A CONCEPTUAL FRAMEWORK FOR AN INTELLIGENCE NATURAL DISASTER MANAGEMENT SYSTEM

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BIG DATA

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I. Case study of Intelligent Disaster Management System
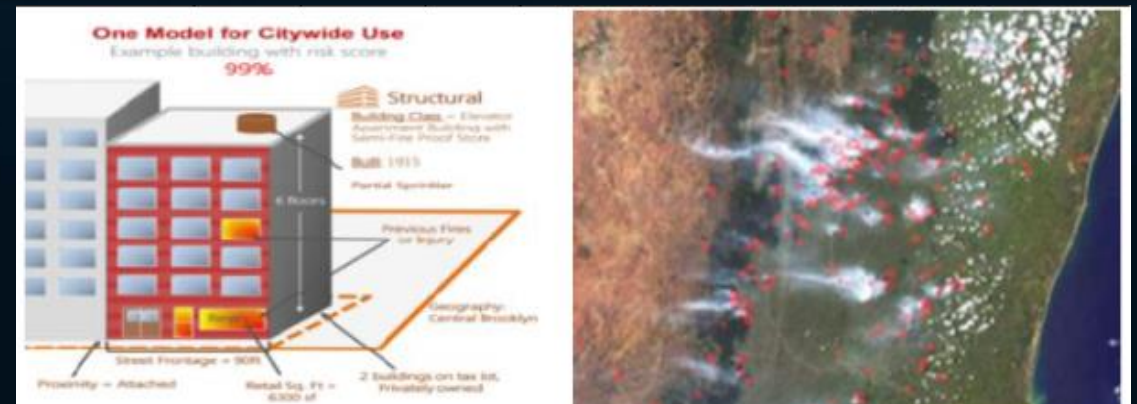
◉ Big Data Based Disaster Response System

Climate Prediction Center

o Collect, create and make DB maps of various climate parameters such as daily, monthly data and temperature

o => check the US daily precipitation analysis based on the DB data in the precipitation map

o Collect and analyze data on past and present atmospheric and marine conditions, El Niño Southern Oscillations (ENSO, stratospheric ozone, and other climate patterns such as temperature)
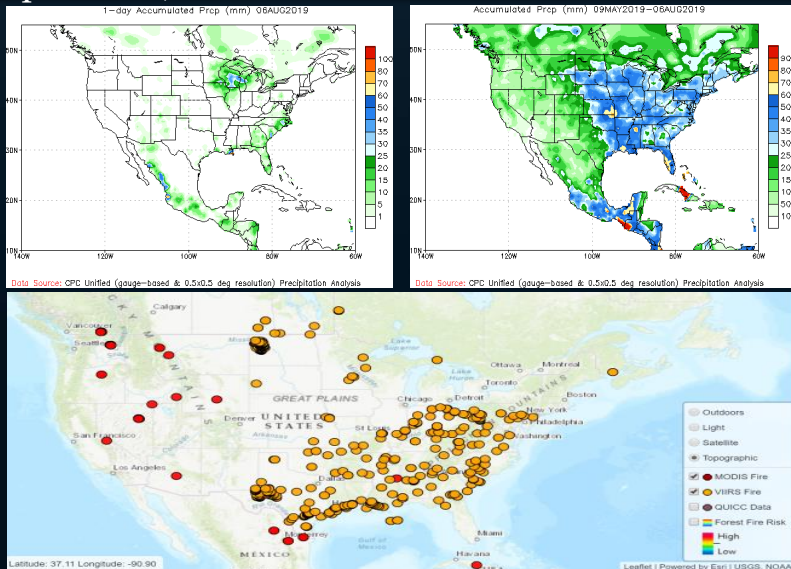
FireCast 3.0

o Fire related monitoring and prediction program using satellite data such as NASA and ESRI and GIS

o Provides Fire Map and provides real-time fire information and damage prediction range for forest areas.

o Perform monitoring and prediction of fire using satellite data and GIS, and provide relevant information through fire map

o Providing various information such as escape in case of fire, applied building materials and dangerous substances in buildings

o Through the RBIS system, it can be provided to fire departments and fire crews throughout the country and used for fire suppression.

