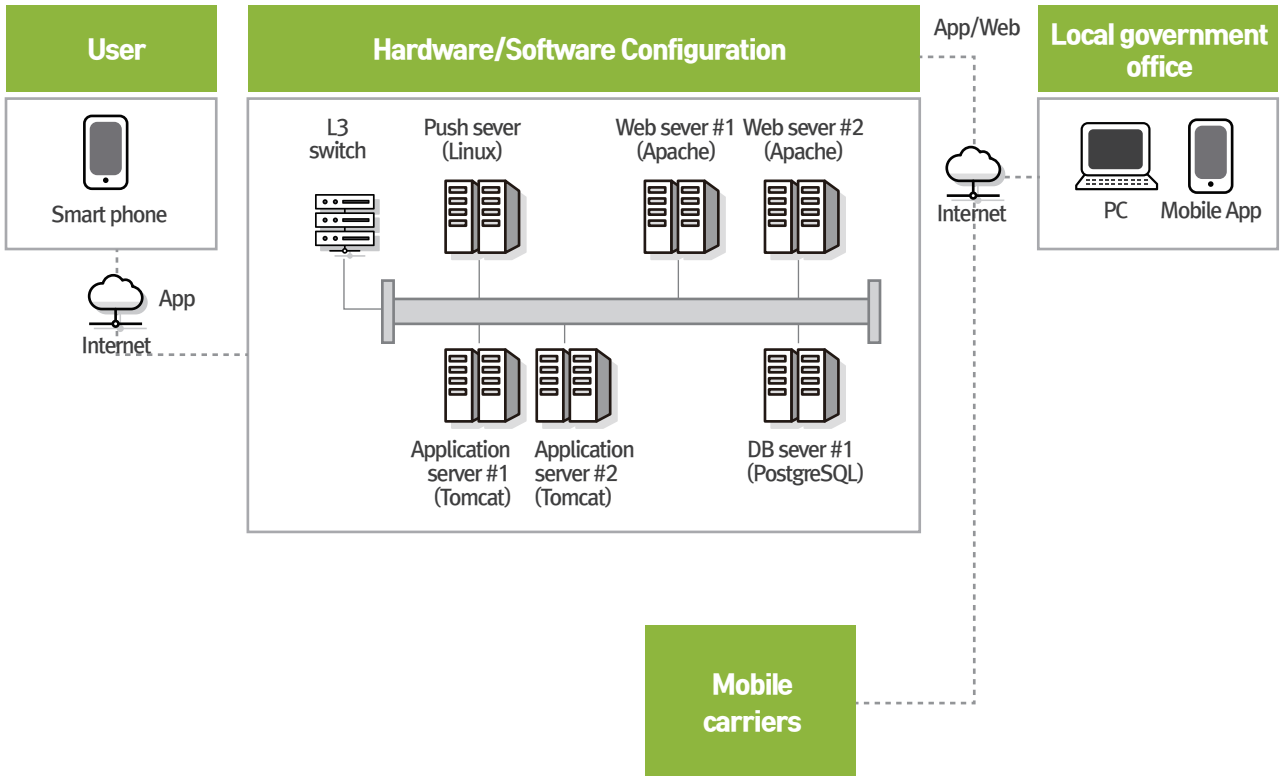
Self-Quarantine Safety Protection App

2. Hardware, Software Structure

The Self-Quarantine Safety Protection App is a server-based app service consisting of dual WEB servers, WAS servers, and a distribution server that distributes data and the app. It is also composed of software like Apache, Tomcat and PostgresDB.

It is connected to the mobile carriers' LBS platform to locate users' smartphones. It also maintains compatibility with most operating systems, like Android and iOS, and with most global brands. Recently, the app added a function that checks user location by floor in a building for all-time management of patients' stay within the quarantine area.

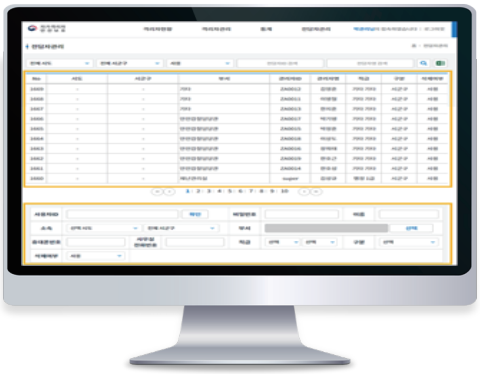
Operation Environment and Hardware/Software Configuration



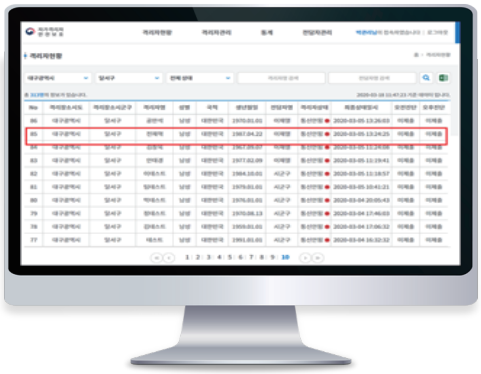
Managed by Ministry of the Interior and Safety
For use by People under self-quarantine (users)
and assigned case officers (managers)

3. Administrative features for assigned case officers

Assigned case officers manage the people under self-quarantine by checking their personal information, location, and self-health check status collected through the web in real-time. The Self-Quarantine Safety Protection Web consists of menus like self-quarantine subject status that shows the self-health check status and result submission, assigned case officer status that shows IDs and departments of the assigned officers, quarantine subject management, and statistics.



▲ Assigned Case Officer Status Web Page



▲ Self-Quarantine Subject Status Web Page

05 Main Features

The Self-Quarantine Safety Protection App includes the registration function for entering the personal information and location of the users under self-quarantine and the self-health check function that screens symptoms of COVID-19. It also provides a location-based notification function that detects and notifies if a self-quarantined subject leaves the quarantine area, along with more additional functions such as safety guidelines and emergency contacts. The app currently supports three languages (Korean, Chinese and English).

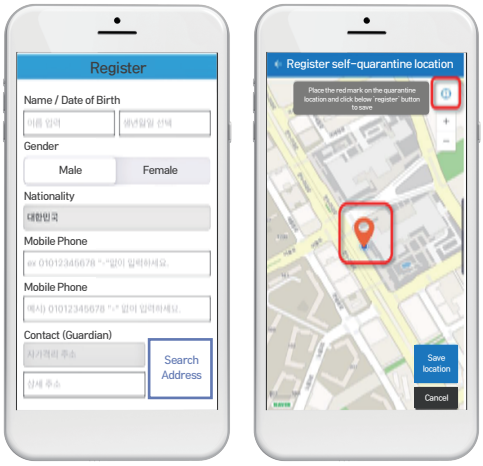
Self-Quarantine Safety Protection App

1. Registration of personal information and location

If a person is classified as a self-quarantined subject, he/she is required to enter personal information such as name, date of birth, gender, nationality, and mobile phone number and register the address of quarantine area (location).

Registering Personal Information ▶

Registering Quarantine Location ▶▶



2. Self-Health Check

People under self-quarantine go through self-health check twice a day (morning and afternoon) concentrating on four symptoms - fever (37.5℃ or higher), cough, sore throat and difficult breathing. The results are automatically delivered to the assigned case officers.

When checking fever, in particular, the self-quarantined subject must check and enter the temperature to submit the results. If a user does not follow self-health check, the assigned case officer notifies and requests the user within six hours. If a user develops any symptom, the case officer sends the health status and personal information to the local public health center.

The app also provides safety and protection guidelines for people under self-quarantine and their family members or partners living together, 1339 (KCDC call center for COVID-19) and contact information of the assigned case officers.

▲ Self-Health Check

Managed by Ministry of the Interior and Safety
For use by People under self-quarantine (users)
and assigned case officers (managers)

3. Location-based Notification and More

The app for self-quarantine subjects and the web for assigned case officers send automatic notifications if a subject leaves the registered quarantine area or blocks the Global Positioning System (GPS).

Location-based Notification ▶

Additional Features ▶▶

06 Contact information

Institution	Person In charege	email
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Winitech	Young-tae Heo	darum2002@hanmail.net

Negative Pressure Isolation Room Information System (NPIRI)

01 Introduction

The negative pressure isolation room* operational status data management system (https://www.hurb.or.kr/) was developed to promptly and efficiently allocate severe COVID-19 patients to the negative pressure rooms. A negative pressure isolation room is an isolation chamber with ventilator, air-conditioning system, open space corridor that generate and maintain negative pressure to prevent airborne infection.

The system allows monitoring on the status of negative pressure isolation room operation at medical institutions across the country including ones designated by the Central Disaster Management Headquarters for Novel Coronavirus Infection and users can find the status of use, COVID-19 patients administered to hospitals, patients status by severity, and data on equipment and medical workers at a glance.

The system provides visualized data on the use of negative pressure isolation rooms by COVID-19 patients each day, allowing the government to monitor and manage such negative pressure units effectively.

02 Background and Purpose

As COVID-19 spreads to local communities throughout the nation since the outbreak, the government needed to identify nationwide status on the use of negative pressure isolation rooms as they are necessary to treat patients confirmed with the disease.

Therefore, the government began to monitor medical institutions with negative pressure isolation rooms that are registered to Health Insurance Review and Assessment Service (HIRA) in accordance with National Health Insurance Act by making phone calls each day. There was a need for a system to allocate severe COVID-19 patients to hospitals with proper treatment equipment in time was necessary for the government to carry out its duty promptly and efficiently. According to the need, HIRA developed the negative pressure isolation room operational status data management system to monitor all negative pressure isolation rooms nationwide in real-time. Through this system, the government supports proper allocation of severe COVID-19 patients so that they can promptly receive the necessary treatment.

Also, by allowing the local governments to check the operation status of negative pressure isolation rooms in medical institutions in its region through the system, it supports cooperation between the government and the local governments.

Managed by
Health Insurance Review and Assessment Service
For use by medical institutions with
negative pressure units

03 Pre-requisite

The negative pressure isolation room operational status data management system utilizes data collected through the integrated medical healthcare resource report portal, where medical institutions report their medical resources. Each institution reports details of hospital beds and its availability, status of the patients, and information of the person in charge and it is shared with MOHW, 17 cities and provinces, and the National Medical Center (NMC).

Category	Requirement
Data	▪ negative pressure isolation room status in medical institutions, status of patients, status of treatment equipment and medical personnel, information of person in charge of hospital ward allocation
System	▪ integrated medical healthcare resource report portal

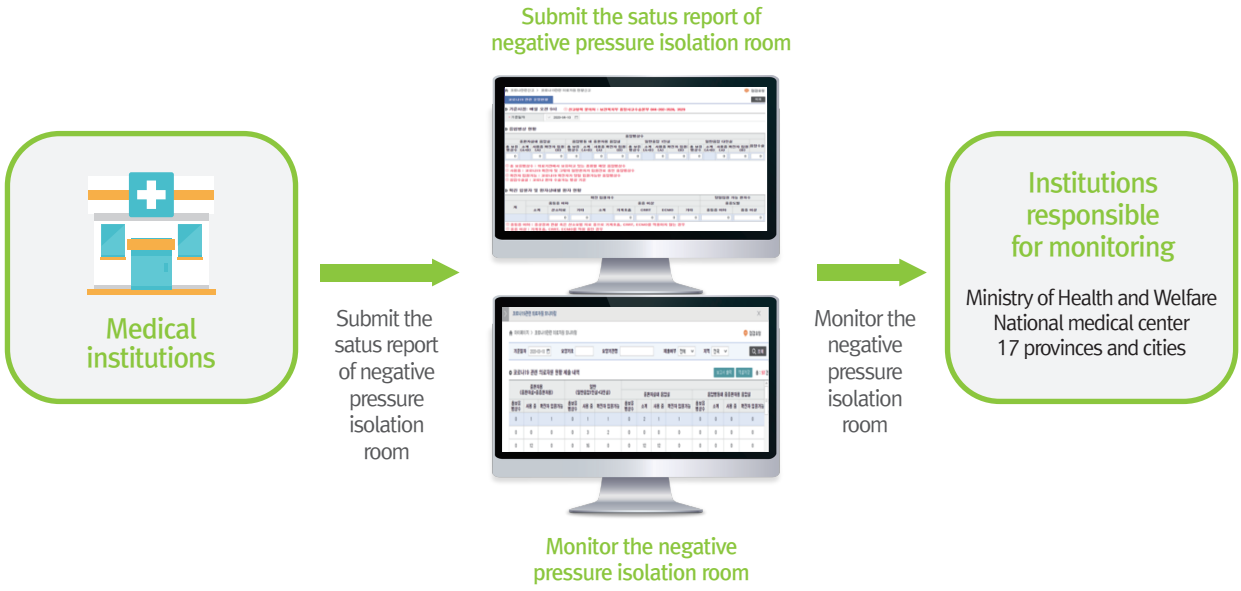
04 System Configuration

1. System Process

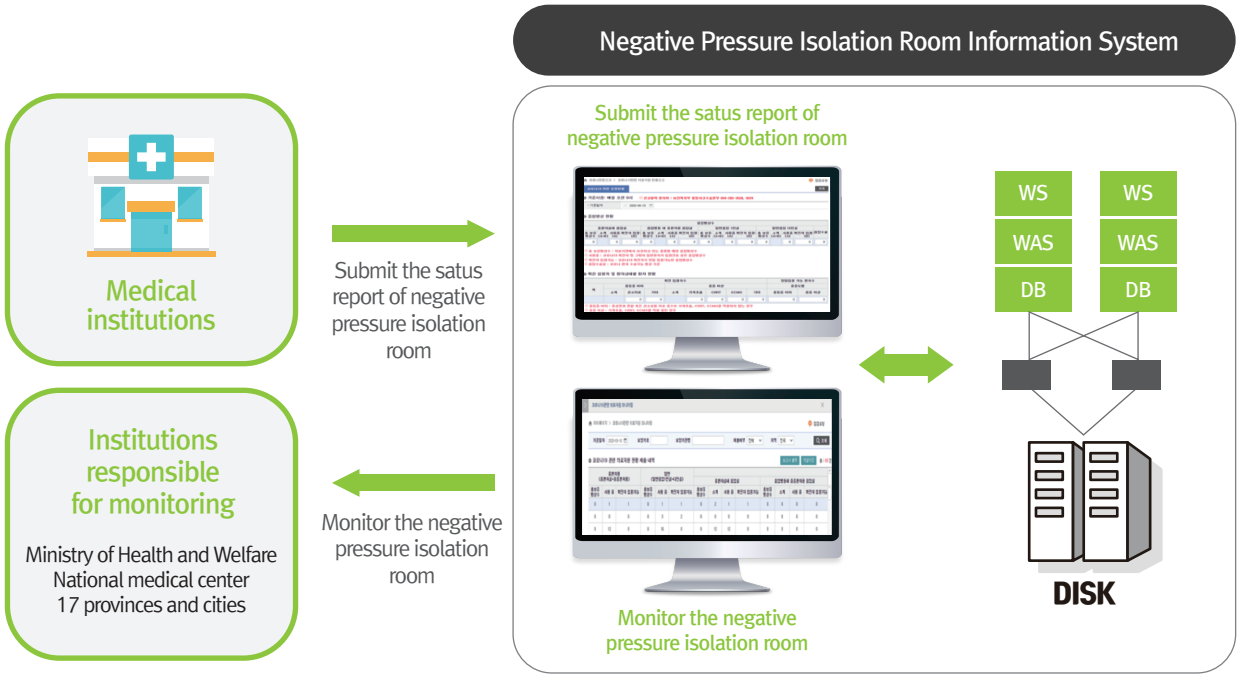
The system allows medical institutions to submit data on the operational status of negative pressure isolation rooms, status of administered COVID-19 patients and severity of their symptoms, equipment and personnel status, and person in charge of hospital ward allocation. Monitoring institutions such as MOHW and NMC check the submitted data in real-time so that COVID-19 patients can be allocated to hospitals with required treatment facilities.

Negative Pressure Isolation Room Information System (NPIRI)

I Negative Pressure Isolation Room Information System Process



2. Hardware/Software Structure



Managed by
Health Insurance Review and Assessment Service
For use by medical institutions with
negative pressure units

05 Main Features

The system provides information on the operational status of negative pressure isolation rooms, administered COVID-19 patients by severity, medical equipment and personnel status, persons in charge of patient administration and allocation of hospital beds of each medical institution across the country. Such information enables prompt allocation of hospital beds which are essential in providing severe COVID-19 patients with medical treatment they need.

1. Submission of negative pressure room operational status

With this function, medical institutions can submit data on their negative pressure isolation room operational status, administered COVID-19 patients and severity of symptoms, medical equipment and personnel status, persons in charge of administration and hospital bed allocation to the system.

The list of information to be submitted includes 1) total number of beds by unit, the number of beds taken, the number of beds available, 2) patient's health conditions by severity, number of equipment being used by confirmed patients, daily number of patients that can be hospitalized on that day, 3) availability of other medical equipment such as mechanical ventilators, ECMO, etc., number of persons in related department including physicians specializing in infectious disease and etc., 4) contact information of persons in charge of hospitalization and allocation.

2. Monitoring of negative pressure room operational status

The system supports monitoring function that helps users identify operational status of negative pressure isolation rooms in medical institutions by region and category and they can also download and export such information in form of a report to keep up with daily operational status.

06 Contact information

Institution	Person In charege	email
HIRA(Health Insurance Review & Assessment Service)	Kim Ji-hong	army1002@hira.or.kr

Patient Management Information System (PMI)

01 Introduction

The Patient Management Information System is designed to systematically manage COVID-19 patients to prevent further spread and check their real-time status. Using this system, the Korea Centers for Disease Control and Prevention (KCDC), local quarantine task forces of 17 cities and provinces, public health centers, community treatment centers and medical institutions can manage information on allocating of confirmed patients to monitoring organizations, patient conditions, hospitalization or transfer, isolation or release, and deaths.

In addition, each medical institution can use the system to retrieve the current availability status of negative pressure rooms and facilities to assign COVID-19 confirmed patients accordingly and to grasp real-time patient update from each local government and quarantine institution.

02 Background and Purpose

The COVID-19's nationwide spread and the rapidly increasing number of confirmed cases in Korea raised the need for systematic classification and treatment of confirmed patients. Errors were often found during the process of collecting patient information from each institution and therefore, an integrated framework for patient information management was also needed. Against this backdrop, the Health Insurance Review and Assessment Service (HIRA) has developed an information system for checking travel routes and treatment status of patients in each city and province.

The purpose of this system is to integrate patient information that are scattered around different organizations, manage the information as a whole and immediately treat or isolate confirmed patients based on their severity level (no symptom, mild/ moderate/ severe/ extremely severe cases).

03 Pre-requisite

Type	Requirement
System Interconnection	▪ Information system on negative pressure room operation, portal service for nursing care institutions
Required Data	▪ Confirmed patient registration data, patient allocation data, traceability data and statistics

Managed by
Health Insurance Review and Assessment Service

For use by Administrative institutions, community treatment centers, medical institutions

04 System Configuration

1. System Process

Patient Status		Data Entry Subject	Data Entered
System Interconnection		❶ Interconnection with KCDC's Integrated Disease and Health Management System	▪ Patient number ▪ Resident registration number ▪ Local government office in charge
▼			
Waiting		❷ Local quarantine task forces	▪ **Severity classification:** no symptom, mild / moderate /severe / extremely severe cases ▪ **Allocation result:** medical institutions, community treatment centers or self-quarantine
▼			
Isolated or released	Hospitalized	❸ Medical institutions	▪ **Status:** hospitalization, transfer, release from isolation, death ▪ **Severity classification:** no symptom, mild / moderate /severe / extremely severe cases ▪ **Treatment status:** under general or oxygen treatment, oxygen therapy, artificial respiration
	Admitted to Community Treatment Center	❸ Community treatment centers	▪ **Status:** entrance, transfer, release from isolation
	Self-quarantined	❸ public health centers	▪ **Status:** self-quarantine, transfer, release from isolation

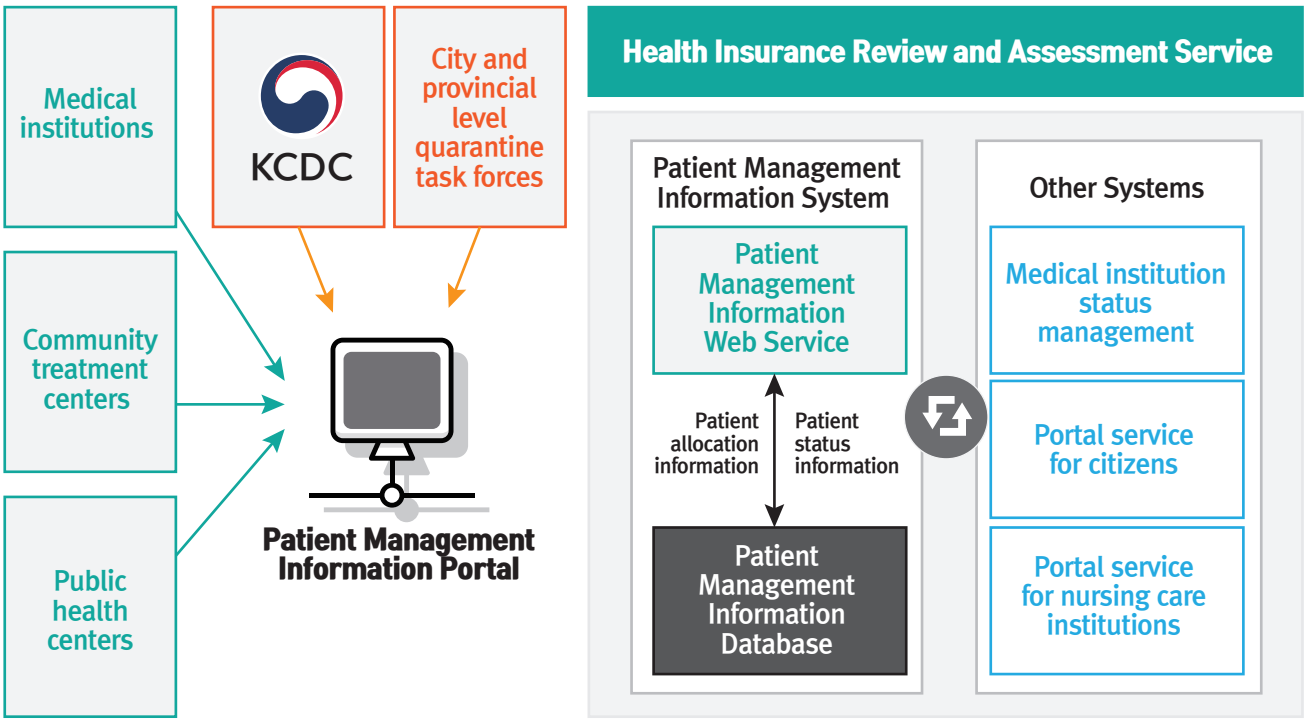
The KCDC registers confirmed patients' information into the Patient Management Information System at around 9 AM every day and allocates them to the cities and provinces of their residence. The local quarantine task force at each city or provincial level then checks availability of negative pressure rooms and facilities and assigns confirmed patients based on their conditions (to medical institutions, community treatment centers or public health centers). Each of these institutions enter patient status data – severity and treatment progress, transfer, release from isolation, and death.

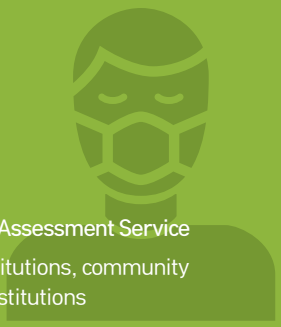
Patient Management Information System (PMI)

2. Hardware and Software Configuration

Based on the roaming data received from overseas telecom companies, KT identifies subscribers who visited contaminated areas, combines the data with the information provided by the government on countries affected by infectious diseases to verify their visits to such countries. KT sends mobile text alerts to those visiting contaminated countries, informing them about the infectious disease outbreak in their destinations and provides KCDC the information of the subscribers visiting the contaminated countries.

When subscribers return to Korea before the maximum disease incubation period is over after visiting a contaminated country, signals are sent to telecom companies informing their roaming is terminated. The same information is also sent to KCDC, which is then shared with medical institutions via DUR so they can check people visiting medical institutions have been to contaminated countries before.





Managed by
Health Insurance Review and Assessment Service

For use by Administrative institutions, community treatment centers, medical institutions

05 Main Features

This system helps each city and provincial government check the status and availability of negative pressure rooms and facilities in quarantine institutions and allocate patients accordingly based on their conditions. It enables quarantine institutions to manage patient information such as severity, treatment progress, and release from isolation, helping them check the patient status on a real-time basis. If patients are to be transferred to different institutions or confirmed of COVID-19 infection again after release from isolation, the system supports timely management and treatment with their isolation history information.

1. Central Disaster Management Headquarters

The Central Disaster Management Headquarters keeps the patient register on the system, which provides patients' travel routes and status as well as real-time statistics on the total number of confirmed cases, released cases and deaths by each city or province, town or district, and quarantine institution.

2. Korea Centers for Disease Control & Prevention

KCDC registers confirmed patients on the system's registration page on a real-time basis. Bulk registration of patient data can be made using Excel. The system also provides the patient register and statistics of each city or province, town or district, and quarantine institution.

3. Local Quarantine Task Forces

The system provides local quarantine task forces in city and provincial governments the page for assigning allocated patients to quarantine institutions, and the page for registering patients in community treatment centers as they are managed by local governments. In addition, it provides the page where local quarantine task forces can check the type and availability of negative pressure rooms and facilities in each medical institution for faster allocation of confirmed patients. Moreover, it also provides the local patient register page for better management of patients in unavoidable situations like closure of quarantine institutions. On this page, they can enter patient information such as transfer, release from isolation or death. The system also provides major statistics of each local quarantine institution.

Patient Management Information System (PMI)

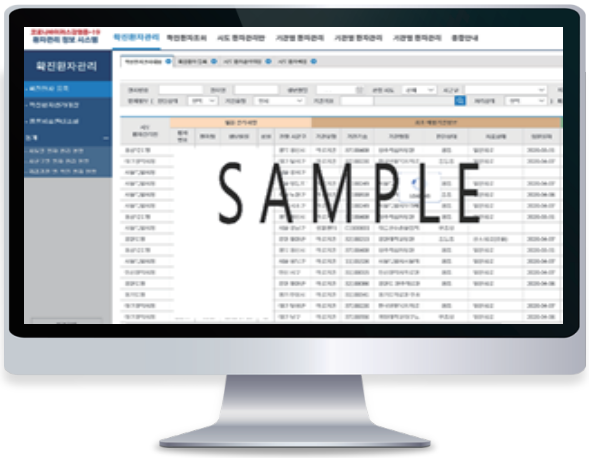
4. Quarantine Institutions (including medical institutions)

The system provides the page for managing patients' hospitalization, transfer, isolation and release information, as well as their severity and treatment progress. It also provides the page to any institution where medical workers are assigned, such as the community treatment centers.

In particular, medical institutions are also managing patients' treatment progress (general treatment, oxygen treatment, high flow oxygen therapy, mechanical ventilation) in detail. When a confirmed patient gets better, he/she must be tested negative on two PCR tests (gene amplification tests) before release from isolation, and such information is also managed through the system.

Pages of Patient Management Information System

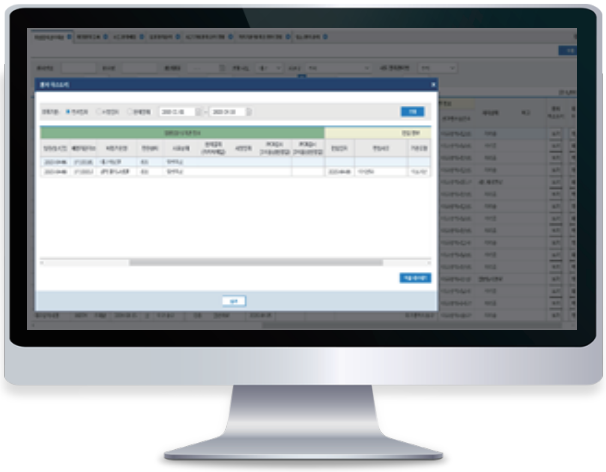
▲ System Access



▲ Patient Management

Managed by
Health Insurance Review and Assessment Service

For use by Administrative institutions, community treatment centers, medical institutions



▲ Patient History Management

▲ Statistics

06 Contact information

Institution	Person In charege	email
HIRA(Health Insurance Review & Assessment Service)	Kyu-sub Song	mihosubi@hira.or.kr

Clova CareCall

01 Introduction

Clova CareCall, developed by a Korean ICT company Naver, is an AI solution for telephone counseling and automatic response to health inquiries via the company's AI platform called Clova. Previously, the public health centers made calls to those under active monitoring in order to check their daily health condition. Now, this AI platform monitors them by making automatic calls twice a day (at 9am and 3pm) to check whether they have developed any symptoms and their health state is directly reported to the public officials of local governments.

Naver provides technical support for the operation of Clova CareCall and Sejong Telecom, a key telecom service provider, pays communication expenses. Clova CareCall is currently used in Seongnam City, Gyeonggi Province on a pilot basis.

02 Background and Purpose

In March 2020, when the COVID-19 was in full swing, the Ministry of the Interior and Safety (MOIS) developed the 'self-quarantine safety protection app' for those under self-isolation and made every effort to stop the spread of COVID-19. As for those under active monitoring, however, employees at public health centers had to make phone calls manually to check their health condition. Therefore, Naver introduced the AI CareCall service for the first time in Korea in cooperation with Seongnam city, where its headquarter is located, with the aim of contributing to local community with its advanced technologies (Mar 9, 2020).

Also, Naver applied the 'face mask inventory information' function to its Smart Call service since April 7, 2020 in order to reduce much workload in pharmacies that were busy responding to customers regarding COVID-19. When a customer asks Smart Call for face mask inventory, Smart Call informs the real-time mask inventory based on pharmacy information registered on Naver's 'Smart Place'.

Developed by Naver
For use by all Koreans and foreigners

03 Pre-requisite

Database of monitoring targets is needed to operate the Clova CareCall service. Based on the data, Clova Carecall, which is applied with AI technology such as voice recognition, makes an auto-call to the target via wired, wireless, and Internet networks, and all calls are stored in the cloud.

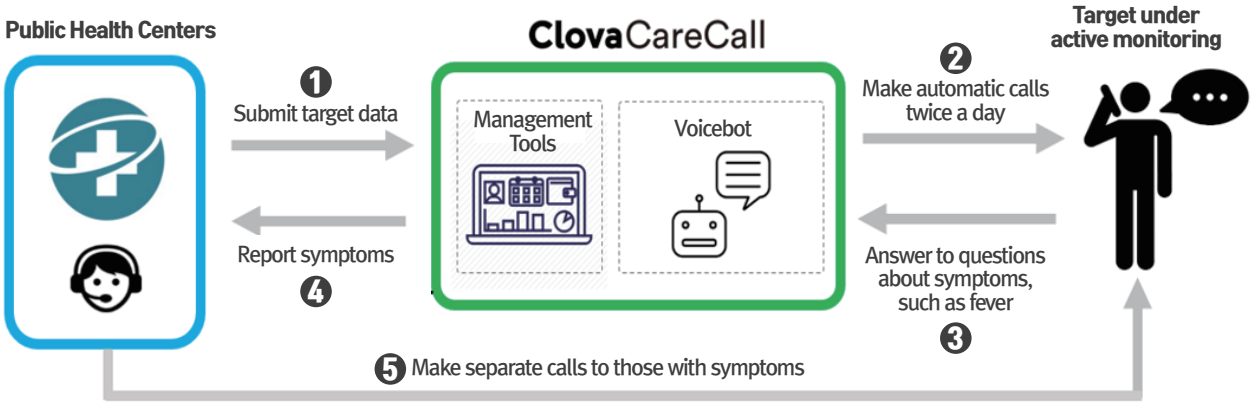
Type	Requirement
Used Technology	▪ AI (Speech Recognition, Natural Language Processing, Speech Synthesis, Text Analysis, etc.) ▪ Cloud

04 System Configuration

1. System Process

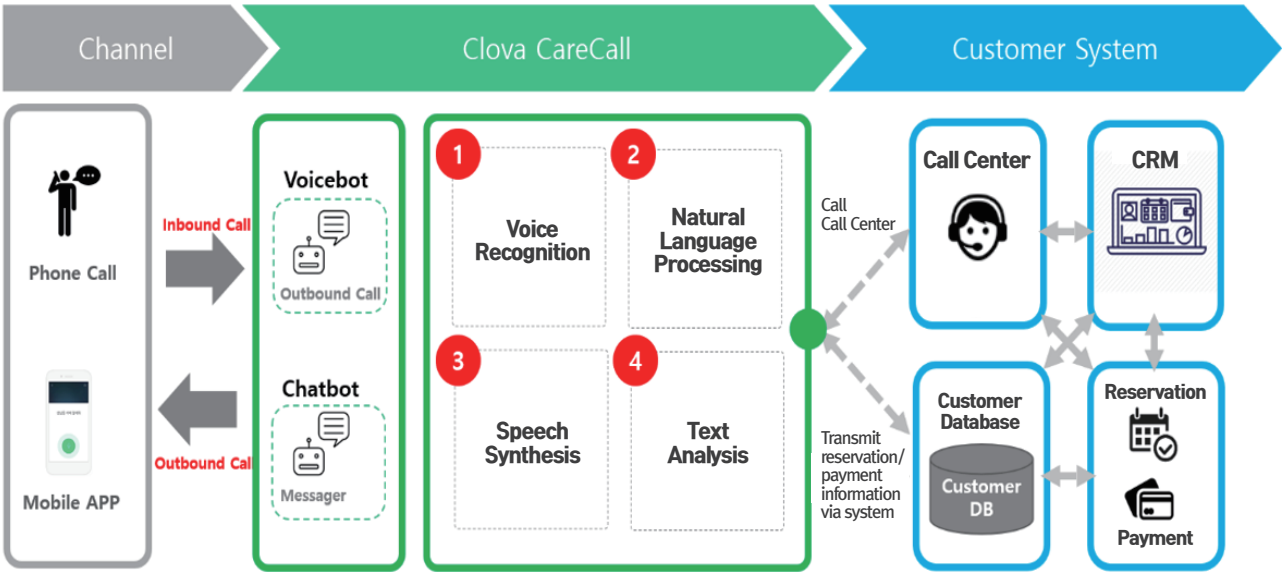
Clova CareCall automatically calls those under active monitoring for potential infection of COVID-19 twice a day to check their health condition and whether they have any symptoms related to the disease.

First, the public health centers submit data on those under active monitoring to Clova CareCall system and the system makes phone calls to them and check their health state based on automated scenarios. The results are reported to the public health centers so they can take measures deemed necessary.



Clova CareCall

2. Software Structure



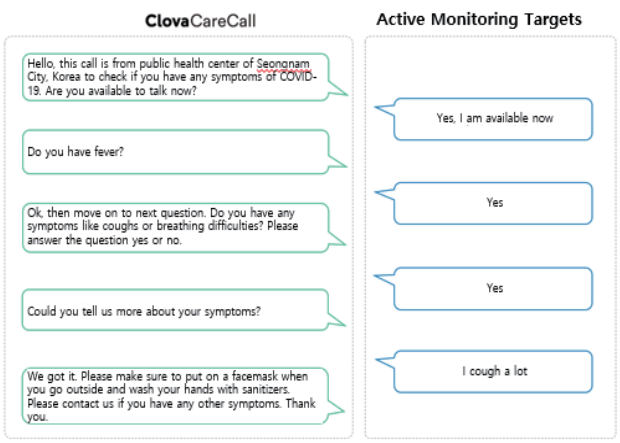
05 Main Features

Clova CareCall, the AI based service, is designed to check fever, chills, respiratory symptoms of those under active monitoring by auto-call twice a day (at 9am and 3pm). The response results are sent to the public officials in charge at the public health center in Seongnam City via email and they take necessary actions upon detection of any symptoms.

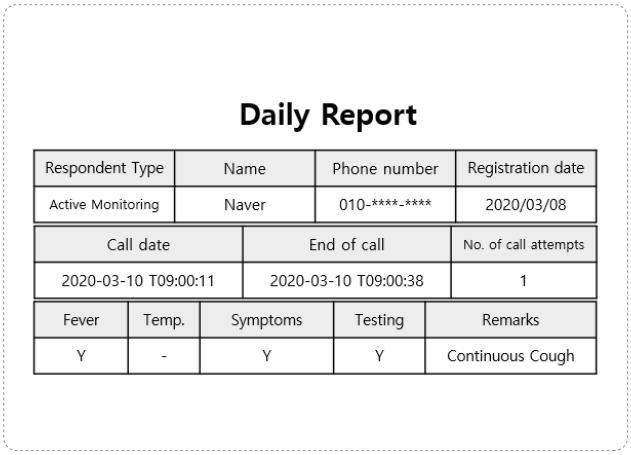
If those under active monitoring do not answer the call, two more calls are made (in 10-minute interval). If they fail to receive the call three times in a row, such result is reported to the public officials via email.

The Seongnam City government adopted this service for the first time among local governments on Mar 9, 2020. Clova CareCall service was provided to 5 people who were included in the list of active monitoring on that day. Among them, 4 people replied to the call and one person did not respond, so the result was sent to the public health center.

Developed by Naver
For use by all Koreans and foreigners



Clova CareCall COVID-19
Dialogue scenario for active monitoring target



Daily Report

Respondent Type	Name	Phone number	Registration date
Active Monitoring	Naver	010-****-****	2020/03/08

Call date	End of call	No. of call attempts
2020-03-10 T09:00:11	2020-03-10 T09:00:38	1

Fever	Temp.	Symptoms	Testing	Remarks
Y	-	Y	Y	Continuous Cough

Clova CareCall daily report

06 Contact information

Institution	Person In charege	email
NAVER	Sanghoon OK	dl_clova_partnership@navercorp.com

Hancom AI Check 25

01 Introduction

Hancom AI Check 25 is an outbound call system that uses AI voice recognition technology to check the health state of persons under monitoring (including those under self-quarantine or active monitoring), who are exposed to COVID-19. It is an unmanned call center service for outbound call services that gathers necessary data and provides information through automated, AI-powered calls instead of previous man-to-man telephone counseling.

Korea's leading software provider Hancom Inc. (Hancom Group) developed Hancom AI Check 25 to help efficient monitoring of these people, as their number is rapidly on the rise along with the spread of COVID-19, Hancom Group has been providing the system free of charge to local governments. Starting from Jeonju City in Jeonbuk Province (on Mar 20, 2020), the system is now used in Daegu, Seoul (25 districts)*, Gyeonggi Province (31 cities and districts), and the company is discussing provision of the system to Gyeongbuk Province (23 cities and districts) and Sejong City.

* Gangnam District in Seoul added features asking whether respondents are from foreign countries and if they had been tested, as the number of confirmed cases is increasing among entrants from foreign countries. Anyang City in Gyeonggi Province also added features for post-management of those who are released from isolation. Likewise, Hancom AI check 25 enables additional services tailored to different situations of local governments.

02 Background and Purpose

The number of persons under self-quarantine and those under active monitoring, as well as the ones released from self-quarantine but still under monitoring has increased significantly along with the rapid spread of COVID-19 since February 2020. As the number of people who need to undergo monitoring was skyrocketing, it was difficult for local governments to literally respond to the situation.

Against this background, Hancom Group has developed Hancom AI check 25 by integrating its AI call center technology and know-how, which its partner, iFLYTEK in China, had operated to deal with the COVID-19 situation in China.

Hancom AI Check 25 allows monitoring of a large number of people increasing exponentially, as it can make a wide range of simultaneous calls.

Developed by Hancom Group
For use by People under self-quarantine and active monitoring (user), government officials in departments assigned to monitoring, etc. (administrator)

Another benefit of the system is that it reaches those who need monitoring but in blind spots - who did not install self-quarantine or self-health check apps distributed by the government, who failed to be tested for COVID-19, 2G phone users, and the elderly having difficulties using smartphones. The system enables active monitoring of these people, filling the monitoring loopholes effectively.

The company provides Hancom AI check 25 platform to local governments of Jeonju, Daegu, Seoul, and others for free to help the administrators and public health centers reduce work overload in responding to the disaster with the continuing spread of COVID-19. In the meantime, Naver Business Platform (NBP) also provides its high-performance cloud infrastructure for free to support stable operation of the Hancom AI check 25.

03 Pre-requisite

When a local government sends requirements regarding target-based operation scenarios, estimated number of calls, and the preferred network environment to Hancom, the company configures the AI Call system by utilizing scenario production and AI technologies. The local government installs network connecting systems (like telecommunication network and switching network) to operate AI calls, and launches the service after connecting the database of monitoring subjects.

Type	Requirement
Used Technology	▪ Database on persons under self-quarantine and active monitoring
Network	▪ Wired/wireless internet telecommunication network ▪ Switching network (IP-PBX, SIP Server)
Technology	▪ AI (voice recognition (speech-to-text, STT), natural language processing (NLP), test-to-speech (TTS) etc.) ▪ Cloud

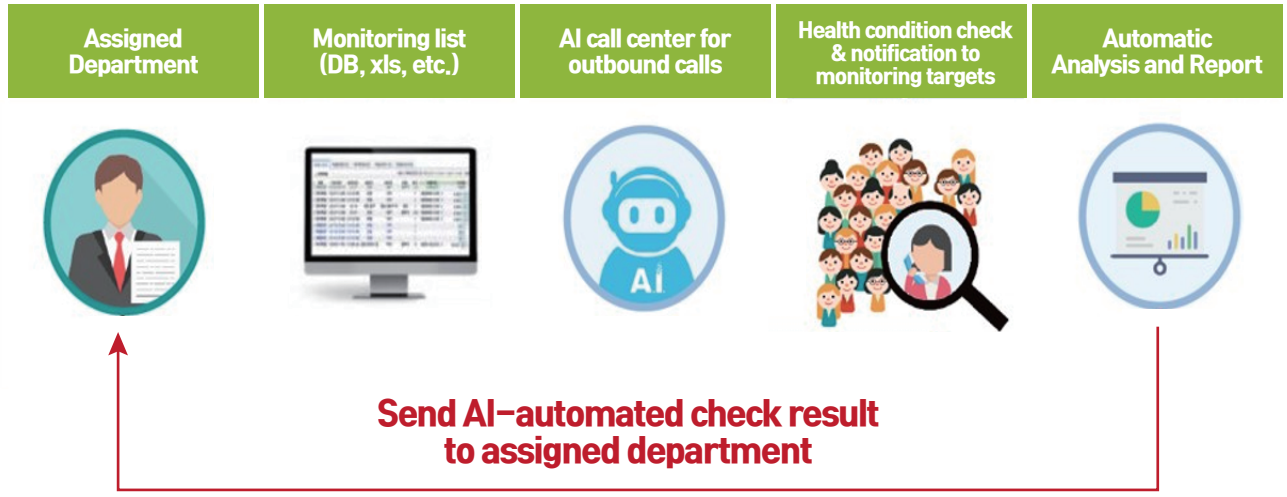
Hancom AI Check 25

04 System Configuration

1. System Process

Hancom AI Check 25 makes AI-driven automated calls to persons who are under monitoring (including those under self-quarantine) by a department of a local government (for example, Disaster Management Division of Daegu Metropolitan Government) assigned to the monitoring work. The calls check their health conditions, analyze data based on their responses, and report the result to the department. AI automatically monitors a large number of respondents, from which it screens those who need intensive monitoring, and reports the result to the department assigned so it can focus on close monitoring of the selected group. This way, the department can check the health conditions of monitoring targets at low-cost and high-efficiently and further improve work efficiency by concentrating on tailored approaches to different conditions of the targets.

Hancom AI Check 25 System Process



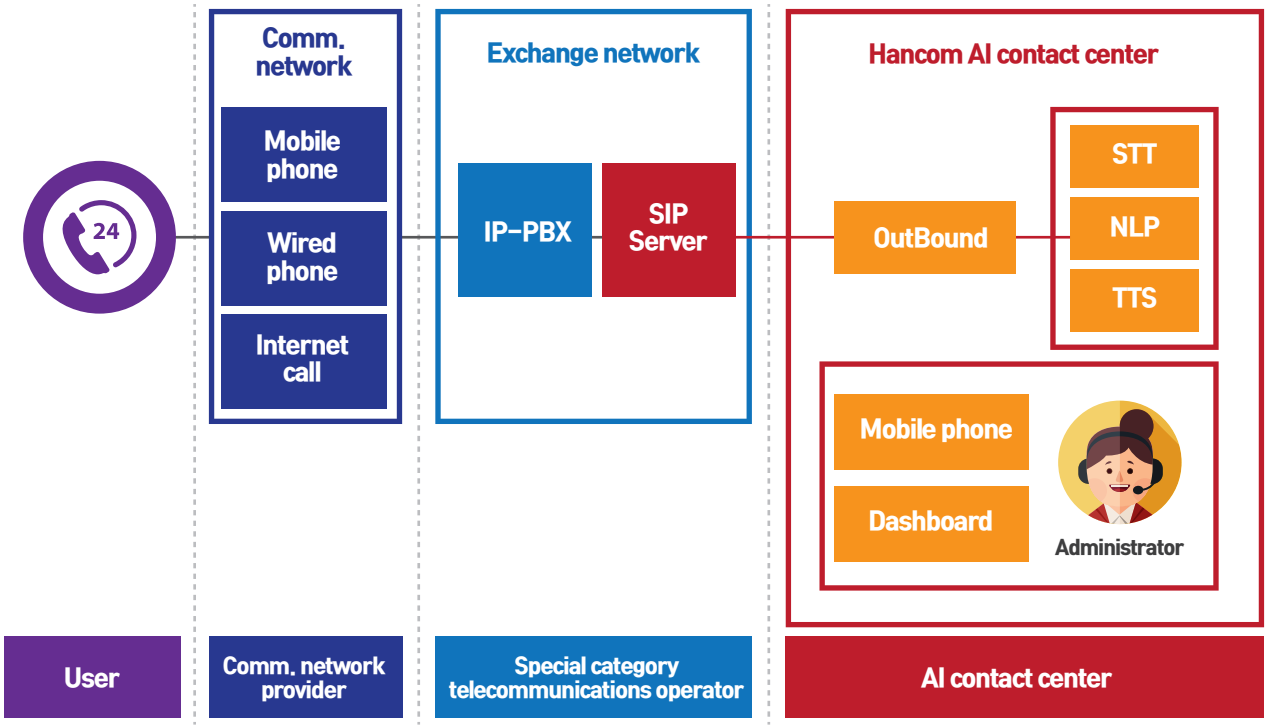
* Source: Hancom Group

Developed by Hancom Group
For use by People under self-quarantine and active monitoring (user), government officials in departments assigned to monitoring, etc. (administrator)

2. Hardware, Software Structure

When a user answers the call, such reception instantly integrates data computing and call processing via the internet-based exchange equipment (IP-PBX). The data is transmitted to AI Contact Center through SIP server and the system automatically recognizes and processes user's response by using voice recognition (Speech to text, STT) and natural language processing (NLP). Following dialogues are sent to the user through text to speech (TTS) technology based on the scenario and the conversation (indicating health conditions such as fever, cough, fatigue, etc.) is recorded on the dashboard.

Hancom AI Check 25 System Process



* Source: Hancom Group

Hancom AI Check 25

05 Main Features

Hancom AI Check 25 makes automated calls to persons under monitoring or self-quarantine to check their health conditions, analyzes the result and promptly sends it to designated government workers. Currently, this service is also offered in English and Chinese for foreign residents.

1. Automated Outbound Call

A voice-activated robot with AI makes an automated phone call to each person under monitoring for COVID-19 once a day for 2 weeks based on the preset scenario to check his/her health condition such as fever, cough, respiratory symptoms or chills. If a user answers that he/she has any symptom, the information is shared with the local public health center or other assigned organizations in real-time, and the person is connected to a professional consultant. Through such recognition and analysis technologies, the robot automatically screens and selects people who need active monitoring, sends their data to the department assigned to close monitoring. The AI call service also provides safety guidelines and more information on the disease. If a user refuses to receive consultation or fails to answer the call, such information is automatically analyzed and reported to the department assigned

I Target-based Scenario Example

Step	Speaker	Depth 1	Depth 2	Depth 3
Confirm ID	AI call	Hello? This is OOO. We check your health conditions twice a day if you are included in the monitoring list. It will take a minute. Please hold and tell us about your symptoms to check your condition. Are you 000?	No	No
	Person in self-isolation	Yes	Are you a member of 000 family?	
Check symptoms	AI call	Thank you. Did you have fever over 38°C today?	Yes	Sorry. Make sure to wear face mask, refresh air, and wash your hands frequently to prevent the spread and infection of COVID-19. Have a nice day. Stay safe and health. Thank you.
	Person in self-isolation	Yes/no		
	AI call	Did you have dry cough?		
	Person in self-isolation	Yes/no		
	AI call	Did you feel low or extreme fatigue?		
	Person in self-isolation	Yes/no		
	AI call	Did you feel shortness of breath or have any breathing difficulties?		
	Person in self-isolation	Yes/no		
	AI call	Did you have a sore throat and phlegm?		
	Person in self-isolation	Yes/no		
	AI call	Did you have any symptoms such as muscle soreness, chills, headache, and diarrhea?		
	Person in self-isolation	Yes/no		

000 is in the active monitoring list and should answer the phone two times a day to check his/her health state. We ask for your cooperation so that 000 can answer the call. Please call to local health center or dial 1339 or area code+120 to contact with call centers to receive counseling on your health conditions and visit a COVID-19 screening center if 000 or any of your family members have fever or any abnormal symptoms within 14 days. Stay safe and healthy. Thank you.

* Source: Hancom Group

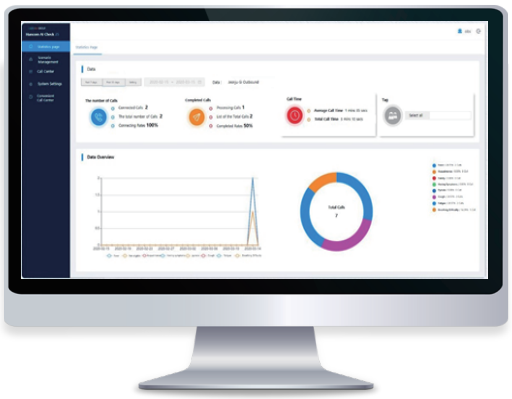
Developed by Hancom Group
For use by People under self-quarantine and active monitoring (user), government officials in departments assigned to monitoring, etc. (administrator)

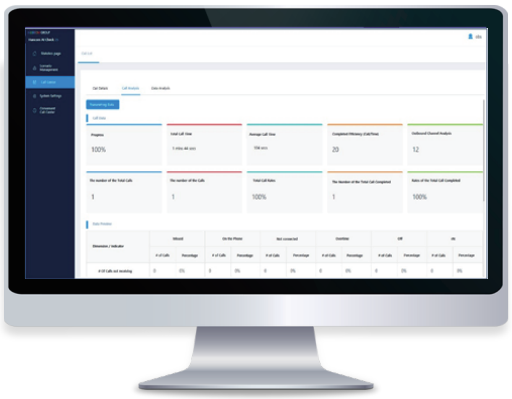
2. Statistical Analysis and Scenario Management

Hancom AI Check 25 provides key monitoring results such as the total number of calls made and call success rates for a set period of time, the average duration of calls and users' health conditions (fever, cough, extreme fatigue, etc.) through the dashboard, a web-based management tool for the department assigned.