I. Case study of Intelligent Disaster Management System

◎ Big Data Based Disaster Response System

Disaster BD Analysis Technology

- Leveraging IoT technology, disaster site sensor information and disaster management centers share information in real time and support decision making and information sharing

- Weather information such as earthquakes, tsunamis, various alerts and warnings sent from the nationwide instantaneous warning system, and disaster damage situations where employees are collected are shared with the central office, general branch offices, shelters, etc

IBM Watson Global-Green Horizon

- The Green Horizon project is designed to help analyze air pollution or manage renewable energy projects.

- Leverage IBM cognitive computing technology or analytical systems and anticipate and prepare for the future without ending analysis of information

- Processing large amounts of data from satellites, geographic information, and optical sensors can predict air pollution in three days

- Provide scientific data to help government officials make policy decision

Fujitsu general disaster prevention Method information sharing system

Watson's Green Horizon

International Big Data Disaster Response Cases

Urban Operation Integrated Control Center (Huawei)

- China has developed an artificial intelligence-based urban operation integrated control center that is similar to human intelligence.

- Developing and operating China's entire city development project as a smart city

- To secure a foundation for research on AI cities in China, aiming to build an Expert System that can be widely used in various fields such as power, transportation, and crime prevention / disaster prevention.
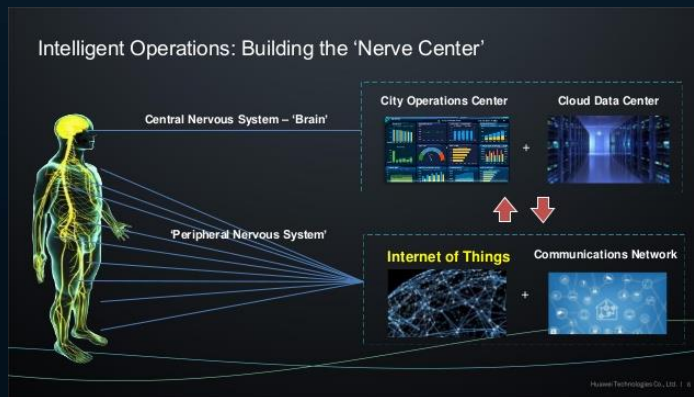
Smart Nation Project
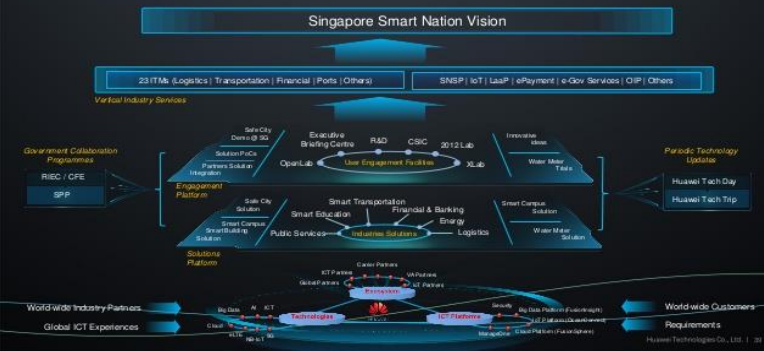

Multi-dimensional Insights into a City from Macro to Micro by IOC

Intelligent Operations: Building the 'Nerve Center'

Hawei 종합 방재.방법 정보 공유 시스템

Innovate to Build a Fully-connected, Intelligent World

Singaprore Smart Nation Project

◎ In Korea

Social Bigdata

- Operator: National Institute of Disaster Safety
- Characteristic
- Disaster-based disaster monitoring technology based on social big data by analyzing SNS data (Technology that automatically detects and informs of real-time disaster reports through social media) Analyze and use national demands in disasters
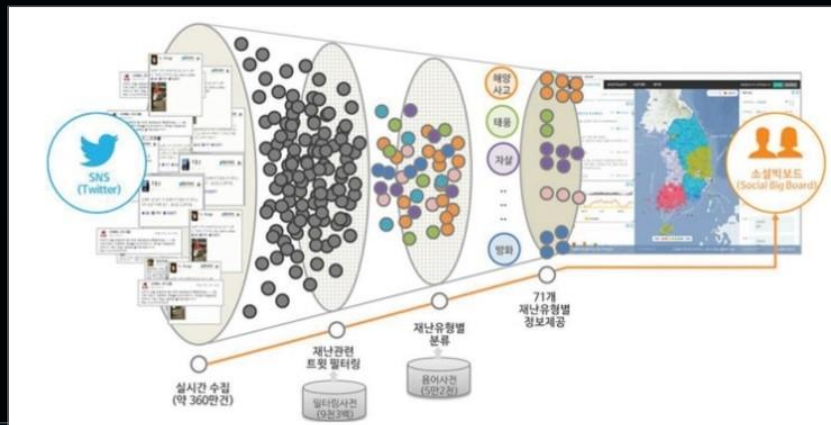
Real-Time Disaster News Monitoring System