Also, visualized scenario templates are offered for simple and easy creation of and reference to scenarios. The existing scenario templates can be downloaded to create similar ones faster.

Web-based Scenario Management Tool for Department Assigned





3. Additional Features

In addition, the system provides service in Chinese and English, enabling local governments to check health conditions of foreign residents and send them information.

06 Contact information

Institution	Person In charege	email
Hancom Group	Mr. Yu, Hogan	sales@hancom.com

ICT utillizing cases tackling against **COVID-19** pandemic of Korea

Prevention Stage

Open public data on COVID-19

01 Introduction

Disclosing information on face mask distributed by the government to the public (including places to buy and their locations, the time of shipment and the quantity, and remaining inventory) as open data is considered as a representative case of opening of public data in an effort to prevent the spread of COVID-19. National Information Society Agency (NIA) converted raw data of Health Insurance Review & and Assessment Service (HIRA) into open API* and distributed it to the private sector so that developers could develop mobile apps and web-based services easily.

*It is a publicly available (open) application programming interface allowing developers to access certain internal functions or contents from outside with web protocols (HTTP)[1)]

Based on the open data, developers in the private sector released over 150 apps and web services. Such apps and services showed a high usage rate by recording 670 million API calls on face mask in 3 weeks. People were able to check the remaining inventories of face masks in nearby pharmacies and marts easily and pharmacies and marts selling face masks identified their inventory with ease. Public complaints over the mask significantly reduced as well.

02 Background and Purpose

Civic Hacking* has served as a background for opening of public data. Developers in the private sector devised an idea to provide a service to inform customers on face mask inventory as there were a lot of confusion and difficulties to purchase face masks distributed by the government due to a lack of information. However, there were certainly limitations for them to identify all inventories of over 20,000 drug stores. Hence, citizens gathered together to take a 'joint response to open public data on COVID-19' and asked the government to disclose it. The government immediately initiated a public-private joint project to provide open data on government distributed face masks.

* Civic Hacking is an emerging civil movement in the digital era led by people who are willing to collaborate with others to create open source solutions for social and urban problems voluntarily with the help of ICT.

1) NAVER Developer(https://developers.naver.com)

Managed by National Information Society Agency
and Health Insurance Review and Assessment Service
For use by Korean and foreign nationals

The opening of public data on government purchased face masks and provision of open APIs mean that the government detached itself from traditional practices(end-to-end development) of developing the system itself to satisfy various public demands by promptly providing services the people want and attracting private sector to engage in the project.

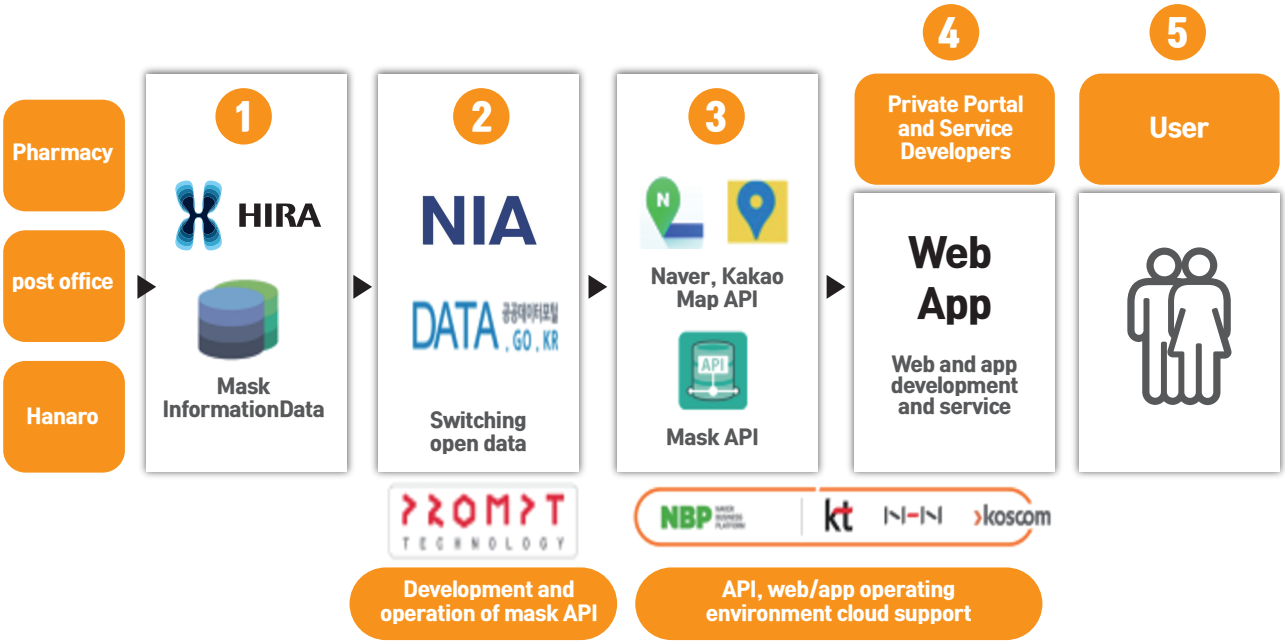
03 Pre-requisite

To open public data, the government should establish related laws first and create a pan-governmental platform to register and share the data. Next, the government should provide open APIs in consideration of development environment of the private sector. Other requirements such as cloud should also be met to provide an environment to maintain and operate open data service.

Item	Description
Law	▪ Act on Promotion of the Provision and Use of Public Data
Pan-governmental data platform	▪ A pan-governmental data platform to access public data
Open APIs, free support of cloud	▪ Open APIs for a better service development environment for civic hackers ▪ Provide free cloud environment to maintain service, operational support

Open public data on COVID-19

04 System Configuration[2)]



※ Visit the public data portal for more information including API specification and technical documents (https://www.data.go.kr/dataset/15043025/openapi.do)

1. HIRA provides data such as list of selling locations*, time of shipment, number of available masks, etc. after receiving such data from pharmacies that sell government distributed masks to NIA

* Approx. 24,000 pharmacies, 1,406 post offices, and 1,702 Hanaro Mart

2. NIA reprocesses the data including segmenting of inventory stat* and combining coordinates of address and provide them as open APIs via cloud platforms of private companies

* Sufficient: +100 (green) / Moderate: less than 100 (yellow) / Small quantity: less than 30 (red) / Sold out: (grey)

2) Source: Joint report by related agencies, 'How to find nearby pharmacies selling face masks supplied by the government' (Mar 10,'20).

Managed by National Information Society Agency
and Health Insurance Review and Assessment Service
For use by Korean and foreign nationals

Status and number of available masks

3. Cloud service providers (KT, Koscom, NHN, NBP)* provided API servers, map API, etc. to create an optimal development environment for stable service operation

* Naver Business Platform (NBP): API servers to transmit data on pharmacy stats and number of available masks
KT, NHN, Koscom: Development environment including languages· database management system, web server (WAS), etc.

4. Developers in the private sector including internet portal service providers (Naver, Kakao), civic hackers (independent developers), startups, and developer communities promptly developed various web services and apps on face mask data notification

5. Citizens can check number of available masks through these apps and internet service via their PCs and mobile apps in real-time (updated in every 5~10 minutes)

Open public data on COVID-19

05 Main Features

1. Open APIs for COVID-19 screening stations and designated National Safe Hospitals

Ministry of Health and Welfare (MOHW) and HIRA provided data on COVID-19 screening stations and designated National Safe Hospitals which are displayed on the COVID-19 micro page, and Ministry of the Interior and Safety (MOIS) and **NIA reprocessed it as open data through open API and disclosed it to the public data portal (data.go.kr)**.

COVID-19 related information such as **the list of 'Designated National Safe Hospitals'** which protects citizens from potential COVID-19 infection and its details (city/province, city/county/district, institution name, address, availability of specimen extraction, types of request, phone number) and the list of 'COVID-19 screening stations (including drive-thru screening stations)' installed to prevent the spread of disease and its details (city/province, city/county/district, institution name, address, phone number) are now available via the public data portal and it is updated every morning at 6 AM.

Developers in the private sector including civic hackers, startups, developer communities and internet portal providers in the private sector **released search apps and web services for COVID-19 screening stations and designated national safe hospital** by using the open data. Thanks to that, people can now easily find nearby screening stations and designated National Safe Hospitals through these apps and web services.

COVID-19 screening station search service (Naver) ▶

◀ Designated National Safe Hospitals search service (medical clinics with COVID-19 units throughout the nation)

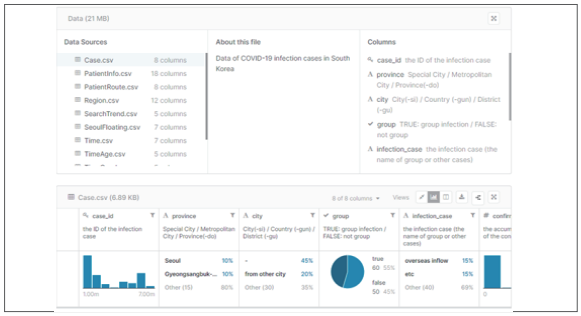
Managed by National Information Society Agency
and Health Insurance Review and Assessment Service
For use by Korean and foreign nationals

2. Opening of public data on people`s daily life for COVID-19

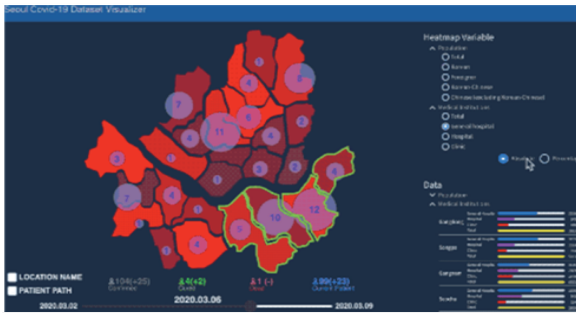
Other than data related to face masks distributed by the government, the government actively opened public data on people's daily life including confirmed cases of COVID-19 in Korea and overseas(via homepage of local government, public data portal, etc.). Based on this, citizens and companies are generating public data and sharing it with the world.

- MOHW discloses and provides COVID-19 updates including confirmed cases in Korea (by gender, age group, and city/province) and overseas cases to the public data portal through open API.
- Domestic companies and developers crawl data such as updates on confirmed cases by city/province, distribution of confirmed cases in Korea, recent COVID-19 patient routes posted on the homepage, add latitude and longitude and other geographical features, and reprocess it as public data with detailed information including infection route and number of infections, and post it to Kaggle, an AI-based prediction and analysis competition platform.

▲ Updates on COVID-19 confirmed cases in Korea and overseas posted on the public data portal



▲ Confirmed cases in Korea posted on Kaggle



▲ Visualization of data on travel routes of people with COVID-19 (Mindslab)

Pathogens Information Management System

01 Introduction

The National Culture Collection for Pathogens (NCCP) has established the Pathogens Information Management System (PIMS) in 2010 in order to contribute to promoting healthcare R&D activities by distributing and managing high quality pathogenic microorganisms and pathogens as national resources.

The main features of PIMS include registration of pathogen resources information (virus, fungi, bacteria, derivative material etc.), management of location and storage facility information, information on quality management, deliberation and management of pathogen resource registry, management of online and offline distribution, and management of statistical data.

02 Background and Purpose

To prevent and control the pathogen infection, there is a growing demand for prompt and precise diagnosis on pathogens and development of treatment and effective vaccine. To support such R&D activities, the government need to secure useful and various resources, and manage, disclose, and distribute characteristics of pathogens and other information systematically. To make this happen, a management system ensuring systematic and safe preservation of pathogens is required considering their specific features.

Since the enforcement of the Act on the Promotion of Collection, Management, and Utilization of Pathogen Resources in 2017, Korea has improved laws, institutions, and organizational structure to respond to MERS-CoV and other emerging infectious diseases. Specifically, the government installed the National Culture Collection for Pathogens (NCCP) and specialized pathogen resource banks (specialized banks). NCCP is in charge of collection, analysis, evaluation, preservation and distribution of national pathogen resources and specialized banks store and manage over 1,000 strains of pathogens and carry out professional research and management activities.

Managed by Ministry of Health and Welfare
For use by National Culture Collection for Pathogens and other specialized banks

National Pathogen Resource Management Organizations and Their Functions

Organization		Main Functions	
NCCP		Finding resources	▪ Secure, develop, and collect useful and effective pathogen resources ▪ Characteristics analysis and systematic preservation and management
		Distribution and utilization	▪ Develop management, operation, and utilization plans for NCCP and specialized banks ▪ User-oriented distribution of resources to create a virtuous cycle and building a healthcare R&D infrastructure * Provide pathogen resources to institutes with persons and facilities that can handle pathogens according to its biosafety level in accordance with NCCP procedure
		Pathogen standardization	▪ Support the designation and operation of specialized banks ▪ Share information and resources with resource banks locally and internationally ▪ Standardize pathogen resources
Specialized banks	Korea University College of Medicine School of Medicine (virus)	▪ Founded as a viral disease research institute, it conducts activities such as identification of viral pathogens, epidemiological investigation, treatment and disease prevention research	
	Seoul Asan Hospital (virus)	▪ Identification of viral pathogens, treatment and disease prevention research	
	Catholic Kwan-dong University (pathogenic fungus)	▪ Specializing in fungal biology research, it makes an effort to secure pathogen resources and develops vaccines and treatments	
	Jeonbuk National University (zoonosis)	▪ Able to handle and manage high-risk zoonotic pathogens and risk group 3 pathogens via biosafety level 3 (BSL-3) research facilities. Secures and preserves viruses causing infectious diseases and distributes them to researchers and research institutes locally and internationally to support their basic and applied research	

Pathogens Information Management System

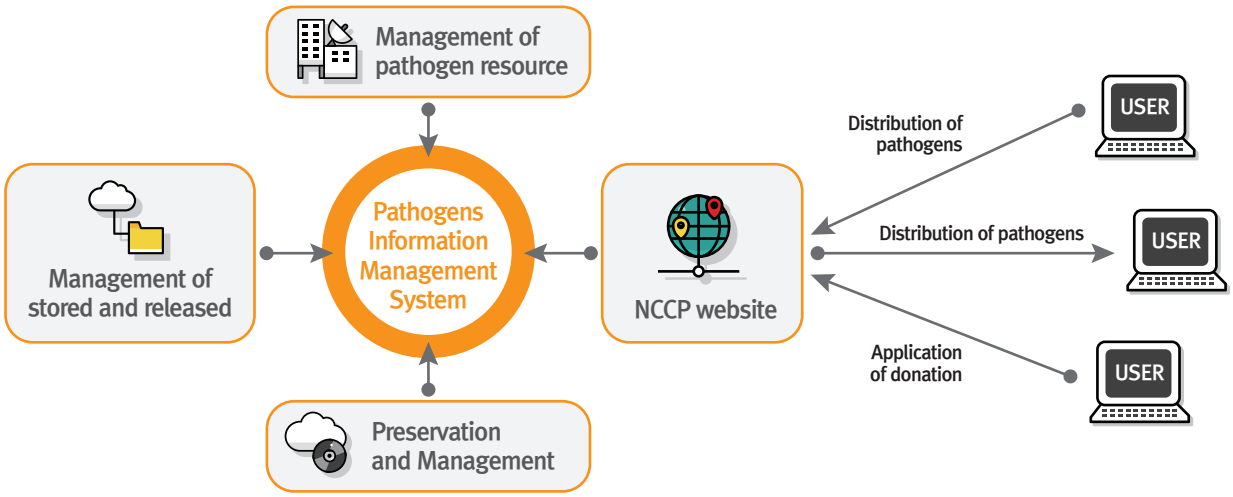
PIMS provides following services including search of pathogen resources and management of distribution, deposit, outbound transfer and approval of acquisition of pathogen by foreign and international institutes based on pathogens resource database of specialized banks and NCCP. PIMS also streamlined the pathogen distribution process helping both administrators and applicants save time and check the application result easily online.

Pathogen Information Provided by NCCP

Pathogen	Growth data	Reference data
Pathogen species and NCCP No. (#####), classification (bacteria, fungi, virus, derivative material), isolation source, date of isolation, name of person who isolated the pathogen, path of pathogen isolation and characteristics (genotype, toxic type, serotype)	Growth medium, temperature, pH, CO2	Risk group, BSL, distribution price, notes, reference, etc.

03 System Configuration

1. System Process



Managed by Ministry of Health and Welfare
For use by National Culture Collection for Pathogens and other specialized banks

04 Main Features

1. Registration of pathogen resources (bacteria, fungi, virus, etc.)

PIMS users are categorized into administrators, unit bank subscribers and general users. General users can only search the pathogen resources through the website and institutional members can apply for pathogen distribution. Unit bank subscribers and administrators can register their resources and designate locations where their resources are stored.

2. Provision of information on pathogen preservation facility locations and registration information

Pathogen resources deposited, developed, and produced by NCCP are placed in designated containers and preserved in designated locations (such as ample cabinet, cryogenic freezer, nitrogen tank). After registering pathogen, the resource is kept in preservation facilities and registered to PIMS.
If the storage of pathogen resources is confirmed, each pathogen is assigned with an NCCP number and a Lot number. In the past, bar codes were attached to each pathogen resource; however, the new system converts bar codes into QR codes. After a pathogen resource is stored in a designated location (management facility), their location data is recorded for management.

3. Quality inspection and history management of pathogen resource

The preserved pathogen resources undergo regular quality inspections in accordance with the annual operation plan (regular quality inspection plan) and quality inspection guidelines.

4. Distribution and deposit history management

Although NCCP allows distribution of preserved pathogen resources to researchers for the purpose of research, education, etc., distribution* is only available to institutions having experts and proper research facilities with the right BSL level to accommodate each pathogen. NCCP also makes the distribution information open and manages the distribution information of pathogen resources each year.

* Distribution is available to institutes with BSL 3 research facilities only.

05 Contect information

Institution	Person In charege	email
KCDC(Korea Centers for Disease Cntrol & Prevention)	Kim Jong-in	eruwayo@korea.kr

Cell Broadcast System (CBS) – Emergency and Disaster Alerts

01 Introduction

The emergency and disaster alert system was first introduced in 2005 as a service that uses the mobile communication system and allows users to receive data information (text messages) from base stations by entering a specific reception ID (channel) into their mobile phones. The system uses the Cell Broadcast Service (CBS) feature of mobile phones to provide text message instructions to mobile phone users in the event of a disaster or if a disaster is expected. The revision of the law in 2013 made it mandatory for all mobile phone handsets to support CBS. Unlike the general method of text messaging, CBS does not require entering of phone numbers, which makes it do without the process of collecting personal information. Aimed at protecting the public safety, this service is provided free of charge.

02 Background and Purpose

Natural and social disasters like climate change, earthquakes and tsunamis are causing enormous human and material damage. Therefore, it has now become more important to build a system through which all who take part in prevention activities can share disaster information and take actions accordingly. The first thing that the government must do for effective disaster response is identifying real-time disaster status, sending the urgent information to citizens immediately so they can be informed of how to be prepared or respond.

In this regard, Korea became the first and only country in the world in 2005 to develop and universally provide the CBS disaster alert service through mobile phones.

Disaster alerts can be received as long as the mobile phone supports CBS . While they can be also received in 2G phones released after 2005, the service is not available for 3G phones that were introduced in Korea in 2007, as they found issues regarding battery draining, handset malfunction and changes in the international telecom

03 Pre-requisite

Emergency and disaster alerts can be successfully delivered when the national ICT infrastructure, like the national disaster management system, disaster information sharing system and the CBS platform, is built along with the ICT development infrastructure, where intra-ministerial systems can be connected with each other and mobile phones and apps can be connected to mobile carriers.

Managed by Ministry of the Interior and Safety
For use by Citizens and assigned case officers
(Disaster Information and Communication Division)

Type	Requirement
Required Systems	▪ National Disaster Management System, Disaster Information Sharing System, CBS Platform, and Seol Administrative Information System
	▪ Connection of ministerial systems (ESBs, Ministry of Public Administration and Security, Ministry of Health and Welfare, Ministry of Environment, Ministry of Land, Infrastructure and Transport, Ministry of Maritime Affairs and Fisheries, National Police Agency, National Fire Agency, Korea Forest Service, Korea Meteorological Administration, Korea Centers for Disease Control and Prevention, public institutions and local governments); connection of cell phones (2G and 4G), mobile app Safety Stepping Stone (3G) and mobile carriers

04 System Configuration

1. Service Concept (Process)

Emergency and disaster alerts are automatically or manually sent to the public through mobile carriers in the event of a disaster through national disaster information systems (e.g., weather, earthquake, tsunami, traffic, forest fires, accidents, etc.).

Although the Ministry of the Interior and Safety directly sends the message alerts in a state of national emergency, when responding to special weather reports or providing civil defense information, the 17 metropolitan and provincial governments can also send them in the case of natural and social disasters, such as forest fires, earthquakes, and hazardous chemical leaks, which require on-site assessment of incidents. In addition to the text message alerts, there is also a system that automatically delivers disaster broadcast programs through DMB terrestrial broadcasting and the online disaster broadcasting system (EDBS) of the Ministry of Science and ICT to 164 broadcasting companies that are obligated to air disaster broadcasts - they are 68 terrestrial TVs, radios, general broadcasting and news report program providers; and 96 system operators, IPTVs, and satellite broadcasting providers (including the Ministry of Science and ICT).

Cell Broadcast System (CBS) – Emergency and Disaster Alerts

05 Main Features

The CBS System sends text messages based on Short Message Service (SMS) but at lower cost compared to SMS. There are three types of emergency and disaster message alerts.

Difference between CBS and SMS

CBS (Cell Broadcasting Service)	SMS (Short Messaging Service)
Point to Multi-point (Simultaneous Multi Broadcasting)	Point to Point (Individual Polling Method)
▪ Simultaneous transmission to all subscribers within the base station provides real-time information regardless of the number of people. ▪ Little cost is needed for transmitting information; no need to develop a telephone number database; and optional transmission - to local base station coverage area or to the whole nation ▪ Large capacity of up to 230 characters per single transmission.	▪ The more targets, the longer it takes from minutes to hours; and real-time transmission unavailable to more than 300,000 people ▪ Individual transmission costs high (KRW 25~30 per person) and transmission only available to phone numbers already included in database ▪ Limited capacity of approximately 40 characters per transmission

* Source : Disaster Information Transfer System Using Advanced It Technology, National Fire Agency, Ahn Kyu Ho

1. (Urgent) Emergency and Disaster Alert

This alert type is sent in very urgent situations (in wartime), with texts and a warning sound (of 60 dB or louder). It is not possible to refuse reception, and the warning sound is made even when the phone is in vibration mode.

2. Emergency and Disaster Alert

This alert type is sent when there are infrastructure failures or social unrest caused by disasters like earthquake, tsunami or typhoon, with texts and a warning sound of 40 dB or louder (the warning sound made even when the phone is in vibration mode). The central government ministries and local governments also provide information on the disasters and how to respond.

3. Safety Information Alert

When safety precautions are required in special weather conditions like heatwaves or fine dusts and epidemic or infectious disease outbreaks, safety information alerts are sent to the public, with vibration, tone and sound volume all adjustable as with regular text messages.

COVID-19 Micropage

01 Introduction

COVID-19 Micropage (ncov.mohw.go.kr) is an integrated information platform that was launched by the Korean government (Central Disaster Management Headquarters and Central Disaster Control Headquarters) to provide the public with important and relevant information related to COVID-19 quickly and conveniently.

Through this website, a wide range of information, including the number of COVID-19 cases in Korea, routes taken by confirmed cases, details on Korea's quarantine system, Korean government's daily briefings, fact checks on fake news, countermeasures of related organizations, and useful media resources, is promptly made available to the public. [1)]

02 Background and Purpose

With citizens all around the world being highly concerned about COVID-19, false information and fake news can easily generate fear. Accordingly, interest in platforms capable of promptly providing accurate information regarding COVID-19 has grown.

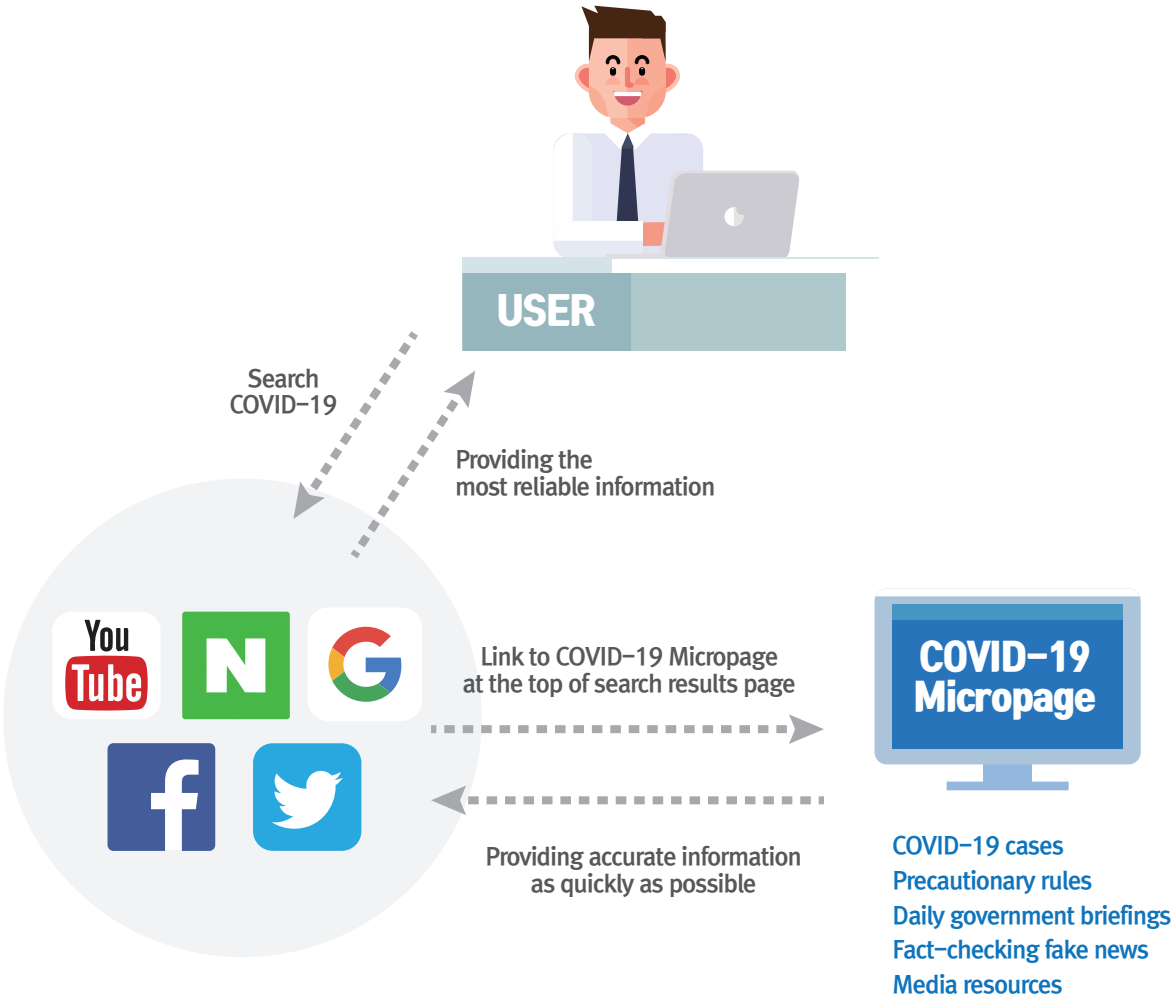
Recognizing this demand, the Korean government (Ministry of Health and Welfare) launched COVID-19 Micropage on February 5, 2020. In addition to the wide range of information mentioned above, the service offers a search function to help people find COVID-19 screening centers and an FAQ section, among others. It also provides fact checks of various rumors and fake news and airs the live government briefings at 11:00 a.m. and 2:00 p.m. every day.

03 System Configuration

1. Service process

The Korean government (Korean Communications Commission) worked together with not only Korean search engines, such as Naver, but also overseas platform operators, such as YouTube, Google, Twitter, and Facebook, to place a link to COVID-19 Micropage at the top of user search results for searches related to the coronavirus in order to ensure the prompt delivery of accurate information regarding COVID-19.

Managed by Ministry of Health and Welfare
For use by Nationals and foreigners



04 Main Features

COVID-19 Micropage is composed of six sections: About COVID-19, Latest Updates (including the number of cases in Korea, routes taken by confirmed cases, and status of COVID-19 around the world), News & Issues (including the daily government briefings and fact checks on fake news), Media Resources & FAQ, Damage Support Policy, and Notice. On the main page, users can search for screening centers and national safe hospitals.

COVID-19 Micropage

COVID-19 Micropage menu

About COVID-19	▪ What is COVID-19 ▪ Korea's quarantine system ▪ Patient treatment and management ▪ Guide on preventive measures
Latest Updates	▪ Cases in Korea ▪ COVID-19 around the world ▪ Cases in Korea by city/province ▪ Routes taken by confirmed cases
News & Issues	▪ Press release ▪ COVID-19 fact-checking ▪ Status of daily supply of masks for the public
Media Resources & FAQ	▪ Media resources ▪ FAQ
Damage Support Policy	▪ General public ▪ Vulnerable social groups ▪ Small businesses and enterprises ▪ Medical institutions ▪ Outbreak areas ▪ Others
Notice	▪ General public ▪ Inbound travelers and foreign tourists ▪ Self-quarantined people ▪ Medical institutions ▪ Group and multipurpose facilities ▪ Local government ▪ Enterprises and markets ▪ Social distancing

1. Latest updates on coronavirus cases

The number of coronavirus cases in Korea has been increasing since January 3, 2020, when the Central Disaster Control Headquarters began operating the task force (following the first confirmed case on January 20). The total number of cases is updated at 12 a.m. every day.

The cumulative number of confirmed cases, cumulative number of tests done, numbers of confirmed cases by city and province (as well as gender and age group), and information on the spread of the virus nationwide are tallied and displayed on the main page.

▲ Summary of coronavirus cases in Korea on main page of COVID-19 Micropage

Information on the status of COVID-19 around the world is updated at 9 a.m. every day, based on the data posted on the COVID-19-related government website of each country and related press releases, with the time in each country provided as well.

COVID-19 Micropage

2. Quarantine system of Korea

COVID-19 Micropage provides information on Korea's quarantine system. Having established the Central Disaster and Safety Countermeasures Headquarters (CDSCHQ), headed by the Prime Minister, the Korean government is currently operating a pan-government quarantine system. The Central Disaster Control Headquarters is serving as the quarantine control center.

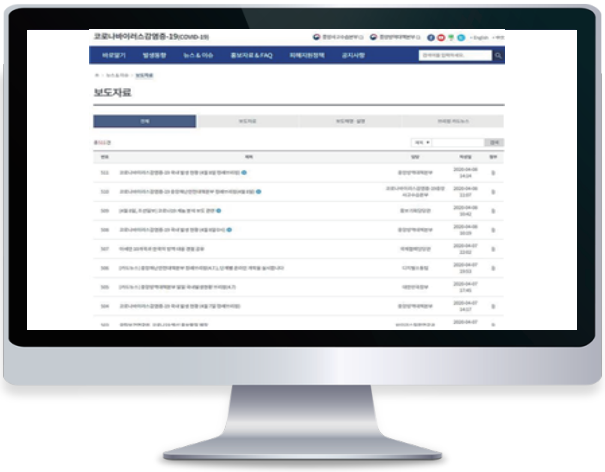
The website also provides information on preventing the inflow and spread of COVID-19, including special entry procedures and stronger quarantine inspection measures for overseas travelers, and shares the overseas travel histories of incoming travelers with health care organizations. In addition, information is provided on preventing the spread of the virus by detecting infected patients early through the COVID-19 screening centers, testing and diagnosis, and contact tracing and quarantine measures for people who have been exposed to the virus.

3. Government briefings

Users have access to the live regular briefings given by the Central Disaster Management Headquarters and Central Disaster Control Headquarters at 11:00 a.m. and 2 p.m. every day. These briefing materials are available via the "Press Release" menu in the News & Issues section of the website as well as on the main page.

Additionally, various departments in charge within the Ministry of Health and Welfare, including the International Cooperation Office, Virus Disease Research Division, Health Policy Division, Basic Livelihood Security Division, Insurance Policy Division, and Childcare Infrastructure Division, provide press releases on issues related to COVID-19.

This serves to provide reliable information through press releases that address any errors in the press related to COVID-19 and allows the ministry in charge to directly fact check the various fake news and rumors.



▲ Press release board

▲ Fact check board

4. Search for screening centers and national safe hospitals

On the main page of COVID-19 Micropage, users can search for screening centers, including Drive-Thru Screening Stations, and national safe hospitals across the country by city and province, city, county and district, organization name, and phone number.

Public sector | Prevention

KMA Corona Fact

01 Introduction

KMA Corona Fact (http://coronafact.org/), developed by the Korea Medical Association (KMA) is a web and app service designed to provide accurate information on COVID-19. Through a single access to this service, users can check all COVID-19 information, including real-time count updates on confirmed cases and deaths, disease information, news, and GPS-based location information of screening stations.

02 Background and Purpose

In the face of rapidly increasing COVID-19 confirmed cases, Korea saw fake news and rumors spreading, which encouraged KMA to develop the service to correct false information and provide more accurate information on COVID-19. In particular, medical doctors actually joined making of the service pages, correcting fake news and introducing relevant research papers. They tried to provide more reliable and accurate information and give answers to people's questions about the new virus in a more convenient and effective manner.

03 Pre-requisite

The purpose of KMA Corona Fact is to deliver accurate information by collecting and analyzing the existing information on COVID-19, rather than generating and offering new information. Obtaining data first is key.

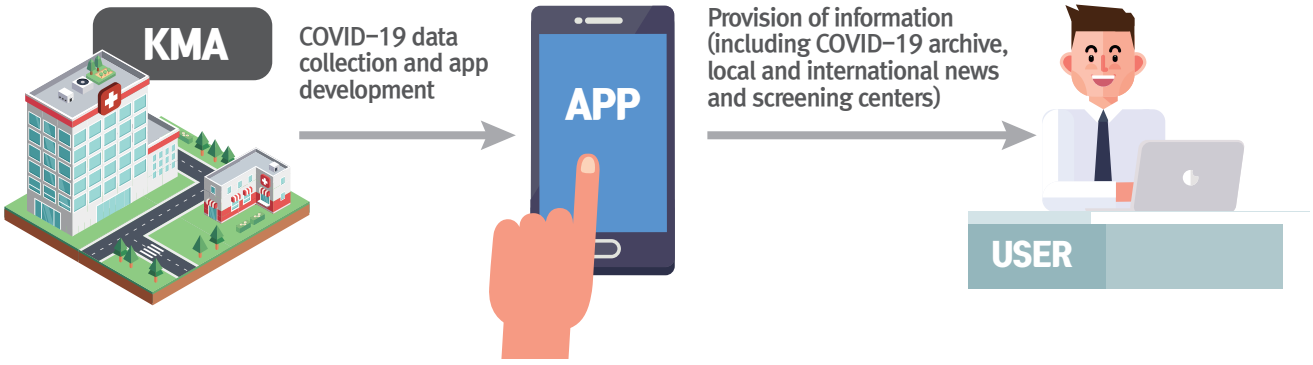
Type	Requirement
Data Needed	▪ Press release from KCDC and local governments ▪ Data on confirmed cases, screening stations and treatment facilities
System Needed	▪ GPS

Developed by Korea Medical Association (KMA)
For use by Korean and international users

04 System Configuration

1. Service process

KMA Corona Fact is a service developed in cooperation with medical doctors and provides various types of accurate information on COVID-19, including up-to-date case counts and important news.



05 Main Features

1. Up-to-date Case Count

Up-to-date Case Count page provides real-time updates on the number of confirmed cases, deaths, suspected cases (PUIs) and persons being tested.

2. COVID-19 Information

COVID-19 Information page provides links to websites of local and overseas organizations including CoronaBoard, US Johns Hopkins University, The New York Times and China Baidu, so users can check real-time COVID-19 information.

3. COVID-19 Screening Stations

COVID-19 Screening Stations page helps users find the location and contact information of the nearby screening stations through GPS. This is a thoughtfully designed page, allowing people suspected of infection to easily access the screening stations, as these stations play an important part in early detecting of potential cases.

KMA Corona Fact

4. COVID-19 News

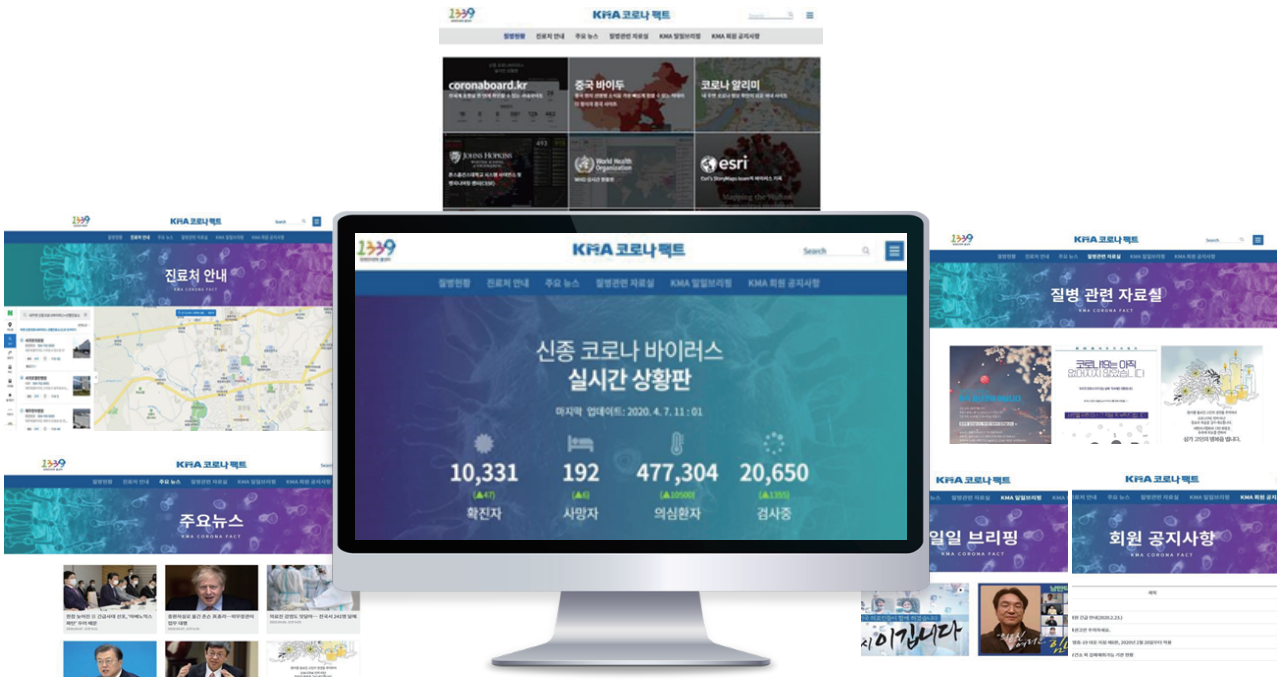
COVID-19 News page provides up-to-date local and international news about the virus. Particularly, 'Live News' is the main feature that users can find only on KMA Corona Fact.

5. COVID-19 Archive

COVID-19 Archive page provides useful information for fighting the virus - currently, the page offers self-quarantine instructions for PUIs, recommended guidelines for prevention and international clinical literature. Users can find a wide range of medical information about COVID-19 from this page.

6. Notices and Briefings

In addition, the website offers users to watch KMA's daily briefings on COVID-19 and provides various information and resources in form of notices for KMA members who are working hard on the front line to contain the disease.



▲ KMA Corona Fact

06 Contact information

Institution	Person In charege	email
Wonju Yonsei Clinic	Cho Seung-Guk	lukechosk@gmail.com
JoyDesign		thejoydesign@naver.com

Global Research Collaboration on COVID-19 (#opendata4covid19)

01 Introduction

The Global Research Collaboration on COVID-19, #opendata4covid19 (https://covid19data.hira.or.kr), gives local and international researchers access to a research platform, based on the COVID-19 data of Korea Health Insurance Review and Assessment Service (HIRA), through which they can exchange analytical codes and results (evidence) instead of raw data. HIRA has compiled the actual five-year clinical data on the existing conditions and prescriptions of patients who have been tested and treated for COVID-19 into an anonymized research dataset, and opened it up to use by researchers worldwide on Friday, March 27, 2020.

#opendata4covid19 as of April 16, 2020

1,232 researchers subscribed as members from 55 countries
(including 358 Koreans, 428 Americans, 71 British, and 56 Italians).

255 project requests made from 30 countries
(including 96 from Korea, 72 from the US, and 17 from the UK).

The system provides Statistical Analysis System (SAS), R, and common data models. There are a total of 57 variables, including those for patients' sociodemographic conditions, medical conditions, and diagnoses and prescriptions. Researchers can use the data schema (explanations of the table structure and variables) as well as the sample dataset provided to develop their analytical codes and upload them back onto the platform. The HIRA research staff then runs the submitted codes on the internal dataset and returns only the statistical results.

02 Background and Purpose

The rapid spread of COVID-19 seriously threatens the health and lives of people around the world, exerting enormous impacts on humans' social and economic activities. Yet there is a critical dearth of evidence-based information on actual patients with which medical practitioners and policymakers can make better decisions. The Ministry of Health and Welfare (MOHW) in South Korea and HIRA thus set out to develop a dataset on Korean COVID-19 patients using the data compiled by the Korean National Health Insurance (NHI) system, anonymized to protect the privacy of patients.

Managed by Ministry of Health and Welfare
and Korea Health Insurance Review
and Assessment Service
For use by researchers in Korea and around the world

This led to the creation of the first open data program that researchers worldwide can access and use to further their analyses of the reality and effects of COVID-19. The two institutions have decided to share this dataset through a platform to promote international research on COVID-19, thereby enabling humankind to overcome the disease.

03 Pre-requisite

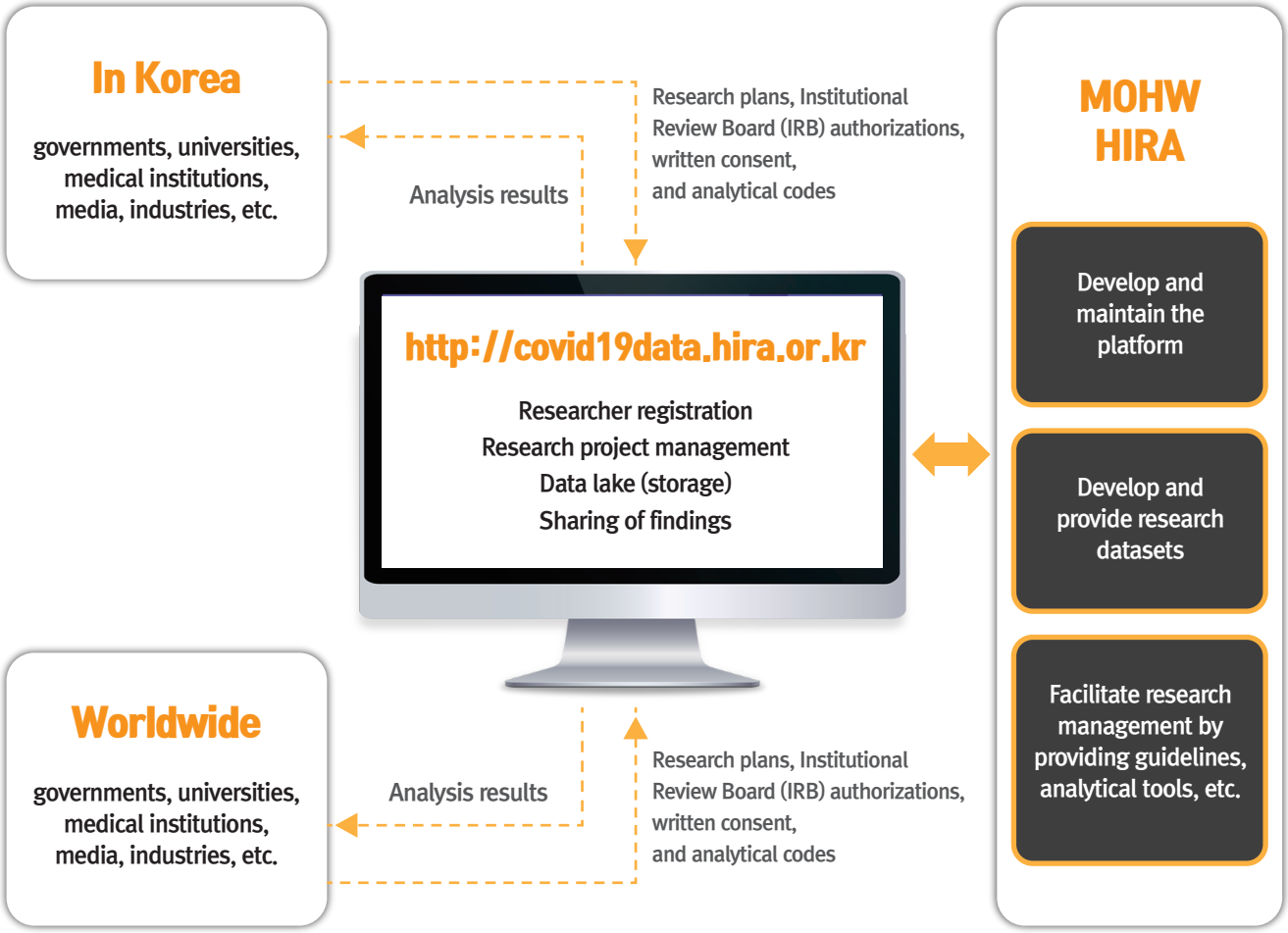
Category	Requirement
Actual clinical data on COVID-19 patients in Korea	▪ Clinical data on all Korean COVID-19 patients, including data on the tests and treatments administered as well as patients' existing conditions and use of medical resources (spanning over at least five years) ▪ Data on confirmed COVID-19 cases and COVID-19-related deaths are to be added in the future.
Servers for large-scale data analysis and a statistical package	▪ The health data of all Koreans have been extracted according to the predefined conditions and compiled into SAS, R, and common data models. ▪ Statistical packages (SAS, R, and Atlas (for CDM)) are also provided.
Online international research collaboration platform	▪ A platform that researchers worldwide can access to register, submit project applications, and upload/download analytical codes and statistical results ▪ Authorized researchers will be able, in the future, to access the analysis servers via remote accounts to view the data themselves. Additional server accounts will be set up to accommodate those researchers. A website will also be set up to share research findings from around the world.

Global Research Collaboration on COVID-19 (#opendata4covid19)

04 System Configuration

1. System Process

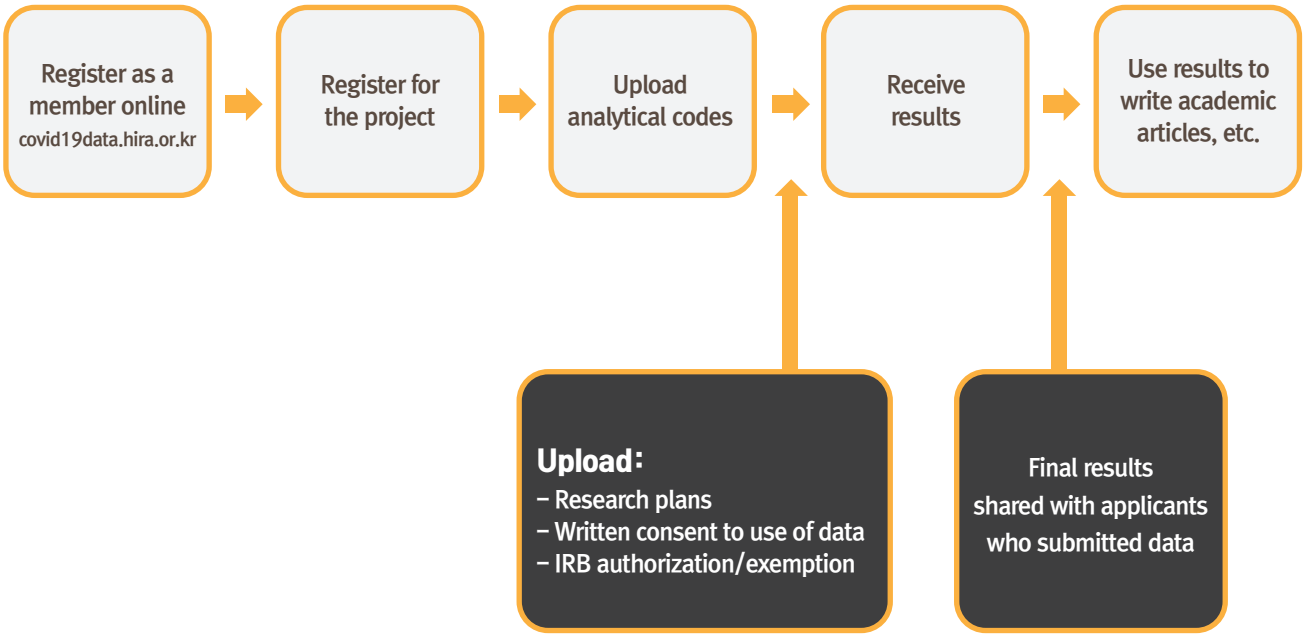
opendata4covid19: System Process



The MOHW and HIRA, together, manage the platform to support research. Governmental entities, universities, medical institutions, members of the press, and researchers in various industries can participate in the program. HIRA is specifically tasked with developing and maintaining the research platform, developing and providing research datasets, and establishing guidelines to facilitate research management.

Managed by Ministry of Health and Welfare
and Korea Health Insurance Review
and Assessment Service
For use by researchers in Korea and around the world

International Research Collaboration Flow



Researchers visit https://covid19data.hira.or.kr, create their accounts by submitting their names, affiliations, and institutional information (to be confirmed by email), and register for the project to develop and upload analytical codes using the SAS, R, and CDM data.