- Operator: National Institute of Disaster Safety Ministry of Public Administration and Security Central Disaster Safety
- Characteristic
- 1. A system for managing current and past events by analyzing news data to detect disaster-related situations early and extracting key information on disaster occurrence and trends.
- 2. Real-time disaster news monitoring system provides past disaster history, recent disaster issues, recent disaster related issues increase / decrease rate, disaster occurrence area, disaster keyword analysis

# I. Case study of Intelligent Disaster Management System

◉ In Korea

Smart big data

- Operator: National Institute of Disaster Safety, Ministry of Public Administration and Security (Busan)
- Characteristic

  1. Through SNS-based public participation disaster management and integration of various information, it is possible to monitor the disaster management process of all stages from response to recovery.

  2. Image and text information acquired through the mobile site information function is transmitted to the server in real time.
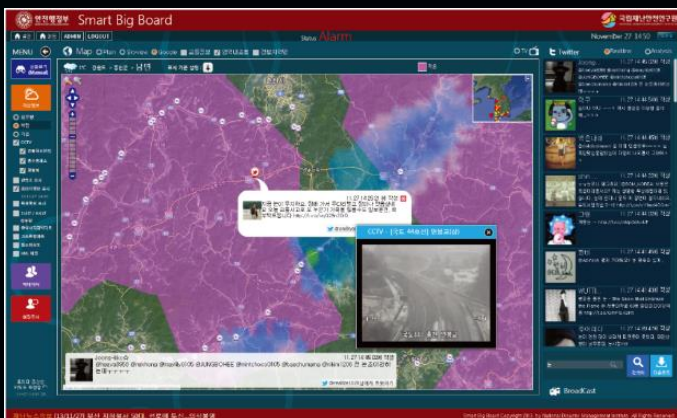
Firefighting big data standard analysis platform

- Operator: Gwangju Fire Department
- Characteristic

  1. Firefighters can check the location information of fire engines and ambulances in real time and identify the arrival time and time within Golden Time through big data analysis such as the local road network.

  2. In the case of municipalities where urban and rural areas are mixed, the factors that hinder the operation of ambulances can be different even within the same province.
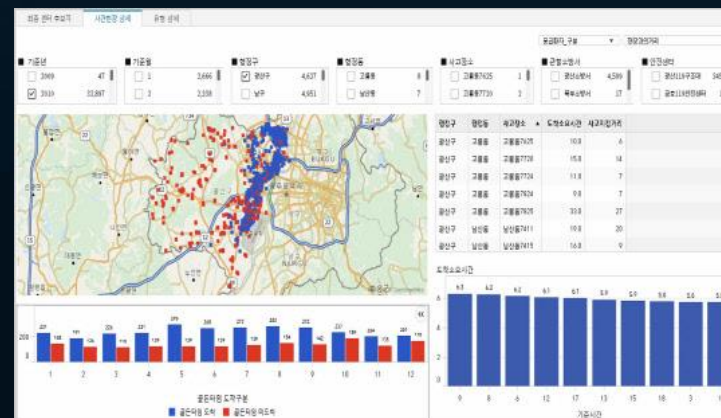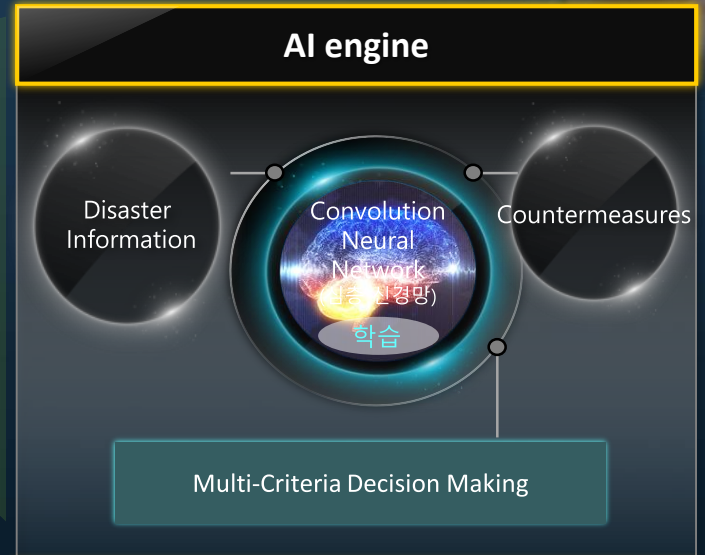
II. Concept of AI for Safety Korea Project