HIRA's research staff then runs the submitted codes on the exclusive international research datasets that it keeps, and shares the results (statistics) with those who submitted the data and codes. In this process, HIRA also checks whether unauthorized attempts have been made to identify patients to whom the data belong. Before they can receive the statistical results, researchers must submit their research plans, written consent to the use of the data, and the Institutional Review Board (IRB)'s authorization or exemption.

The MOHW and HIRA recommend that researchers consult with the two institutions before publishing their academic articles based on #opendata4covid19.

Global Research Collaboration on COVID-19 (#opendata4covid19)

2. Hardware, Software Structure

05 Main Features

The main features of #opendata4covid19 include researcher registration, processing of the consent to the use of data, processing of research project applications, provision of a dataset and range of analytical tools, and operation of a message board.

1. Researcher registration

Individuals affiliated with governments, academia, the press, and industries worldwide can create accounts on the platform by entering their names, affiliations, and affiliated email addresses and setting personal identification numbers (PINs). They can access the platform's content once the information they provide is verified via email.

2. Consent to the use of data

The platform enables participants to submit their consent to the use of data quickly and conveniently online, as the prompt and secure collection, processing, and use of data are crucial to the concerted global effort to fight the pandemic.

Managed by Ministry of Health and Welfare
and Korea Health Insurance Review
and Assessment Service
For use by researchers in Korea and around the world

3. Research project applications

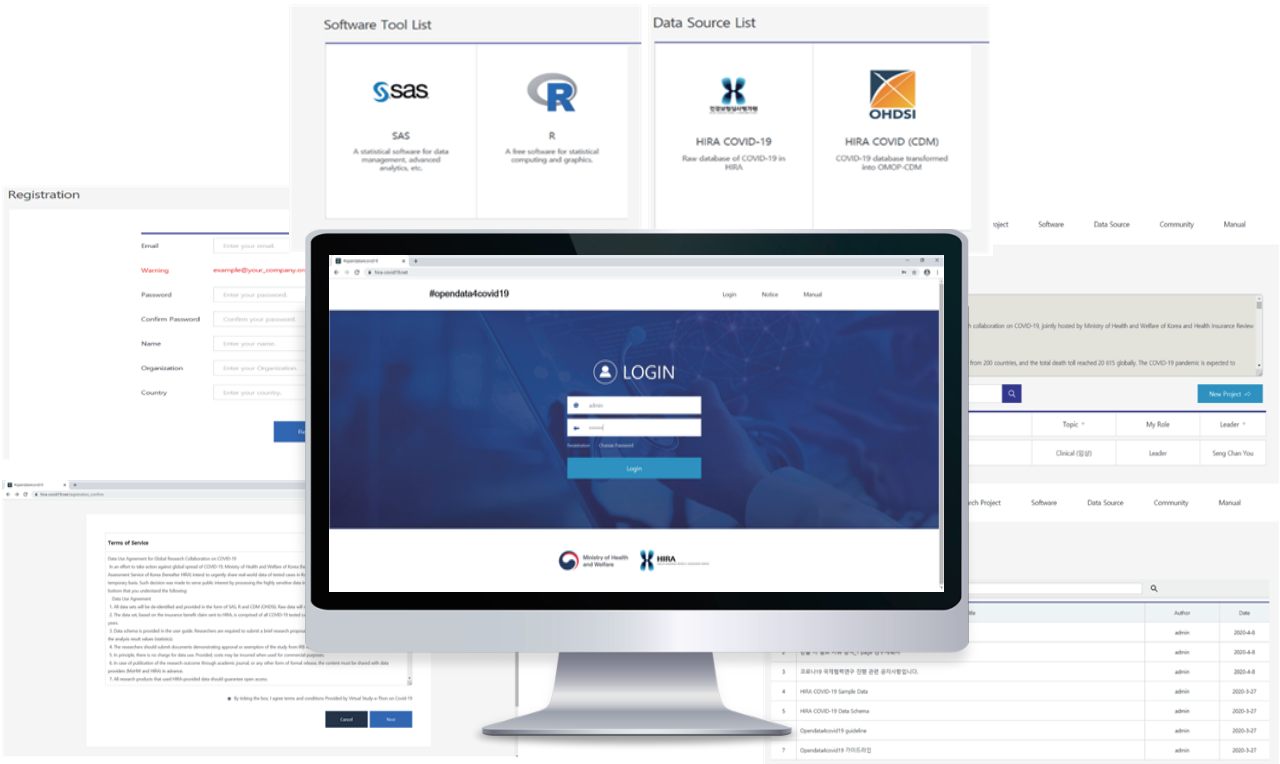
Once they complete their registration, participants can submit applications for research projects by simply entering their project titles, topics, and methods. The “Research Project” page on the platform includes a browser that enables users to upload their files, including analytical codes and related documentation.

4. Dataset and analytical tools

This platform accepts and analyzes SAS, R, and CDM datasets. Upon submitting research applications, users can select the type of datasets and the appropriate statistical package (analysis tool).

5. Message board

The platform provides a message board on which researchers and administrators can communicate with one another. The board includes “News and Notices” and “Q&A” sections as well.



▲ Main Pages

Goodoc

01 Introduction

Goodoc provides a variety of additional services, including the unmanned hospital reception, Coronavirus Scanner (information on routes taken by confirmed cases), and telemedicine support services, as an extension of the hospital search service for preventing the spread of COVID-19.

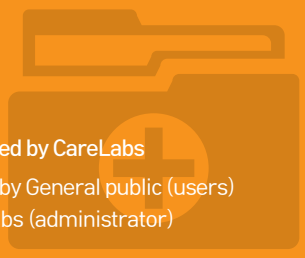
Goodoc 1.0 was launched as a hospital search and reservation service in May 2012. In August the same year, Goodoc 2.0, a one-on-one doctor consultation service, was introduced. In 2015, Goodoc 4.0, a mobile hospital search app, was launched. As of 2020, this service has undergone remarkable growth and development, surpassing total cumulative downloads of 4,100,000

The core function of Goodoc is the hospital search, providing the locations of nearby hospitals and information on the treatments they provide, based on the user's current location. Through this service, searches can be conducted to find various types of hospitals, such as hospitals offering treatments for women, children, and burn victims and hospitals offering treatment after 6 p.m. In addition, various services, such as information on medical teams and treatments, patient feedback, and one-on-one remote consultations, are provided through the web and app.

02 Background and Purpose

With the sudden increase in the number of COVID-19 infections in Korea from early March 2020, the government's first high-priority policy task to prevent the spread of the outbreak was to quickly and transparently provide information on confirmed patients' movements and use of medical institutions.

In response to this need, CareLabs improved the existing Goodoc service and developed additional functions, such as the Corona Scanner service, unmanned hospital reception, and remote medical consultations.



Developed by CareLabs

For use by General public (users)
/CareLabs (administrator)

03 Pre-requisite

To establish this service, it was necessary to provide, nationwide, accurate and refined data on confirmed cases, numbers of masks in stock at pharmacies, and details of all hospitals and pharmacies. This required a platform to open such data through an API. Moreover, for the unmanned reception and treatment service, all hospitals and pharmacies needed to be equipped with the required computers.

Category	Level	Content
National Infrastructure	High	▪ Central/local government needs to provide data related to COVID through an information platform* * Official government data was released in the form of API through an open data platform (National Information Society Agency) ▪ Hospitals and pharmacies nationwide need to be equipped with computers, and real-time communication needs to be made available. ▪ Various information on hospitals and pharmacies nationwide, such as locations, telephone numbers, and business hours, needs to be digitized.
ICT Development Infrastructure	Middle	▪ Servers capable of handling heavy traffic and ICT manpower competent at developing for Android are necessary.

Goodoc

04 System Configuration

1. System process

Goodoc links the computer systems of hospitals with the Drug Utilization Review (DUR) system and International Traveler Information System (ITS). By doing so, the international travel histories of patients are automatically secured and provided to the medical team when the patients register at a hospital.

- **Unmanned reception**

This service helps minimize the spread of infection within medical institutions by removing person-to-person interaction from the hospital registration process. Goodoc provides this service at about 2,300 hospitals and medical clinics nationwide.

Procedure of Goodoc`s unmanned hospital reception service

Category	Content
① Making of treatment reservation	▪ Patient selects hospital and medical department using Goodoc.
② Sharing of travel information to high-risk areas	▪ Upon registration at the hospital, the patient's history of travel to a high-risk area is shared and a warning issued automatically.
③ Acceptance of reservation	▪ Patient receives confirmation of receipt of treatment waiting number on his/her phone.
④ Provision of medical treatment	▪ Medical treatment is promptly provided at the hospital.

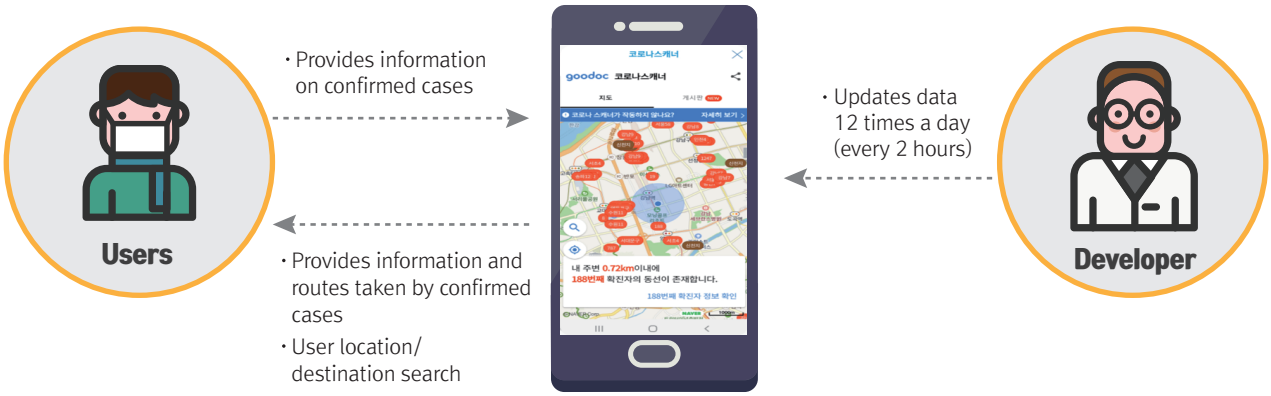
Developed by CareLabs

For use by General public (users)
/CareLabs (administrator)

▪ Service system of Corona Scanner

This service helps alleviate people's fear of infection and aids in their selection of low-risk travel routes by providing real-time information on the routes taken by confirmed COVID-19 patients.

Goodoc`s Corona Scanner



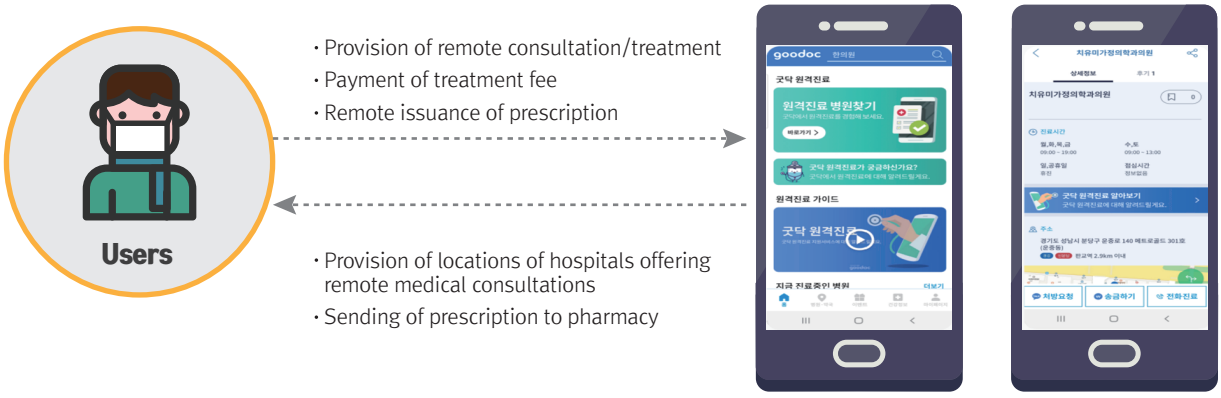
▪ Remote medical service support system

With the government having given certain permissions with the aim of minimizing the infection of medical staff across the country and medical institutions, the nation's first remote medical support service was released. About 100 hospitals are now offering this service through the Goodoc app, which allows patients to receive medical consultations via telephone from hospitals that provide remote medical service and receive their prescriptions and pay their medical consultation fees online.

To help cope with the COVID-19 outbreak, support is provided hospitals to cover the cost of the text messages sent while introducing the remote medical consultation service to patients. In addition, a search function is being provided with which users can easily find hospitals and pharmacies near them that offer remote medical consultations.

Goodoc

Service system of remote medical consultation platform



▪ Service system of Mask Scanner

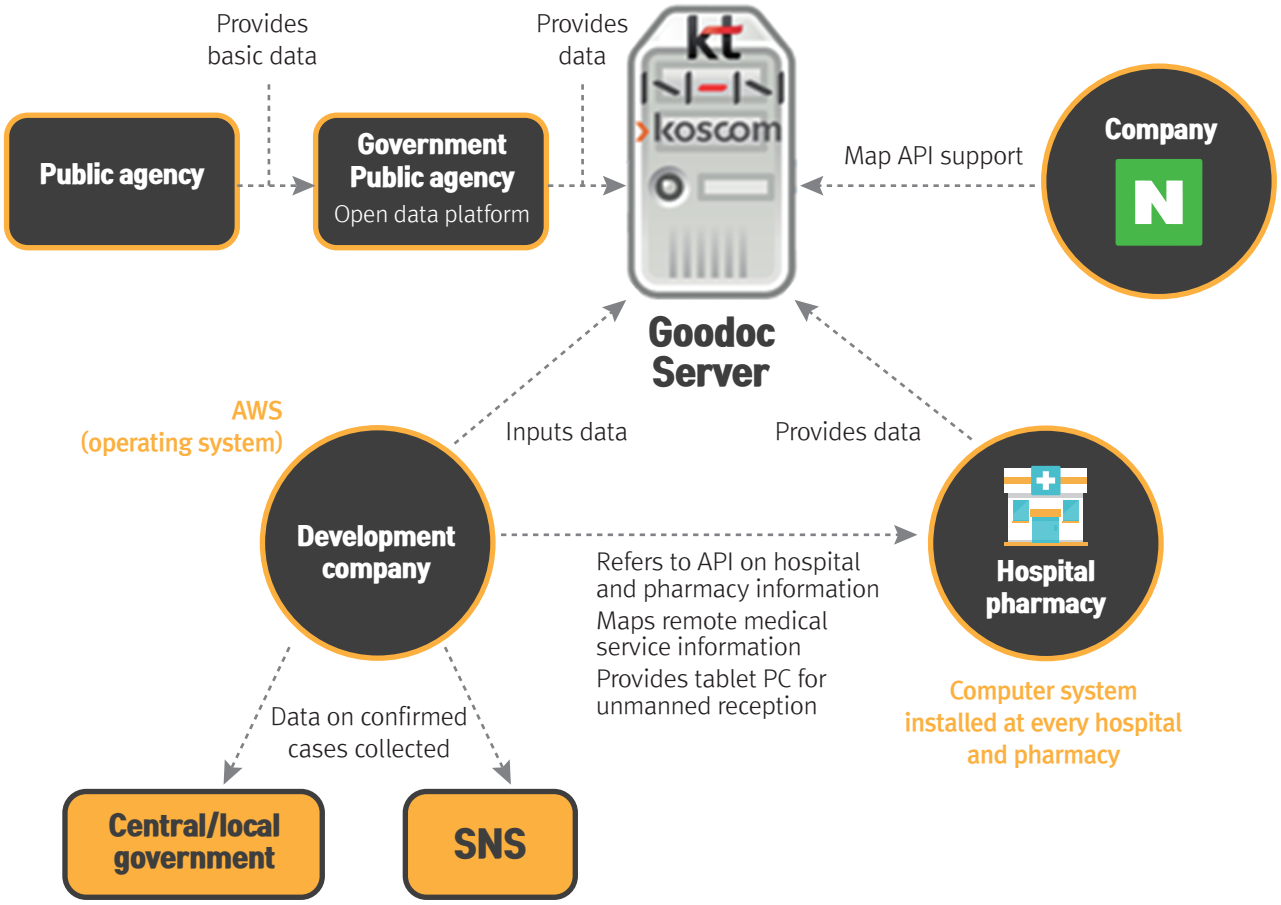
With this service, users can find information on the numbers of masks in stock at pharmacies and the duplicate purchase limit on masks. By combining this system with its information on hospitals and pharmacies nationwide (business hours, pharmacies open on holidays, feedback from pharmacy customers, etc.), Goodoc is able to offer a high-quality service.

Developed by CareLabs

For use by General public (users)
/CareLabs (administrator)

2. Hardware, Software Structure

The Goodoc service was developed through the cooperation of various private and public sector organizations. KT, NHN, and KOSCOM provided the development environment, including the development language, DBMS, and WAS, while Naver Cloud provided the API data server, hosting data such as information on pharmacies and numbers of masks in stock. Public agencies (Health Insurance Review and Assessment Service and National Information Society Agency) provided data such as information on hospitals, pharmacies, and mask supply in API form, while development companies provided web and app services based on the AWS cloud and created extra functions using their own APIs and algorithms.



Goodoc

05 Main Features

Given the current emergency situation, Goodoc added functions to its original service to help people cope with the COVID-19 outbreak. In particular, it added a service that allows users to make reservations for remote medical consultations and a function that automatically shares patients' travel information with hospitals.
Also, there are the Corona Scanner service, which shares the detailed routes taken by confirmed cases; the remote medical consultation support platform, which allows patients to receive medical consultations and prescriptions for medications without having to visit medical institutions; and the Mask Scanner service, which informs users of the numbers of masks in stock at pharmacies.

1. Hospital and pharmacy search service

This function provides the location maps, telephone numbers, business hours, and medical treatment information of all 90,000 domestic medical care institutions (hospitals, pharmacies, etc.) It allows users to easily search for hospitals by type, medical department, and symptoms on a map. Users can also search for hospitals that are open 24/7, allowing them to receive treatment at night or on holidays.

※ Open data of the Health Insurance Review and Assessment Service and National Medical Center (using the API of the National Information Society Agency) are used, and data integrity is maintained by allowing real users to report any errors in the information

Hospital and pharmacy search screen

▲ Search for hospitals

▲ Search for pharmacies

Developed by CareLabs

For use by General public (users)
/CareLabs (administrator)

2. Unmanned hospital reception service

Goodoc offers a function that works as an unmanned hospital reception service via tablets. Nationwide, about 2,300 tablets have been supplied, and about 600,000 patients have used the tablets to register upon arrival at a hospital.

These tablets are linked to the hospital's computer system, DUR, and ITS. When patients register at a hospital, their travel information can be instantly checked on the hospital computer system utilizing the data of the Center for Disease Control and Prevention and Health Insurance Review and Assessment Service. When someone who has recently traveled to a high-risk area registers, a warning is issued.

▲ Main screen of unmanned hospital reception service

Goodoc

3. Corona Scanner

This service began to be provided on February 27, 2020, providing statistics on confirmed cases and the routes they took via the web and app. This information is updated every two hours, 12 times a day, using the results of epidemiological surveys conducted by the Center for Disease Control and Prevention and information from the websites of about 230 local governments. Users can check the routes taken by confirmed cases, down to the meter, in relation to their current location. Also, by searching for details on specific areas, users can check the degree of the risk to which they may be exposed based on the movements of confirmed cases in their area.

▲ Main screen of Corona Scanner

4. Remote medical treatment support service

This service was released on February 27, 2020, according to the Korean government's announcement granting temporary permission to conduct remote medical treatment. With the Goodoc app, users can, without visiting a medical institution, receive remote medical consultation and treatment by phone or text chat. This service also allows hospitals to send patients' prescriptions directly to a pharmacy. Patients can also pay their treatment fees online.

To maximize accessibility, the service supports text chat with medical institutions through KakaoTalk, Korea's most popular domestic messenger app, and payment of treatment fees can be done through KakaoPay, a simple online payment platform. Searches of hospitals offering remote treatment services on a map are made possible by linking with Goodoc's medical care institution (hospital, pharmacy, etc.) search function, which is its core function.

Developed by CareLabs

For use by General public (users)
/CareLabs (administrator)

5. Mask Scanner

This function provides users with information on the numbers of masks in stock using mask sales data of the Health Insurance Review and Assessment Service (via the open API of the National Information Society Agency). It allows for the provision of a range of information by integrating the data of all hospitals and pharmacies nationwide, of which Goodoc was already in possession.

▲ Main screen of Mask Scanner

06 Contact information

Institution	Person In charege	email
Carelabs	Sam	sam.lee@goodoc.co.kr

CoronaNOW

01 Introduction

CoronaNOW (https://www.coronanow.kr) is a website and an application that posts updates on COVID-19 status in form of a dashboard showing case counts – confirmed cases, testing and deaths - based on official reports from KCDC. CoronaNOW also provides other types of information such as domestic actions taken to contain the virus, news updates, nearby COVID-19 screening stations, and links to online shops selling face masks at reasonable prices. In addition, it provides global COVID-19 updates by analyzing data released by foreign websites such as Johns Hopkins University and Tencent, China.

The main point of this service is to gather COVID-19 information scattered in multiple websites in Korea and overseas into an integrated platform and visualize the information using graphs and charts. Moreover, in order to ensure better access to real-time COVID-19 updates, CoronaNOW provides push notifications on the app service.

02 Background and Purpose

The Korean government has raised the national infectious disease risk alert level from 'attention' to 'caution' following the first confirmed case of COVID-19 in Korea on January 20, 2020. Since then, a lot of fake news were spread on SNS, saying for example, 'someone died from COVID-19 in Incheon', or 'more than 200,000 people died in China from COVID-19', which caused increasing anxiety among people. Before the virus started spreading wide, there was no such platform in Korea providing COVID-19 updates in dashboard, and this was one of the reasons behind the rapid distribution of fake news.

Against this background, two middle school students in Daegu, Hyungbin Choi and Chanhyung Lee, developed CoronaNOW to provide COVID-19 updates based on reliable sources of data with the aim of 'reducing social anxiety by offering correct information on the virus to all.' The two developers learnt from Google search and coding books and finally completed designing of the site after a week. The service was launched on February 3, 2020 and its mobile app (for Android) was released one month later on March 4, 2020. Currently, one more student has joined the team to assist in service maintenance and technical support.

Developed by
Hyungbin CHOI, Yeonsoo JUNG, and Chanhyung LEE
For use by All Koreans and Foreigners

03 Pre-requisite

CoronaNOW uses government briefings and press release as its reliable sources. The site basically requires servers as it provides web-based services and may also require HTML, Java Script, open source software (for web design) for website development. It also needs a web crawling tool for data collection and processing.

Type	Requirement
Data	▪ Public data released by the government
Hardware and Software	▪ Server (separate specifications required for simultaneous access by multiple users) ▪ SaaS (cloud-based software)
Framework	▪ Open source software (bootstrap)
Technology	▪ Web development (HTML, CSS, JAVA Script) ▪ Data collection/ processing (web crawling) ▪ Cloud

04 System Configuration

1. System Process

The CoronaNOW website was created by using basic HTML and Java Script. A web hosting provider offers servers for free and a startup provides a free customer support solution as well.

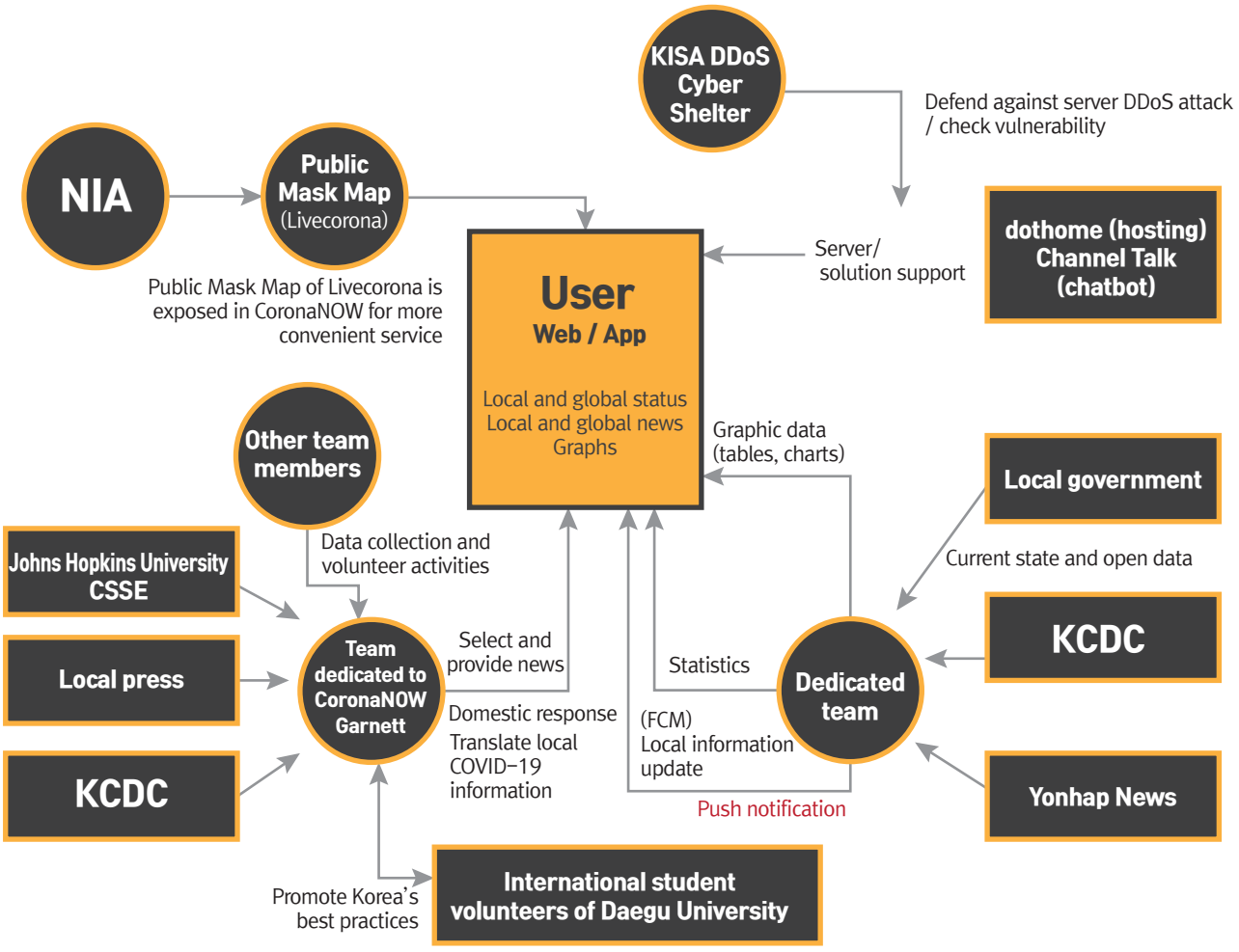
To provide COVID-19 updates in Korea, CoronaNOW uses data released by the government including press release and regular briefing reports. When the government releases official data, the team of developers manually put the data in and visualizes the information in graphs within 3 minutes. This is when push notifications are sent to app users in real-time via Google Firebase Cloud Messaging (FCM).