● **Change after the Project**

Satellite imagery

UAV (Drone, Skyship)

CCTV

Sensor, SNS information

BIG DATA Platform

Big Data Processing Module
(Analysis/Statistics/Intelligence)

Service common function

API

real-time processing

Disaster Data Collection Module

Platform management

Collection

| Forest Fire Monitoring Center | KEPCO | Ministry of Homeland |
| Meteorological Agency data | National park | Ministry of Industry |

Heat wave / cold / forest fire / external data

AI engine

Disaster Information

Convolution Neural Network
(온라인경망)

학습

Countermeasures

Multi-Criteria Decision Making

Disaster Safety Control Center

Disaster Safety Headquarters

III. Framework of ASK Project

Phase 1

❖ Research on Big Data and Intelligent Decision Support System in Disaster Response
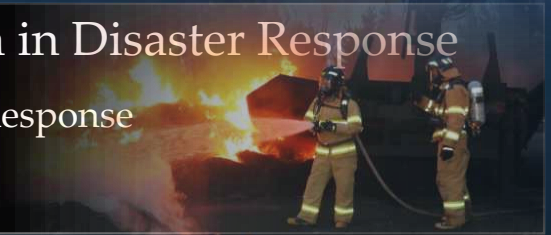- o Research on Big Data and Intelligent Decision Support System in Disaster Response
- o Intelligent Disaster Response through Disaster Record Analysis

Phase 2

❖ Big data-based technology development and standardization plan for disaster response
- o Big data-based technology development for disaster
- o Development of standardization plan for decision support

Phase 3

❖ Research of big data analysis system of various disaster data and development of decision support system through various AI learning techniques
- o Big Data Analysis System for various disaster Data
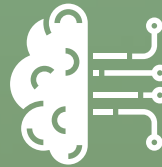- o Development of decision support system through various AI learning techniques

Phase 1

○ **Standardization of Big Data-based Disaster Response Decision Making System**

Disaster case analysis and disaster response status analysis

Big data and artificial intelligence technology research and analysis

GIS-based disaster response technology

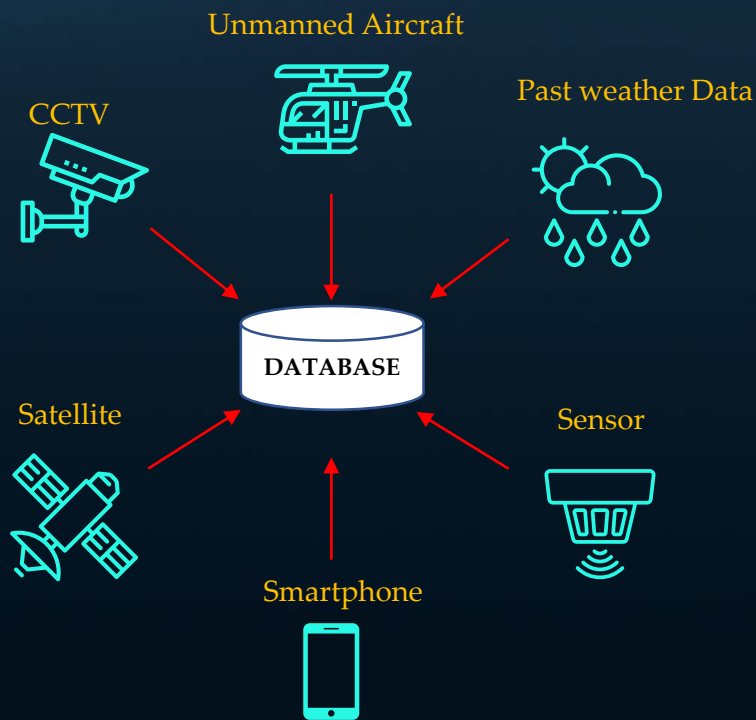Big data research and analysis

Establish input and output data

Big data concept

Phase 1

◉ The importance of Disaster Management Standards Development

❖ The data will be use included past weather data, wildfire history data real time CCTV, satellite in the disaster areas and sensor

❖ Establishing a disaster management standard plays an important role in reducing the time required to return to normal operation when a disaster happen

Data sources will be used

.... Before applying disaster management standards

_____ After the application of disaster management standards
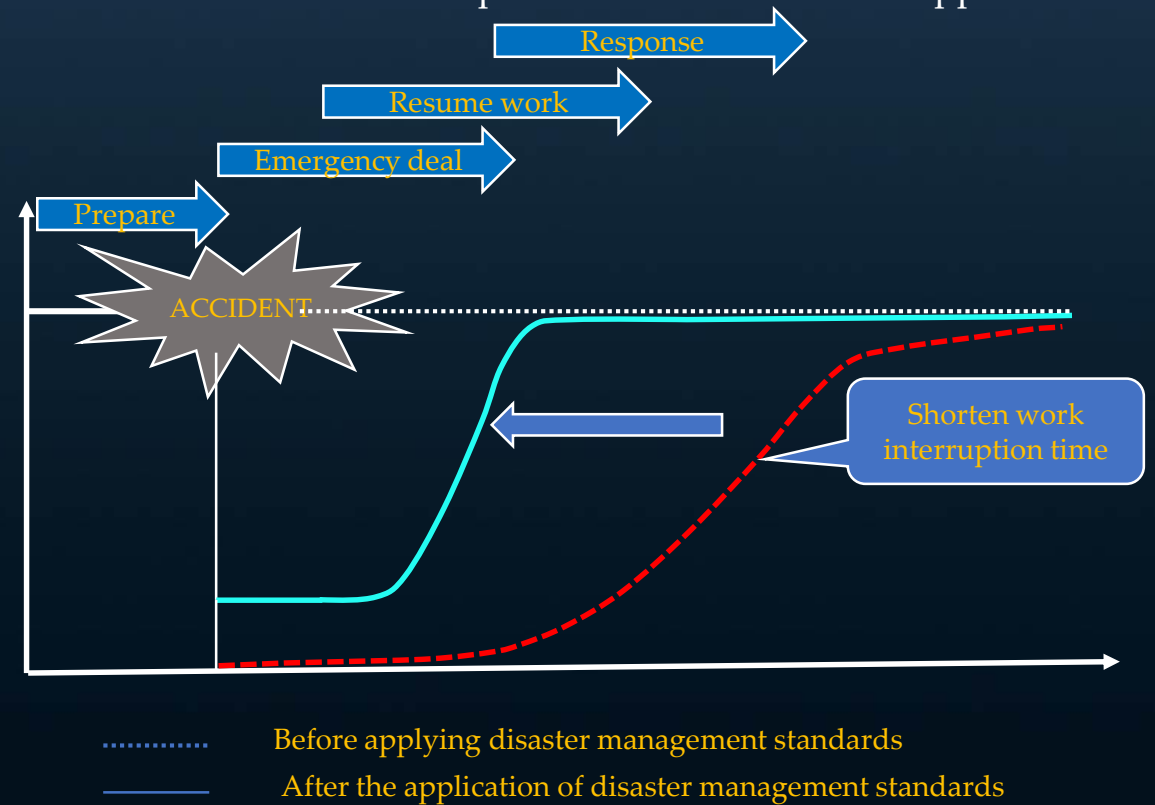
Effect of Disaster Management Standards Development