CoronaNOW

CoronaNOW also provides information on government-supplied face masks (public masks) by linking the app developed by Livecorona. Furthermore, it offers global COVID-19 updates in dashboard-form based on data obtained from reliable sources such as CNN, the Center for Systems Science and Engineering (CSSE), Bloomberg, and Tencent (a Chinese internet service provider).

Meanwhile, the team is working with international student volunteers from Daegu University to create contents like COVID-19 news, related videos, and data analysis lab, and introduce how Korea is dealing with COVID-19 to other countries in multiple languages.

CoronaNOW System Process



Developed by
Hyungbin CHOI, Yeonsoo JUNG, and Chanhyung LEE
For use by All Koreans and Foreigners

2. Hardware, Software Structure

The HTML-based CoronaNOW is developed by using a Bootstrap tool and its servers and infrastructure are provided by dothome (a web service infrastructure provider, http://dothome.co.kr). As CoronaNOW started gaining popularity from February 24, 2020, it became the most searched keyword in a Korean portal site and, unfortunately, the team experienced a server down*. According to monthly search volume data of Naver, it turned out that CoronaNOW was searched for about 9 million times. Its daily number of visitors is approximately 30,000, of which 150~300 are considered as average active users. In addition, over 1,300 users access to the site at the same time during daily COVID-19 briefing (10 AM) by the Central Disaster and Safety Countermeasures Headquarters (CDSCHQ). The website's cumulative page views are about 15 million and the number of app downloads is around 110,000 (from Google Play)**.

* According to Rankey.com, a market research company, the number of daily users of CoronaNOW increased to 63,200 in the 2nd week of Feb (from Feb 23 to 27) from less than 500 in the 1st week of the same month (from Feb 2 to 8).
** Number of user access, average active users, culminative page views, and app downloads are data as of Mar 2020.

CoronaNOW uses DDoS Cyber Shelter offered by Korea Internet and Security Agency (KISA) for users' seamless server access. As the Shelter provides proxies and caches, most of the server overloads are handled by KISA.

Server	Specifications
CPU	▪ E5-2670 8Core 2CPU
RAM	▪ 16GB RAM
DISK	▪ SAS 10K 600GB * 2 (Raid 1) , SATA 1TB * 1 (Raid 0)

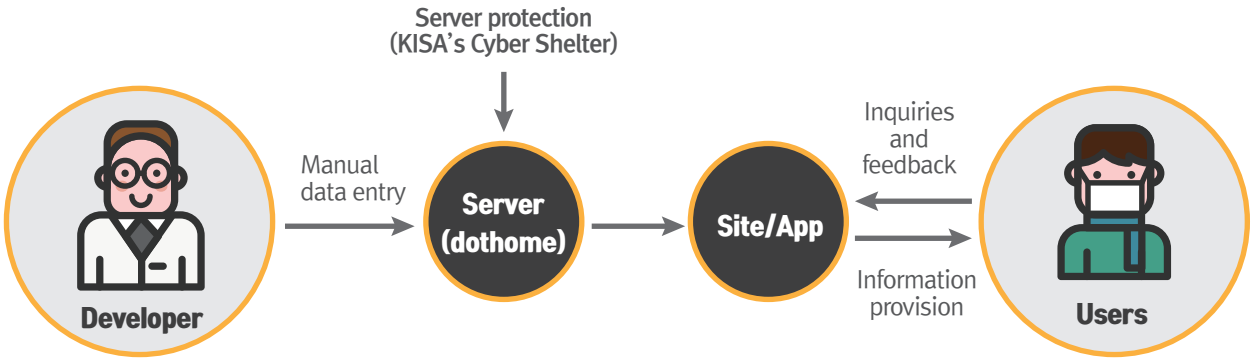
* Source: dothome

As CoronaNOW began to receive countless emails - 4 emails every 5 minutes - from users asking about COVID-19, a Korean SaaS startup (ZOYI Corporation) decided to provide an online business messenger platform called Channel Talk* free of charge. The messenger service provides automated answers to FAQs using 'Support bot', a chatbot answering multiple choice questions. Thanks to the Channel Talk service, CoronaNOW was able to provide automated answers to 60% of 1,500 inquiries per day.

* Channel Talk: A real-time customer service messenger program installed on homepage or mobile device

CoronaNOW

HW/SW Configuration



05 Main Features

The CoronaNOW service focuses on providing updates on COVID-19 case counts and responses in Korea and other countries in dashboard-form and accurate information on the disease through news updates and fact checks. This service is operated for the common good only and all revenues generated from ads are donated. It also has a public campaign feature to support local residents. In addition, it provides a chatbot service to efficiently respond to user inquiries and supports foreign language versions - English and Chinese.

1. COVID-19 Updates

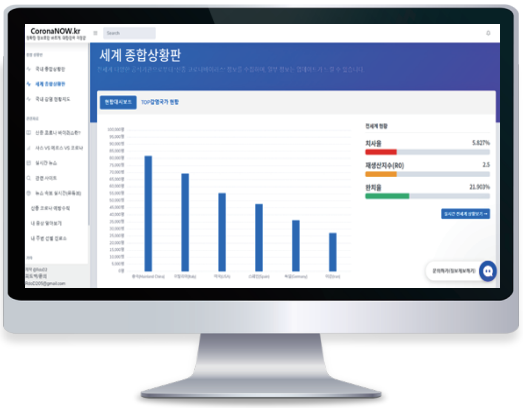
When a user visits the CoronaNOW website or the app, he/she can check the local and global COVID-19 status at a glance. It provides the number of cases confirmed, tested, released, deaths, domestic confirmed case analysis by timeline and case counts by region based on the data released by KCDC(Korea Centers for Disease Control and Prevention) and local governments, which the developers put in manually. CoronaNOW also provides information on COVID-19 patient information such as dates when they tested positive, hospitals they are admitted to, stage of infection, and current condition.

Moreover, it gives updates on the global fight against COVID-19 by analyzing data from foreign sites of the US, UK, and China, with information on fatality rates, recovery rates, and reproduction numbers*.

* The reproduction numbers refer to the transmissibility of virus, quantifying how many people contract virus from a single infected person.

Developed by
Hyungbin CHOI, Yeonsoo JUNG, and Chanhyung LEE
For use by All Koreans and Foreigners

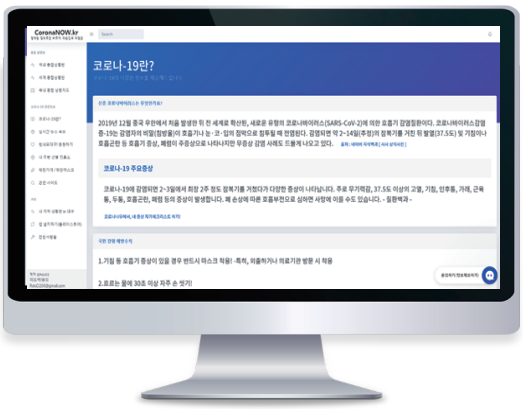
▲ Korea Dashboard



▲ World Dashboard

2. Information Delivery

In an effort to provide accurate information on COVID-19, CoronaNOW offers local and global news headlines, fact checks on COVID-19, and protection guidelines against the virus. It also offers a link to the website of Ministry of Health and Welfare (MOHW) introducing the list of designated national safe hospitals so users can find 'COVID-19 Screening Stations Near Me'. On 'My Area Update' (currently in service only for residents of Daegu) page, it provides confirmed case counts in the user's neighborhood and introduces nearby screening stations. In addition, it also introduces 'Good Mask Shops' where users can buy face masks at reasonable prices.



▲ COVID-19 Fact Check

▲ Good Mask Shops
My Area Update for Daegu

CoronaNOW

3. For the Common Good

The amount of all ad revenues* are transparently made open through the social media, and injected to purchase and donate supplies for medical workers who dedicated themselves to patient treatment and disease prevention in Daegu (donation made to Duryu Assembly Point of Daegu Fire Department, Daegu Medical Center, Keimyung University Dongsan Medical Center, and the 122nd regiment of the 50th army division).

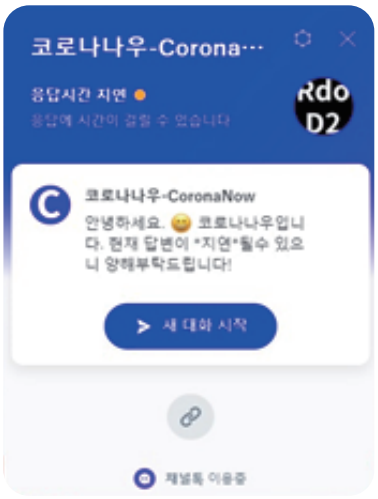
* The cumulative ad revenues since the launch of CoronaNOW from Feb to Mar 2020 are estimated at about USD 1,524 (or KRW 1.8M). However, no revenue is being generated now as Google temporarily suspended the account for having a rapid traffic increase, following its advertising policies.

In addition, CoronaNOW received messages from users to support medical workers in Daegu through the page, ‘Cheer Up, Daegu!’, selected around 100 users who sent messages and gifted them with stickers.

4. Additional Features

CoronaNOW operates an online chat service called ‘Channel Talk’ to help users easily provide information and feedback and ask questions. It also provides the service in English and Chinese for foreigners.

▲ Ad Revenues Open/Cheer up, Daegu!



▲ Channel Talk Service

Developed by
Hyungbin CHOI, Yeonsoo JUNG, and Chanhyung LEE
For use by All Koreans and Foreigners

06 Contact Information

Organization	Person in charge	email
Gosan Middle School	Hyungbin, CHOI	rdod205@gmail.com
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	Chanhyung, LEE	chanhyeong0806@gmail.com

Coronamap

01 Introduction

The purpose of the map service, Coronamap (https://coronamap.site/) is to help prevent the spread of the COVID-19 and share the status of COVID-19 infections. Coronamap provides contact tracing information from confirmed COVID-19 patients; It includes the number of confirmed cases, the location of the quarantined persons, and travel routes and visitation points using a map. Coronamap allows users to easily access geo-spatial information on confirmed cases based on their relative location.

The main features of Coronamap include the visualization of travel routes of confirmed COVID-19 patients by location and time, allowing users to view overlapping movement between the users and the diagnosed patients. The service also offers information on pharmacies where users can purchase face masks and allows users to view the number of masks currently available at each pharmacy based on their relative locations or selected destination. The information is also provided in English for foreign residents in Korea.

02 Background and Purpose

Fake news about COVID-19 was spreading* via social media and other channels when the COVID-19 pandemic began in Korea. In particular, unverified information about confirmed patients were being widely spread as fake news at the beginning of the COVID-19 outbreak, leading to distress and anxiety of the public.

* As of March 15, 2020, a total of 121 people were arrested for the production and spreading of false and misleading information related to the COVID-19 outbreak (National Police Agency).

As a response to this issue, a map service was created that tracks the movement of confirmed COVID-19 patients using data* officially provided by KCDC.

* Since April 8, 2020, dedicated personnel have been assigned to collect and process information officially announced by local governments for this service.

※ This service recorded a cumulative number of 40 million views (as of March 27, 2020) and is continuously updated by around 20 people.

Developed by Lee Dong Hoon
For use by Korean Citizens and
Foreign Residents in Korea

03 Pre-requisite

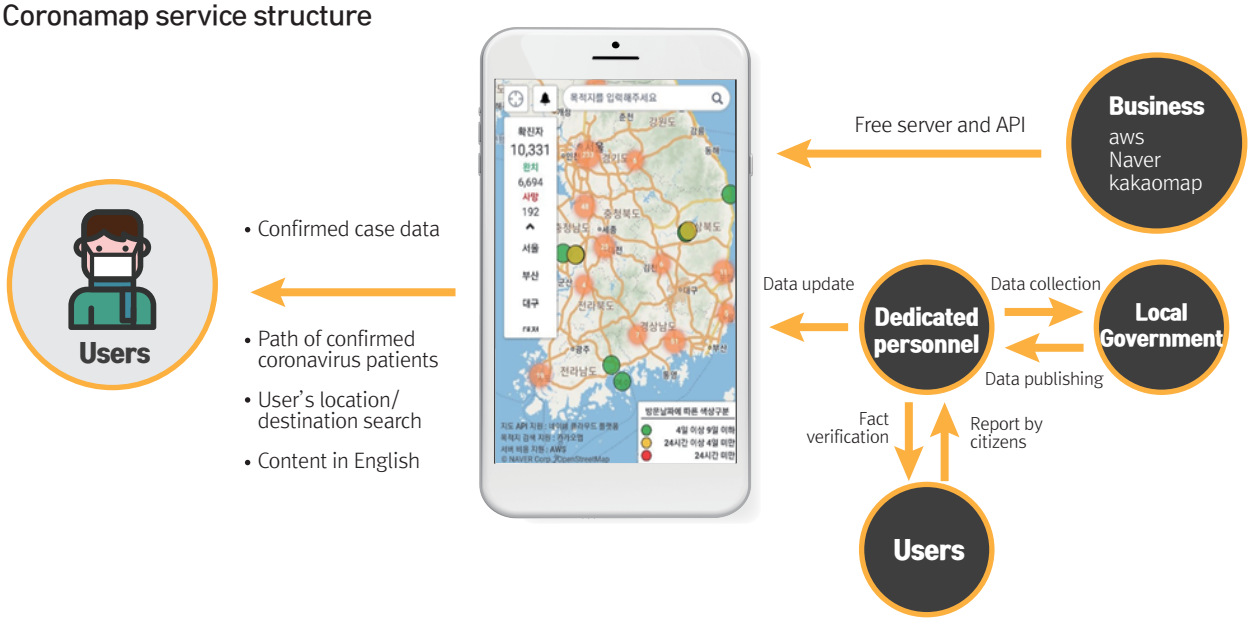
Coronamap requires processed data from confirmed COVID-19 cases by the central and local governments and a platform that can publish information via an API. Since Coronamap is a web application using open source software, it does not require the purchase of additional software. However, additional bandwidth and server costs may occur in the case of excessive use.

Category	Requirement
Data	▪ Confirmed cases of COVID-19, confirmed deaths, travel routes of confirmed patients, regional specific information, etc.
ICT Infrastructure	▪ Free map APIs to visualize geo-spatial data

04 System Configuration

1. System process

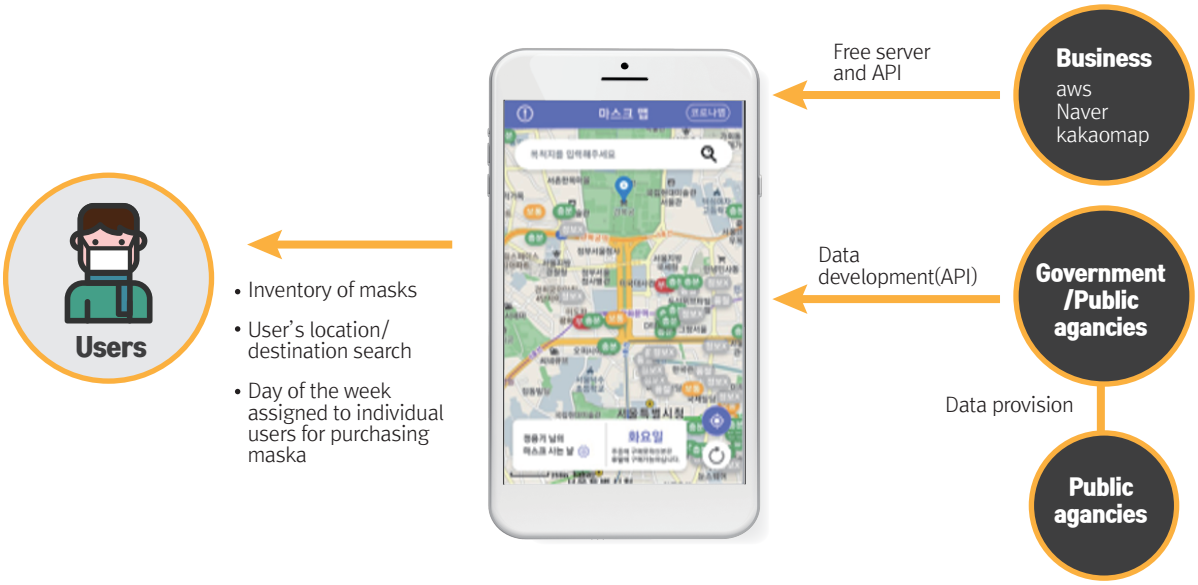
I Coronamap service structure



Coronamap

The dedicated personnel collect, process, and update information obtained from the data officially published by local governments.
Amazon Web Services (AWS) provides a web server free of charge, while Naver and Kakao provide cloud platforms and map APIs to support the Coronamap service operations.

Mask map service structure

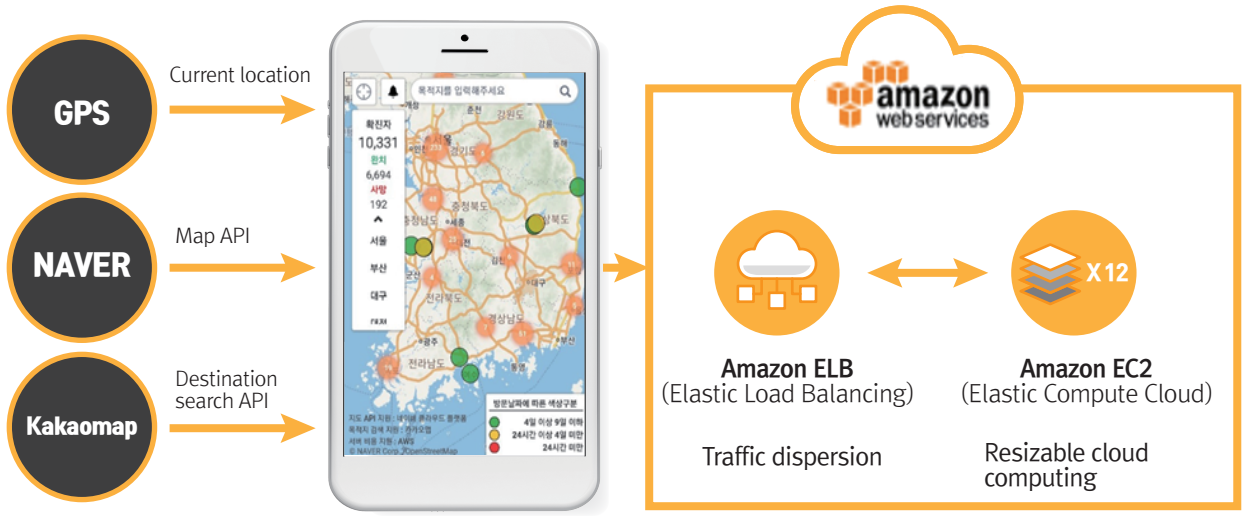


In addition, Coronamap provides a link to "Maskmap", a map service that provides the number of face masks currently available at pharmacies based on the current location or selected destination of users. It uses open public data provided via API (Application Programming Interface) from the Ministry of the Interior and Safety and National Information Society Agency.

Developed by Lee Dong Hoon
For use by Korean Citizens and
Foreign Residents in Korea

2. Hardware, Software Structure

Coronamap service structure



In addition, Coronamap provides a link to “Maskmap”, a map service that provides the number of face masks currently available at pharmacies based on the current location or selected destination of users. It uses open public data provided via API (Application Programming Interface) from the Ministry of the Interior and Safety and National Information Society Agency.

05 Main Features

Coronamap provides visualized movement history of confirmed COVID-19 patients that overlap with the selected travel path (origin/destination) of the user. This helps users to decide if they need to self-quarantine based on overlap of the travel routes of the user and confirmed COVID-19 patients. This service is also available in English for foreign residents.

Coronamap

1. Travel routes of confirmed COVID-19 patients

Coronamap provides visualization of the travel routes of confirmed COVID-19 patients for each region using a simple interface. Specifically, the service provides the number of confirmed cases by region and the time that each confirmed patient stayed at each location. In addition, the service presents important statistics including the number of confirmed, recovered cases, and fatalities by region.

Screens showing travel routes of confirmed COVID-19 patients

▲ Statistics of confirmed COVID-19 patients across the country

▲ Travel routes of confirmed COVID-19 patients by location and time

▲ Screening stations where COVID-19 patients have been confirmed

2. Current position and destination search

The service allows the user to compare the travel routes of confirmed COVID-19 patients with the user's position and selected destination. The destination search function is provided for free by a Korean company (Kakao).

Developed by Lee Dong Hoon
For use by Korean Citizens and
Foreign Residents in Korea

3. Maskmap

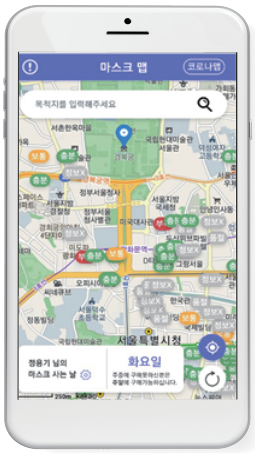
Maskmap provides visualized inventory data of face masks by pharmacies. The service allows users to view the current inventory, restock time and status update time of government-supplied face masks for each pharmacy under the 5-day rotation system for mask rationing* and supports searches according to the current position or selected destination.

* The new mask distribution system, which was introduced on March 5, 2020 as part of measures to stabilize the supply and demand of face masks, allows each person to purchase two masks per week (on a day of the week assigned to individuals according to birth year).

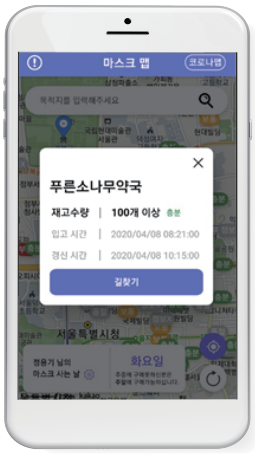
4. Additional features

English content is provided for foreign residents in Korea.

Main Features of Maskmap



Mask inventory by pharmacy



Mask inventory and restock time

Current position and destination search

06 Contact Information

Organization	Person in charge	email
Freelance Developer	Lee Dong Hoon	ehdgns1766@naver.com

Coronaita

01 Introduction

Coronaita (coronaita.com) is a web-based service that helps users search and find information at a glance on places in specific areas where COVID-19 patients visited, places that are on lockdown, or places of which disinfection are completed. With location-based data (GIS), Coronaita provides information on COVID-19 patient routes, facilities where cleaning and disinfection are completed, and places where users can buy face masks supplied by the government and remaining inventory of the masks.

02 Background and Purpose

At the onset of COVID-19 outbreak in Korea, travel routes of COVID-19 patients were mostly provided in texts. However, such data had some difficulties for users to acquire information they need. Also, users had to visit the homepage of each local government as updates on COVID-19 were made by individual local government. Moreover, as the government began to supply face mask to the public, people can now identify the location they can buy the masks but it was not easy to figure out the distance or availability.

Thus, Coronaita was developed to support users in checking travel routes of COVID-19 patients and lockdown areas more easily and intuitively. The service was launched on February 19, 2020, and over 6.4 million users visited the site, according to Google Analytics.