Phase 1

Big data research and analysis

- Data type analysis and data design in disaster field

Big data and AI technology research and analysis

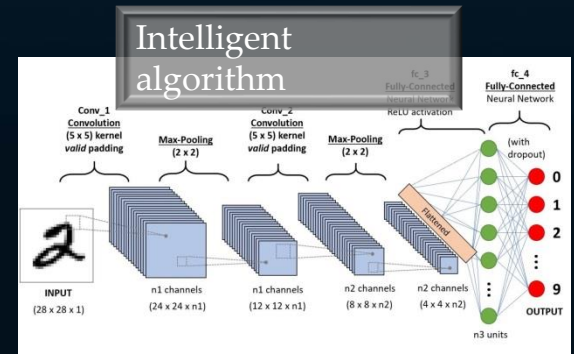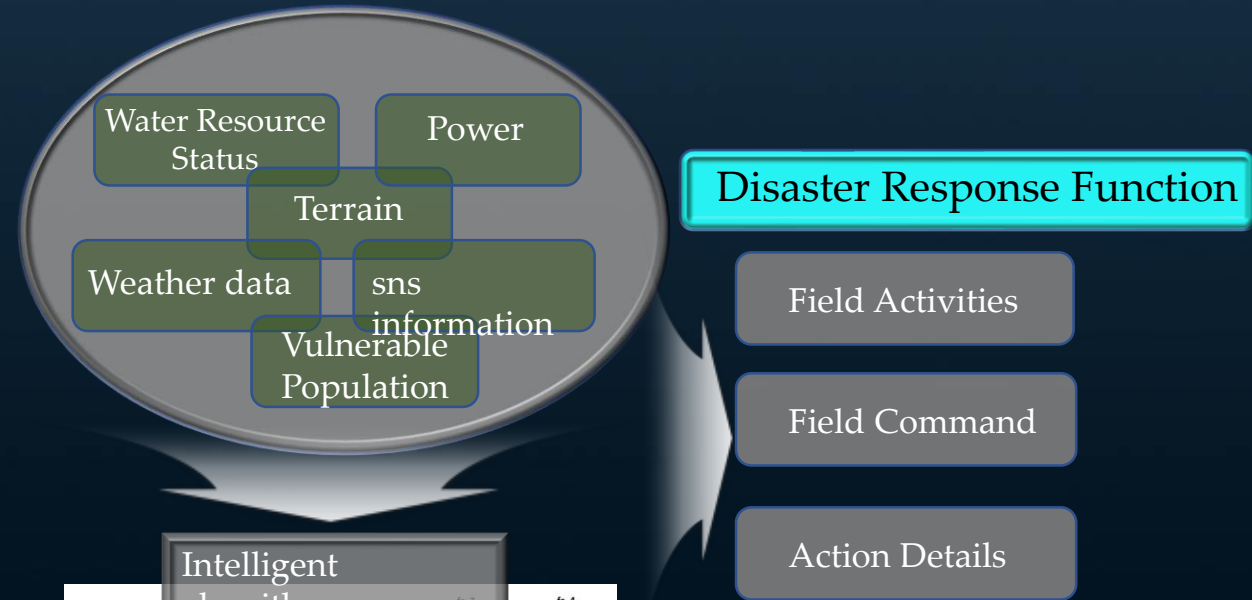- Define key functions of ASK system through big data-disaster research and current situation
- Establish input and output of decision system according to disaster type

Phase 1

○ Data Design for Decision Support in Disaster Response

• We need to design a data collection, storage and classification system and a disaster recovery decision support process, which includes key functions such as creating a detailed list of data items to be collect and analyze, plan storage, extract, convert, categorize data in line with research purposes.

Collection data selection

Sensor information (location, time …)

Weather information (temperature, humidity)