03 Pre-requisite

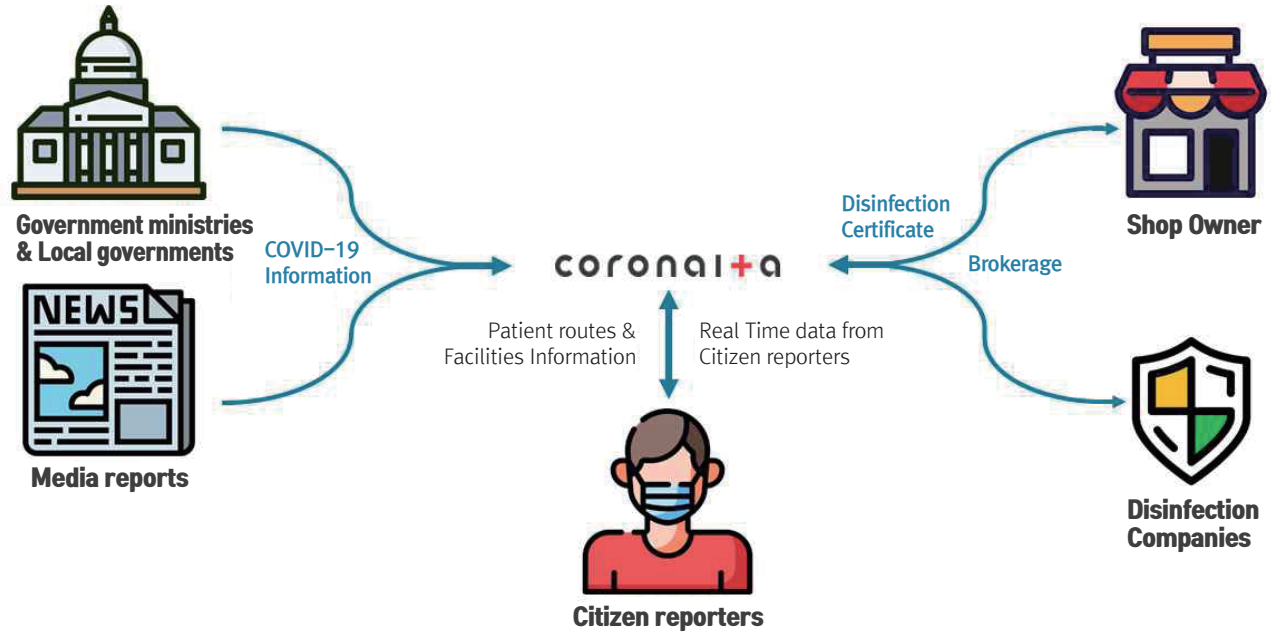
Coronaita obtains data on the routes of confirmed patients of Covid-19 through press releases and various media articles from the central and local governments. It also receives information through 'citizen reporters' via nine SNS (Kakao Talk) open chat rooms that are officially operated for each area. The services provided by Coronaita can be accessed through PC Internet browsers or mobile browsers.

Developed by The Dash Inc.
For use by all citizens

Category	Requirement
Database Infrastructure	▪ Public data though government ministries and local governments ▪ Various data from credible news companies ▪ Real-time data from selected 'citizen reporters'
Service Infrastructure	▪ Service accessed through http://coronaitda.com ▪ Service accessed and used through PC Internet browsers and mobile browsers

04 System Configuration

1. System Process



* Source: The Dash

Coronaita

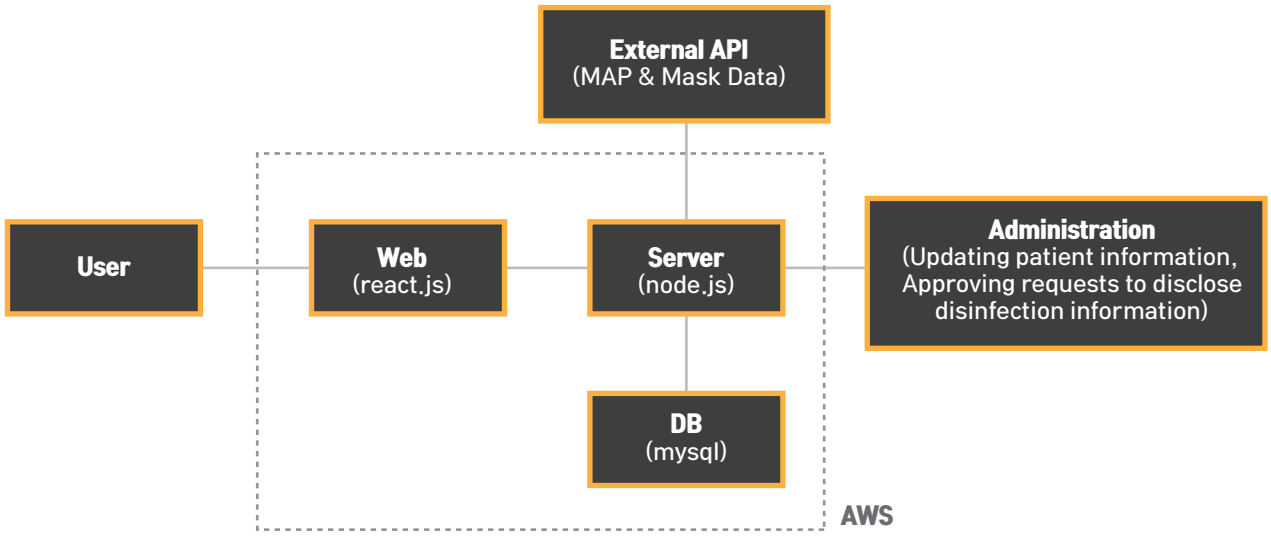
Team members of the Dash and its 'database partners' collect data released by the government ministries, local governments, and media reports. Also, the company officially operates each Kakao open chat room for nine regions, where about 7,000 citizen reporters share the information released by local governments with specified sources. The 'database partners' integrate the collected information and verify its credibility, and send it to 'database administrators' after compiling it by region. The 'database administrators' verify credibility of the information again and upload to the website.

With regard to COVID-19 disinfection data, shop owners and facility managers submit certificates of disinfection, issued by the competent local governments, to 'database administrators', who update the data after checking the certificates.

2. Software Structure

Coronaita is a server-based Web service optimized for PC and mobile. It is composed of internal database and external APIs to receive maps and data on government-supplied face masks.

The server manager updates database of confirmed cases, and manages and approves requests to disclose disinfection information via console function (admin). To be specific, the server manager converts excel files to CSV, automatically uploads latest information on confirmed cases in the database, approves or rejects request by shop owners to apply the disinfection information, and can also delete and make changes to the data.



Developed by The Dash Inc.
For use by all citizens

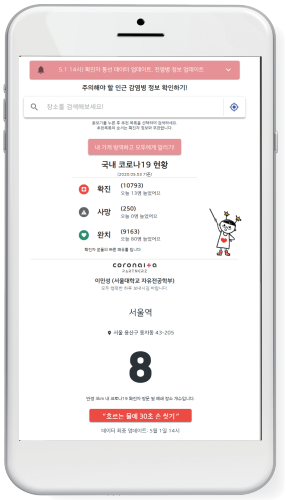
05 Main Features

The key services of Coronaita is 'Ita' search that helps users to check places where people confirmed with COVID-19 infection have visited, 'Eupda' search to check if disinfection is completed in places where the COVID-19 patients have visited, searching places to buy government-supplied face masks, and connecting shop owners to disinfection service providers.

1. `Ita` – searching places visited by COVID-19 patients

Users may submit the names of places they visited already or will visit as keyword. By doing so, they can find the information on where the COVID-19 infected people have visited at a glance. This service can be used to prevent the disease and self-check potential contact with the disease.

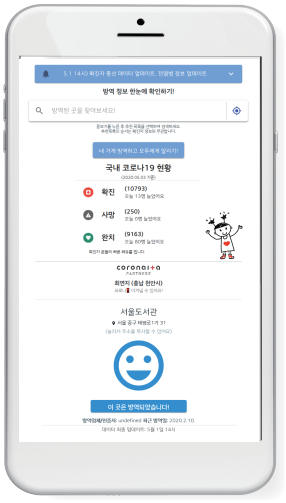
'Ita' – searching places visited by COVID-19 patients ▶



2. `Eupda` – searching places where disinfection is completed

Users can check whether the place they will be soon visiting is disinfected after a patient's visit. If the place is not disinfected or it is not registered in the database, places with similar keyword, where disinfection has been completed, appear below the search bar in the order of proximity.

'Eupda' – searching places where disinfection is completed ▶



Coronaita

3. Searching places to buy government-supplied face masks

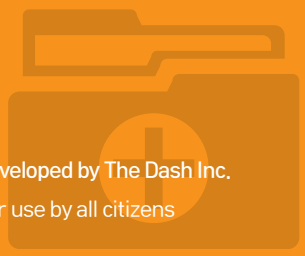
This service helps users find places to buy government-supplied face masks within 3km from the user's location.

4. Connecting shop owners with disinfection service providers

Coronaita connects disinfection service providers to shop owners. The Dash has signed MOUs with private disinfection service providers and connects them to users (shop owners, facility managers) through consultation if they need the service. Users are also provided with such service at a relatively lower cost.

5. Additional Features

Coronaita also initiated a campaign to deliver face masks to seniors living alone who have difficulties with purchasing masks. Users can participate and check the campaign status through the 'Share' page. Also, they can freely share information and opinions via the bulletin.



Developed by The Dash Inc.
For use by all citizens

06 Contact Information

Organization	Person in charge	email
The Dash, Inc.	Hak-jun, Kim	support@coronaita.com

CoronaBoard

01 Introduction

The COVID-19 Dashboard (https://coronaboard.kr/) was developed to provide information on the spread of COVID-19 to people around the world and real-time updates on COVID-19 in Korea as the outbreak has been labelled a pandemic. Also called CoronaBoard, this dashboard provides such information in Korean and English and has more versions for three countries: the US (coronaboard.com), France (coronaboard.fr), and the Netherlands (coronaboard.nl). It presents an overview on global spread of the disease as well as detailed information on situations in Korea including travel routes of COVID-19 patients, allowing people to protect themselves.

02 Background and Purpose

CoronaBoard was developed by two developers who have created emoji and other programs for a long time when concerns and fear over COVID-19 rapidly swept through the world. They updated information on the disease based on data released by Korea Centers for Disease Control and Prevention (KCDC), World Health Organization (WHO), and other health authorities of different countries and gained public trust through prompt updates and information reliability. Updates on COVID-19 in Korea include screening status, distribution of confirmed cases and its analysis. By providing such detailed information, it also contributes to promoting proactive response and efforts by the Korean government in the fight against the disease.

03 Pre-requisite

To operate the site, it should be linked with web sites serving as data sources such as COVID-19 page of KCDC which posts updates on the disease in Korea, and overseas safety information pages of the Ministry of Foreign Affairs (MOFA) website posting global COVID-19 updates.

Category	Requirement
Data	▪ KCDC COVID-19 updates including number of cases confirmed, deaths, released from the quarantine, COVID-19 screening stations, local health centers, patients' travel routes, stats on registered population, MOFA overseas safety information

Developed by Eunjin Joo, Youngjae Kwon
For use by Korean and foreign nationals

04 System Configuration

1. System Process

CoronaBoard provides detailed information on COVID-19 to local and international users who visit the website – the information provided includes global COVID-19 updates by country, cases in Korea, travel restrictions on Koreans, global charts, data charts on cases in Korea, guidelines to prevent the disease in daily lives, information on people confirmed of COVID-19 infection, headline news, and charts comparing COVID-19 with MERS-CoV and SARS-CoV.

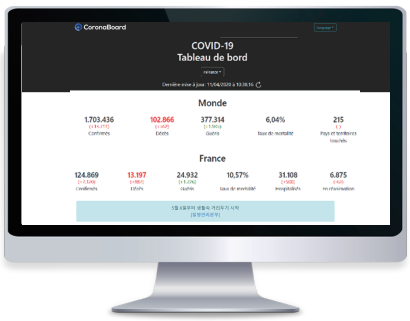
05 Main Features

CoronaBoard provides visualized data on COVID-19 in Korea, the US, France, and the world to help users comprehensively understand the situation. The key features of CoronaBoard include COVID-19 dashboard, cases by country, cases in Korea, and data charts.

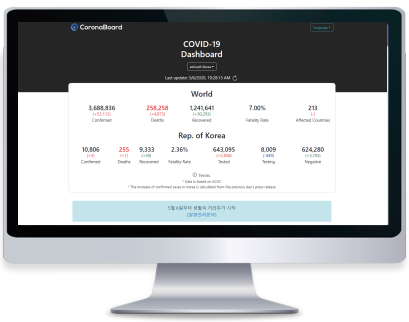
1. COVID-19 dashboard

COVID-19 real-time dashboard offers global updates, case counts in Korea, the US, and France providing information such as confirmed cases, deaths, recovered, fatality rate, data on screening including total number of testing done, total number of screenings in progress, total number of negative cases with the date of its update.

▲ Real-time Dashboard (Korea)



▲ Country Dashboard (France)



▲ Country Dashboard (US)

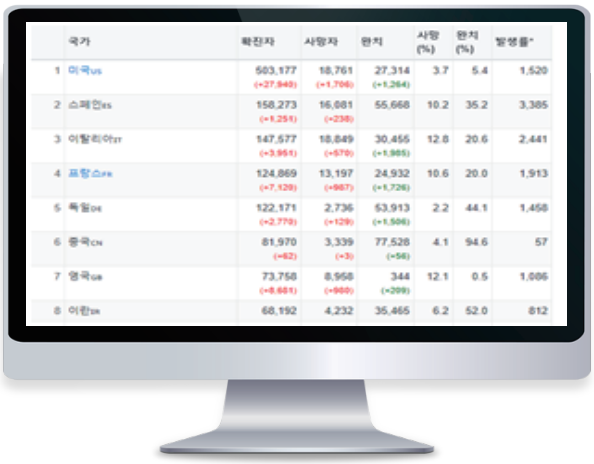
CoronaBoard

2. COVID-19 global updates

Users can find the number of confirmed cases and deaths of a country by clicking the country on the global map. Case counts are also provided in form of a list, showing the number of confirmed cases, deaths, recovered, fatality and recovery rates, and incidence in order.

Users can select each category of confirmed cases, deaths, recovery rate, and population and find the figure on the map and the list shows updates of 211 countries.

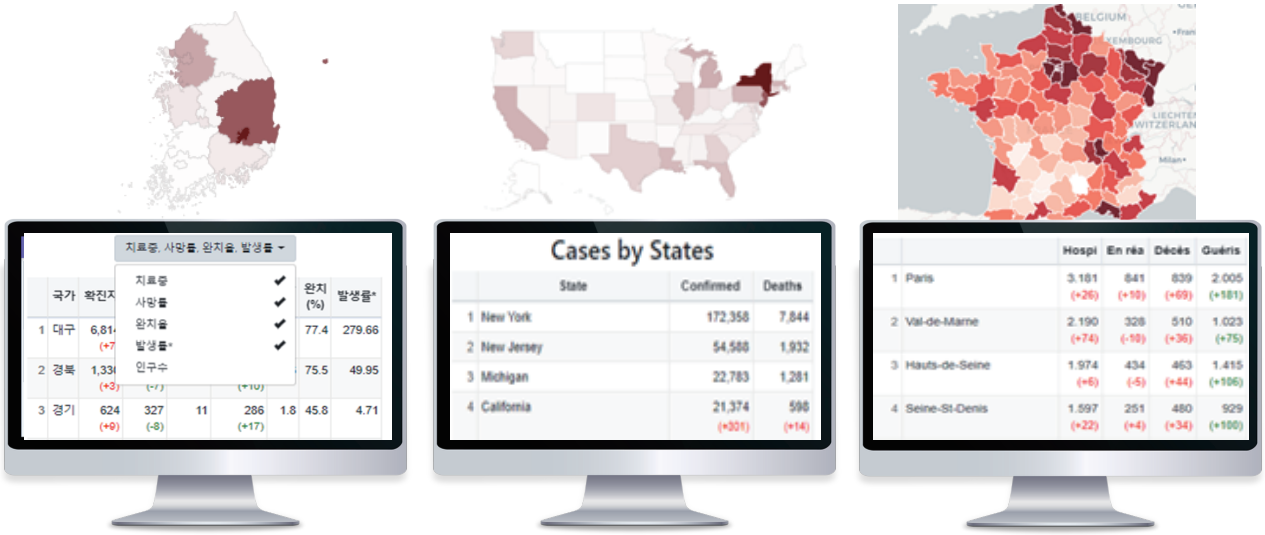
▲ Global update (map)



▲ Global update (list)

3. COVID-19 country updates (Korea, US, France)

COVID-19 update by country (ex. Korea) provides information on confirmed cases, active cases, deaths, released, and incidence. Here, the incidence indicates the total number of confirmed cases per 100,000 population and the active case means the number of those confirmed after subtracting deaths and those released from quarantine.



▲ Korea (map, list by cities)

▲ US (map, list by states)

▲ France (map, list by cities)

4. Global charts

Global data charts provide Global COVID-19 trends, cumulative cases by country, global trend in log scale (confirmed, deaths) by using e-chart. Each chart provides both cumulative and daily trends, and users can check them by selecting a country in the slide bar. The confirmed, deaths, and released cases of COVID-19 trends are displayed in the chart.

▲ Global COVID-19 cases trend

▲ Cumulative cases by country

▲ Global trend in log scale

CoronaBoard

5. Data charts of Korea

Data charts of Korea provide more detailed information on COVID-19 status in Korea than global charts. Users can find COVID-19 trends by date, cumulative cases by region, screening stats, confirmed cases by region, spread of infection by source, number of confirmed patients by gender and age group.

COVID-19 case trends in Korea provides cumulative and daily trends on confirmed, deaths and released as well as cumulative status by region. Testing status in Korea indicates total number of testing completed, confirmed rates, testing in progress by daily and cumulative charts. Status by region provides the status on confirmed cases, deaths, released by region. Status by source indicates the data on infected region or infection source such as inbound travelers, nursing homes, sports facilities, contact with other COVID-19 patients in a selected region via charts. Data charts of Korea also provide status by gender and age group.

▲ COVID-19 trends

▲ Cumulative trend

▲ Testing in Korea

▲ Status by source

▲ Status by gender

▲ Status by age group

6. Confirmed patient information

The case details section provides information on people confirmed of COVID-19 infection and their travel routes to help others protect from disease infection. It also provides information on contacted persons, current health conditions, and infection routes and sources.

06 Contact Information

Organization	Person in charge	email
Independent developer	Eunjin Joo, Youngjae Kwon	coronaboard.report@gmail.com

COVID-19 Chatbot

01 Introduction

COVID-19 Chatbot (http://answerny.ai) is designed to provide transmission routes of COVID-19 and other related information to the public as the disease spreads throughout the country. This cloud-based service software (SaaS) integrates public data available from Korea Centers for Disease Control and Prevention (KCDC) and Ministry of Health and Welfare (MOHW) with a chatbot service called WISE Answerny to provide information to the public. Unlike existing chatbots focusing on answering to simple FAQs and providing information on confirmed cases only, COVID-19 Chatbot offers information customized to each user target such as confirmed patients or people under self-quarantine. Wisenut, the developer of COVID-19 Chatbot, allows government organizations to post the link on their homepages for free, helping them provide reliable and seamless public services.

02 Background and Purpose

For the first month after the first COVID-19 confirmed case outbreak on January 20, 2020, the transmission of the disease was slow. Local governments and public agencies were able to provide accurate information based on the result of epidemiological investigations by KCDC and respond to civil complaints.

However, the disease began spreading rapidly throughout the country from February 20, 2020. Rumors and false information also spread wide and the public agencies faced difficulties in responding to COVID-19 inquiries. Accordingly, Wisenut decided to develop COVID-19 Chatbot beta service by applying its own AI chatbot technology and know-how to the public data so as to inform people on how to prevent or cope with the infectious disease and help public agencies provide prompt and appropriate public services.

03 Pre-requisite

COVID-19 Chatbot uses public data from KCDC and MOHW as the source of information. It connects Wisenut's own chatbot solution with the internet to collect and process data and provides the output.

Developed by Wisenut

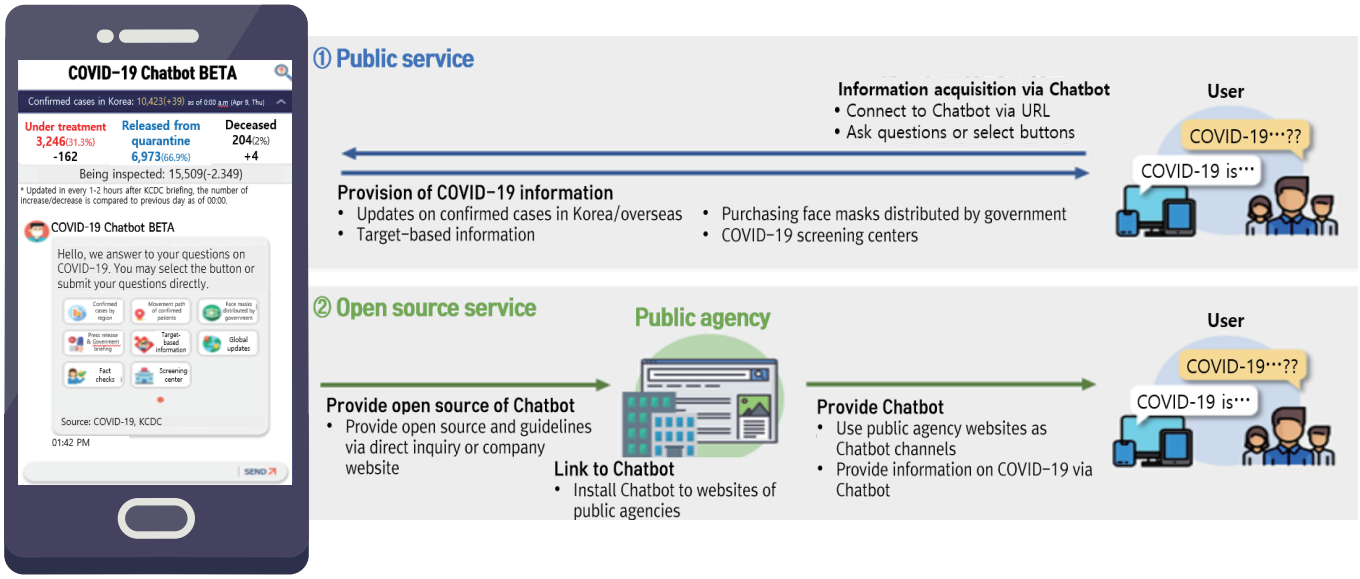
For use by All Korean Citizens

Type	Requirement
Data	▪ Public data released by KCDC and MOHW (confirmed case counts, patients' travel routes, public mask information, international update, screening stations information, etc.)
ICT Infrastructure	▪ User homepage to interoperate with COVID-19 Chatbot ▪ Web connection (HTML, Java Script, etc.) ▪ Data collection and processing (web or manual crawling) ▪ Service used – cloud-based AI chatbot service 'WISE Answerny'

04 System Configuration

1. Service Process

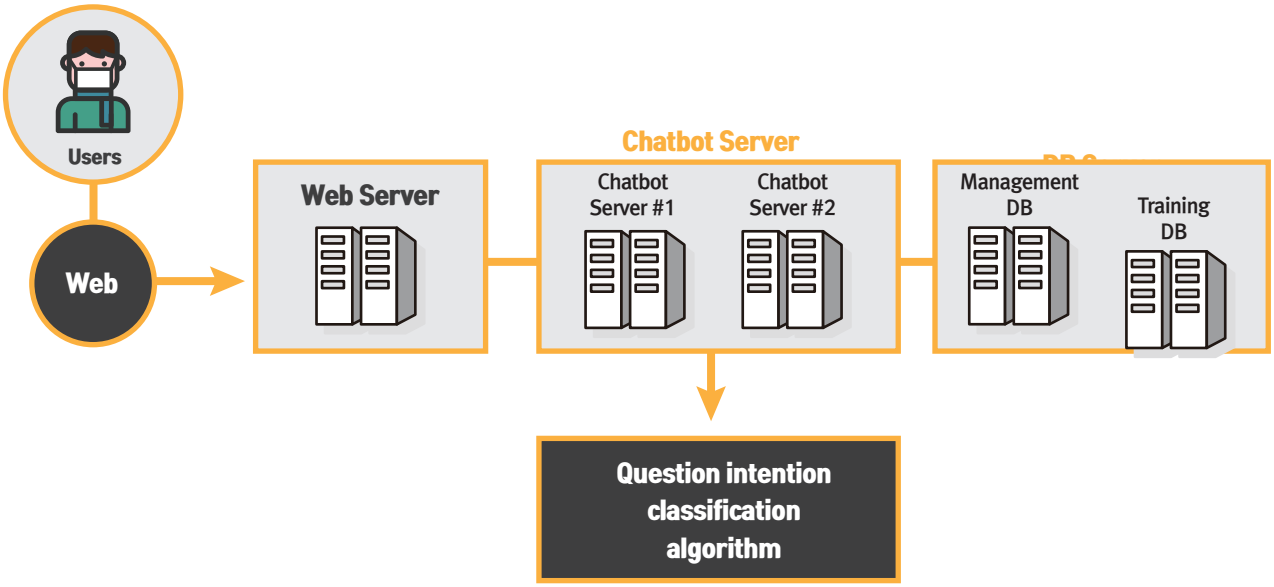
COVID-19 Chatbot understands which button a user has chosen or analyzes the question inputs and provides the right information accordingly. It is also an open source service that enables organizations to directly provide their own COVID-19 information.



COVID-19 Chatbot

2. System Configuration

COVID-19 Chatbot System Configuration



When a user accesses the web server via the internet and inputs questions, the chatbot identifies the intent of the question through its analysis algorithms. Then, it imports related data from the database server and provides answers to the user.

05 Main Features

COVID-19 Chatbot is a service that provides COVID-19 information, such as updates of Korea and other countries, public mask purchase guidelines, and information customized to each user target, for example, confirmed patients or people under self-quarantine.

1. Q&A

COVID-19 Chatbot has an interactive interface. It uses machine learning to identify the intent of questions a user asks in natural language*, just as he/she would say in everyday life, and it gives appropriate answers or information back. Also, users can choose click buttons for prompt information reply or obtain wanted information through links to other websites and file downloads.

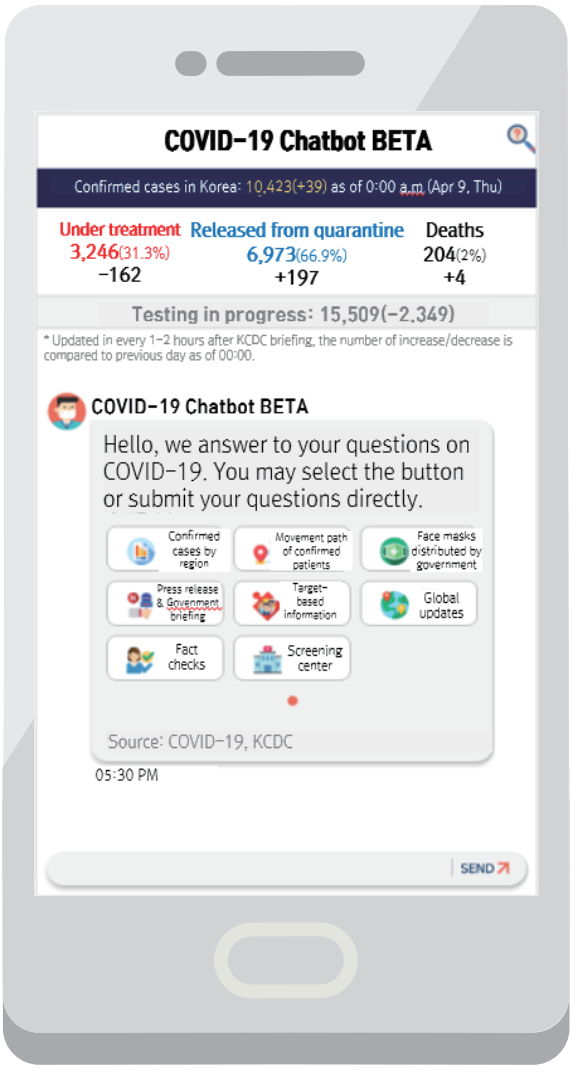
Developed by Wisenut
For use by All Korean Citizens

* The Chatbot gives information on confirmed cases of other countries as an answer to ‘How many COVID-19 confirmed cases overseas?’, ‘Let me know COVID-19 situation abroad’, ‘Show me the confirmed cases of different countries’

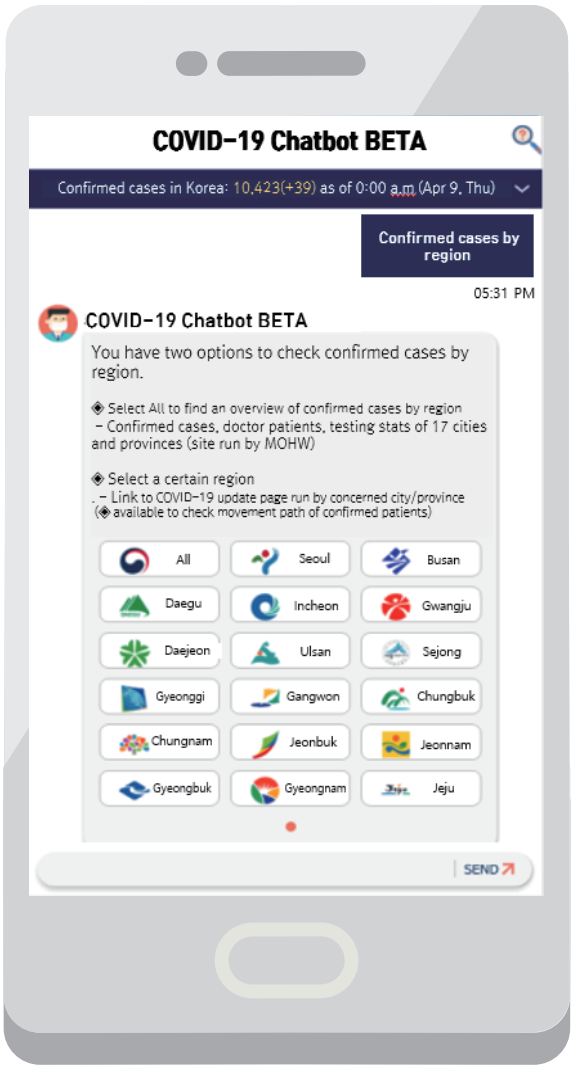
2. Provision of key information

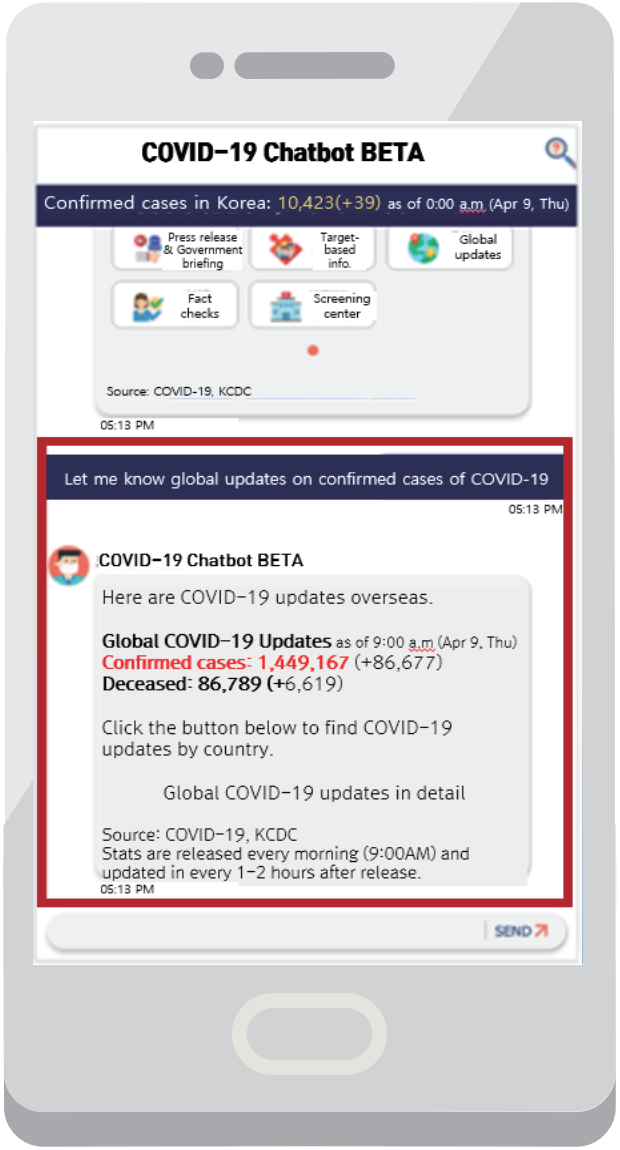
With COVID-19 Chatbot, users can find important information on the disease including updates on confirmed cases in Korea and overseas, customized information and travel routes of confirmed patients.

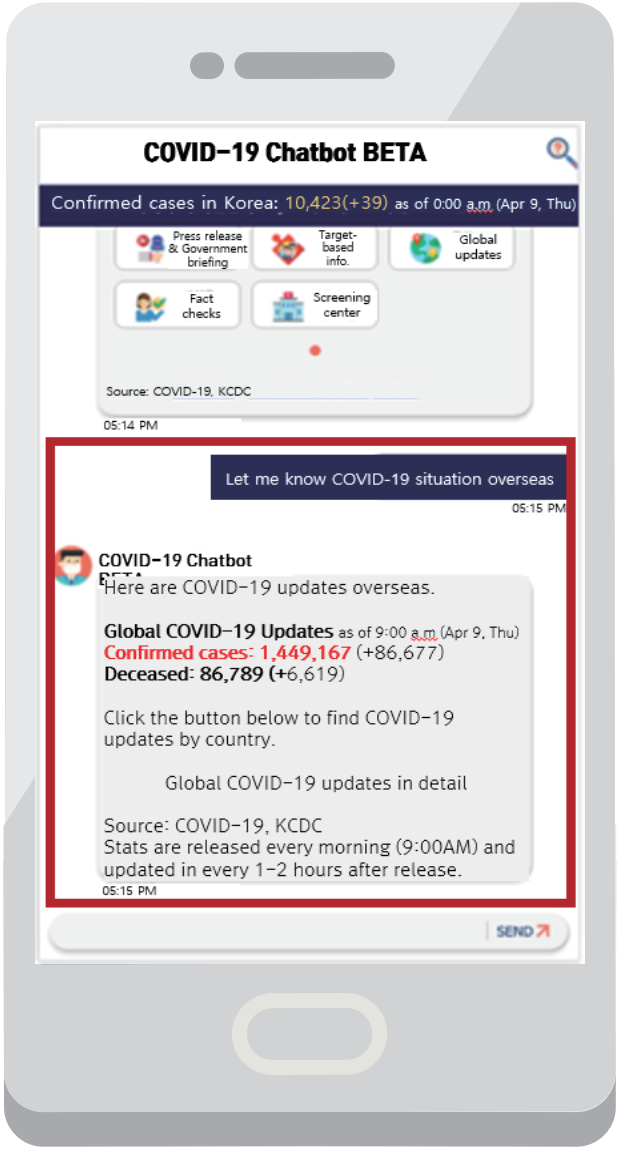
Updates on Confirmed Cases

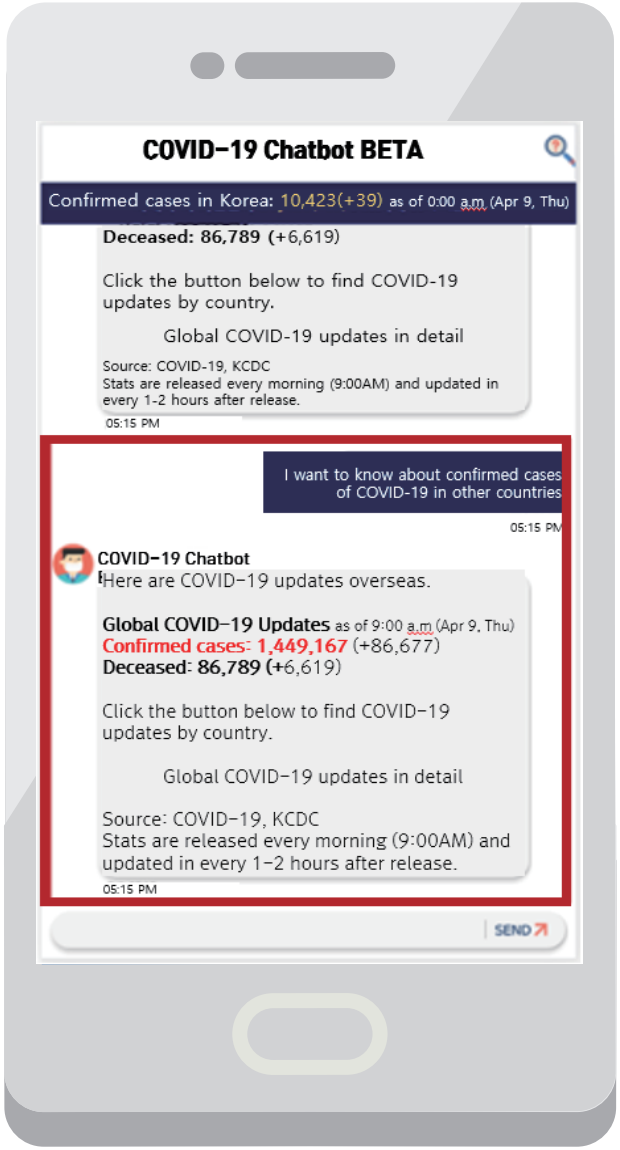


Confirmed Cases by Region




COVID-19 Chatbot BETA
Confirmed cases in Korea: 10,423(+39) as of 0:00 a.m (Apr 9, Thu)
Press release & Government briefing
Target-based info.
Global updates
Fact checks
Screening center
Source: COVID-19, KCDC
05:13 PM
Let me know global updates on confirmed cases of COVID-19
05:13 PM
COVID-19 Chatbot BETA
Here are COVID-19 updates overseas.
Global COVID-19 Updates as of 9:00 a.m (Apr 9, Thu)
Confirmed cases: 1,449,167 (+86,677)
Deceased: 86,789 (+6,619)
Click the button below to find COVID-19 updates by country.
Global COVID-19 updates in detail
Source: COVID-19, KCDC
Stats are released every morning (9:00AM) and updated in every 1-2 hours after release.
05:13 PM
SEND


COVID-19 Chatbot BETA
Confirmed cases in Korea: 10,423(+39) as of 0:00 a.m (Apr 9, Thu)
Press release & Government briefing
Target-based info.
Global updates
Fact checks
Screening center
Source: COVID-19, KCDC
05:14 PM
Let me know COVID-19 situation overseas
05:15 PM
COVID-19 Chatbot
Here are COVID-19 updates overseas.
Global COVID-19 Updates as of 9:00 a.m (Apr 9, Thu)
Confirmed cases: 1,449,167 (+86,677)
Deceased: 86,789 (+6,619)
Click the button below to find COVID-19 updates by country.
Global COVID-19 updates in detail
Source: COVID-19, KCDC
Stats are released every morning (9:00AM) and updated in every 1-2 hours after release.
05:15 PM
SEND


COVID-19 Chatbot BETA
Confirmed cases in Korea: 10,423(+39) as of 0:00 a.m (Apr 9, Thu)
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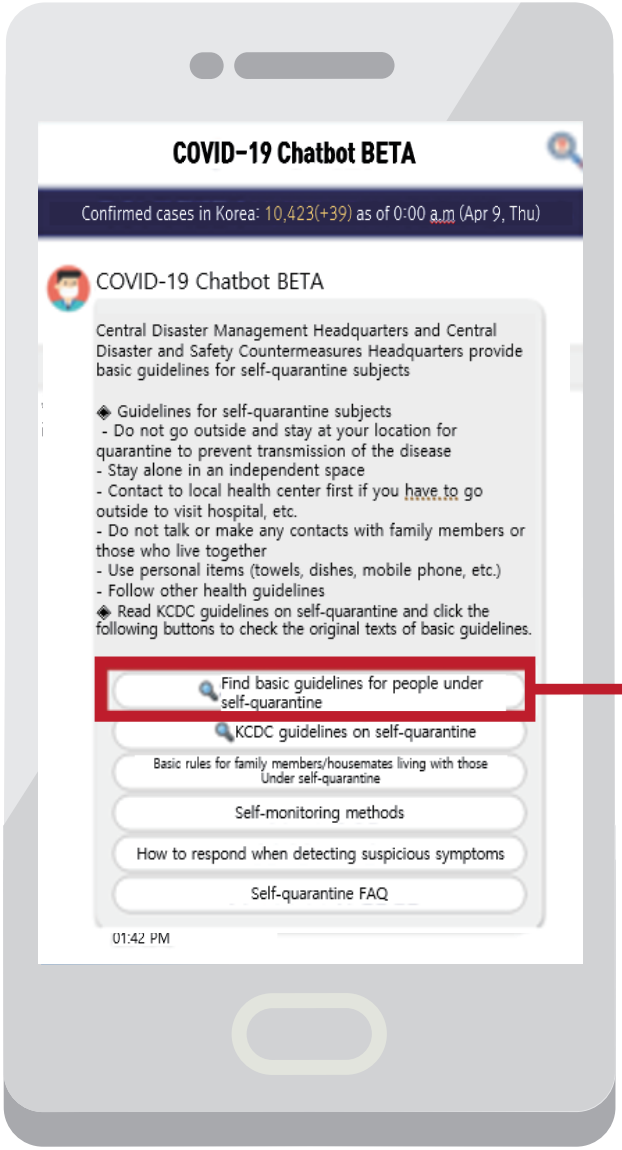
Click the button below to find COVID-19 updates by country.
Global COVID-19 updates in detail
Source: COVID-19, KCDC
Stats are released every morning (9:00AM) and updated in every 1-2 hours after release.
05:15 PM
I want to know about confirmed cases of COVID-19 in other countries
05:15 PM
COVID-19 Chatbot
Here are COVID-19 updates overseas.
Global COVID-19 Updates as of 9:00 a.m (Apr 9, Thu)
Confirmed cases: 1,449,167 (+86,677)
Deceased: 86,789 (+6,619)
Click the button below to find COVID-19 updates by country.
Global COVID-19 updates in detail
Source: COVID-19, KCDC
Stats are released every morning (9:00AM) and updated in every 1-2 hours after release.
05:15 PM
SEND

Answering to Natural Language Questions



Guidelines for self-quarantine subjects

http://ncov.mohw.go.kr/shBoardView.do?brdid=2&brdGubun=22&ncvContSeq=6

Copy URL

Guidelines for self-quarantine subjects

· Do not go outside and stay at your location for quarantine to prevent transmission of the disease

· Stay alone in an independent space

– Close the door and open the window to ventilate frequently, eat by oneself.

– If it is possible, be in the place where only one can use a toilet and a washstand.

* If you use public toilet and washstand, disinfect(by using Sodium hypochlorite) them after use and then let others use.

Contact to local health center first if you have to go outside to visit hospital, etc.

· Do not talk or make any contacts with family members or those who live together

– If it is necessary to contact, do not face each other, wear a face mask, keep 2m distance from each other.

· Use personal items (towels, dishes, mobile phone, etc.)

– Do single laundry of clothes and bedding.

– Put dishware apart from the rest so that others do not use them before washing.

· Follow other health guidelines

– Wash your hands in the running water with a soap, Wear a mask if you have respiratory symptoms such as cough, if you do not have a mask, cough with your mouth covered with your sleeve, After you cough, wash or sterilize your hands.

Self-monitoring in below way for 14 days after touching confirmed patient

Self-monitoring methods

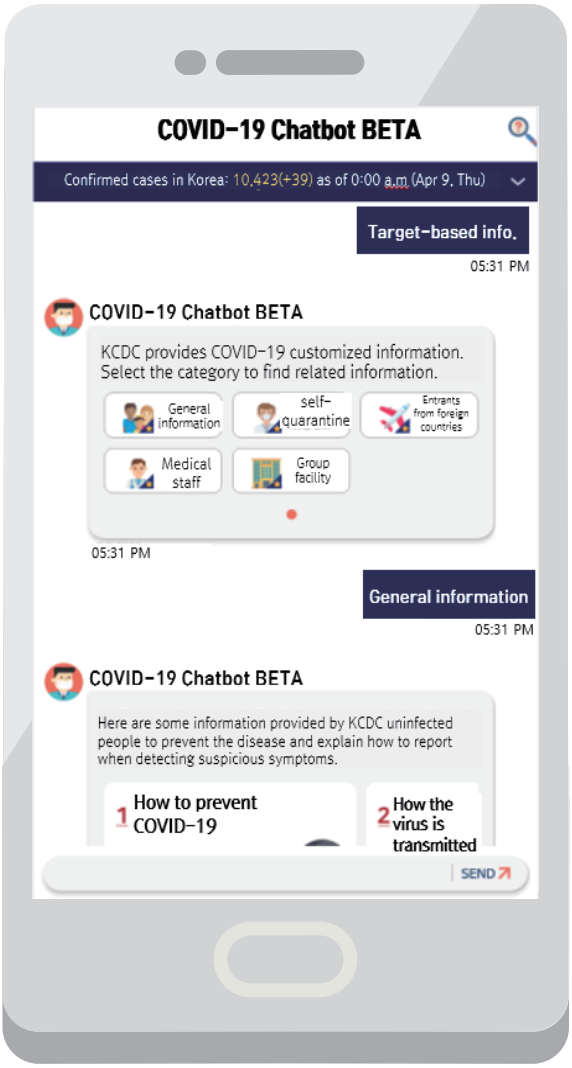
· Check your temperature every morning and night, and check your physical condition if you get the infectious symptoms like respiratory symptoms by yourself.

· Keep in touch with public health center, and let them know whether you have infectious symptoms* or not.

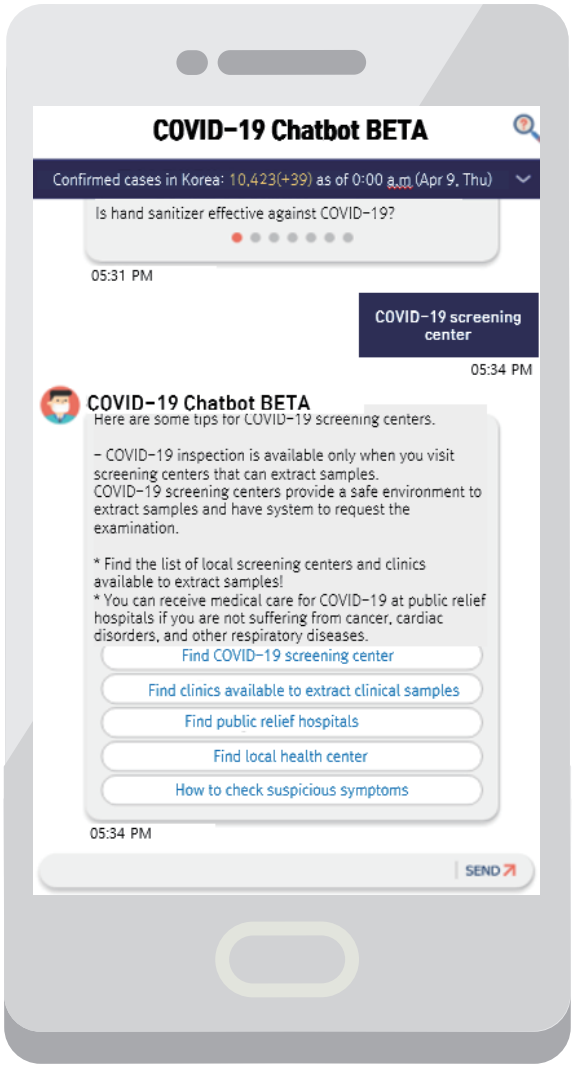
* Fever(over 37.5'C), Respiratory symptoms(Cough, sore throat, etc.), pneumonia is the main symptom.

COVID-19 Chatbot

Target-based information



Info. on COVID-19 screening center



06 Contact Information

Organization	Person in charge	email
Wisenut	Da yeon, Jung	sandy@wisenut.com

Conclusion

The Ministry of Health and Welfare of the Republic of Korea emphasizes that the efficient use of medical resources – such as conducting extensive diagnostic tests on those at higher infection risk to identify patients as soon as possible, and ensuring proper treatment according to classification of the severity of the confirmed patients – can reduce fatalities and prevent collapse of the medical system.
Although it is too soon to declare success at a time when the COVID-19 pandemic has yet to come to an end, there is already a flood of requests from around the world for information and support regarding ICT-based innovative government policies of Korea. The WHO has also invited President Moon to share Korea's comprehensive response to COVID-19 (proactive testing and contact tracing) with leaders from other countries in the world.

There are three main reasons why Korea was able to respond quickly and creatively to the COVID-19 pandemic by utilizing ICTs.

First, the government's open data policies and creative ideas from private developers combined together to develop innovative ways to share information, such as the travel routes of COVID-19 patients, information on the status of face mask supply, screening stations, etc. Using publicly available data from the Ministry of Health and Welfare, the Korea Centers for Disease Control and Prevention, and local governments, various apps that respond to the COVID-19 pandemic such as location-based face mask inventory apps, COVID-19 status monitoring map services, etc., are being created every day. The functions of these open data-based apps have evolved immensely with the feedback and participation of the citizens who use these apps. Because citizens have access to transparent and accurate information, they have come to trust government policies, leading to voluntary and active participation in social distancing measures.

Second, as a way to promote data, network, and AI related (D-N-A) industries in preparation for the 4th Industrial Revolution, the government provided high-performance computing resources to develop AI algorithms, financial support for purchasing data and processing services, and revised the legal framework to allow businesses and individuals to have access to anonymized personal information. As a result, epidemiological investigations have been automated by utilizing telecommunications data and credit card information for rapid and accurate contact tracing and quarantine management; Artificial Intelligence has been applied in innovative ways to develop COVID-19 testing kits and therapeutic agents, and improve X-ray analysis – all as a part of an effective response to COVID-19.

Third, Korea has constantly pushed to transform itself into a digital government for innovative governance and improving public services. Starting with the foundation of a network infrastructure in the 1990s, Korea has steadily prepared for a digital government according to thematic roadmaps to enhance administrative efficiency and increase transparency since the 2000s, resulting in the worldwide recognition of ranking first place three consecutive times in the UN e-Government Survey. This overall environment provided the foundation necessary for the systematic operations of the health and quarantine systems, as well as the smooth coordination between organizations, even in an urgent situation such as the COVID-19 pandemic.

In this moment, approximately three months from the first confirmed COVID-19 patient in Korea, we believe that the Korean government's response based on the three principles of openness, transparency and democracy, the use of innovative ICT technologies, the mature civil response of the citizens and the commitment of healthcare professionals will enable Korea to overcome the COVID-19 pandemic.

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ICT Korea against COVID-19 pandemic
is overall ICT utilizing cases for tackling
COVID-19 Pandemic of Korea.
Thank all of those who participated as
a Supervisory Committee.

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NAVER / Executive Officer / Ha, Jung-woo
Nemustech / CEO / Lee, Seungjong
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Global Digital Government Cooperation Team / Researcher / Lee, Seorin
Global Digital Government Cooperation Team / Researcher / Lee, Konju

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NIA hopes these cases could be a little bit of reference for **COVID-19 termination worldwide**.

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