Voice, document information

GPS Log, ID ID Log

LOAD

REPLICATE, CDC

STREAMING

Data Acquisition-Storage-Classification

Data collection

Data storage

Data classification

Database linkage

Standard SQL-based Distributed Processing Framework

Standard SQL-based Distributed Processing Framework

Structured data | Un-Structured data | Semi-structured data | ……

Data Design for Decision Support in Disaster Response

Phase 1

Data Acquisition / Storage Big Data Platform

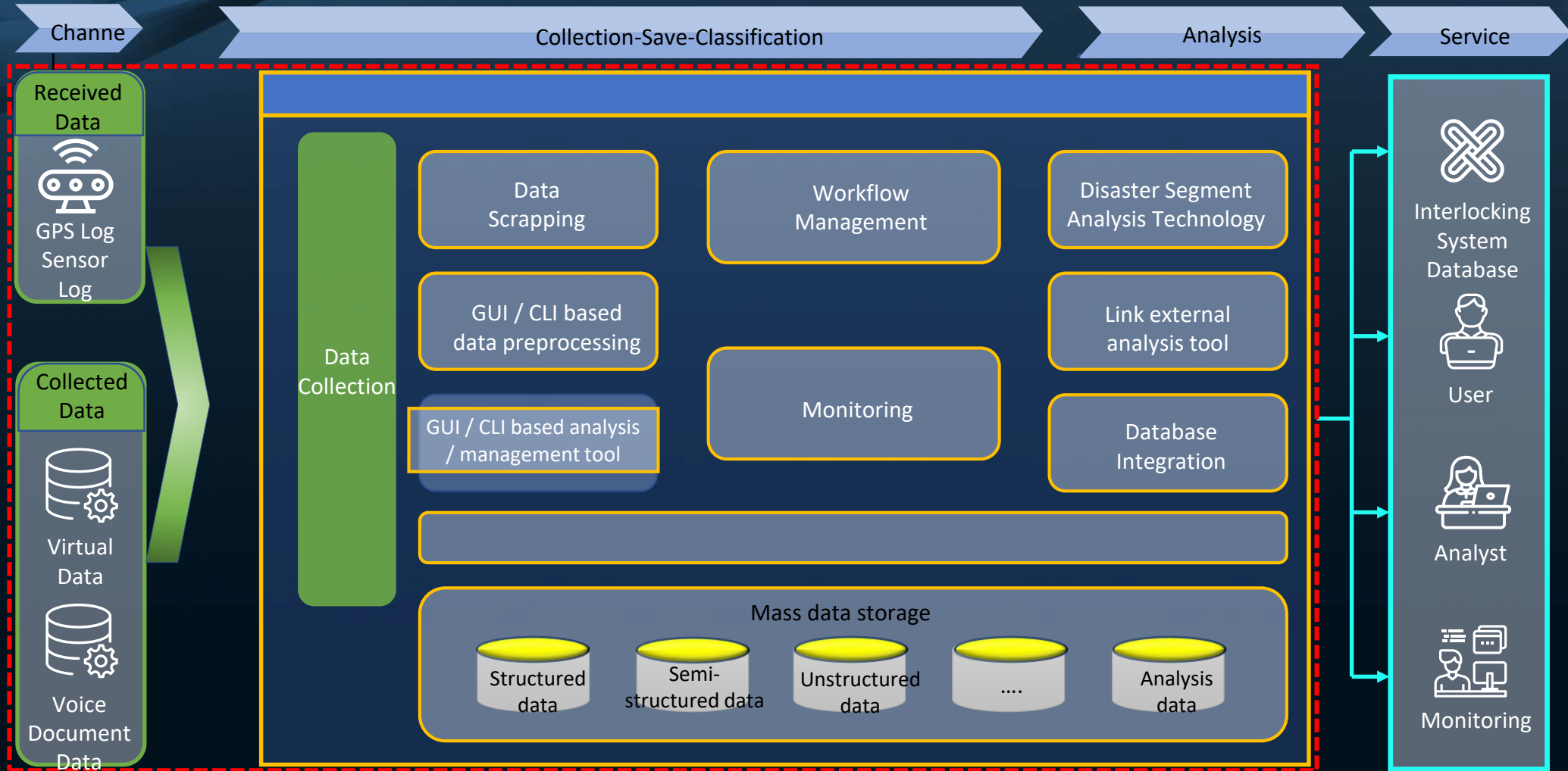There are two types of data that will be used in this study are structural data and unstructured data. However, not all the data collected can be used, so a technology to remove unstructured data has been developed by the scrapping technology.

| Channe | Collection-Save-Classification | Analysis | Service |

Received Data
GPS Log
Sensor Log

Collected Data
Virtual Data
Voice Document Data

Data Collection

- Data Scrapping
- Workflow Management
- Disaster Segment Analysis Technology
- GUI / CLI based data preprocessing
- Link external analysis tool
- GUI / CLI based analysis / management tool
- Monitoring
- Database Integration

Mass data storage
- Structured data
- Semi-structured data
- Unstructured data
- ....
- Analysis data

Interlocking System Database
User
Analyst
Monitoring

Phase 2

- **Development of Big Data-Based AI Decision-Making Technologies**

Development artificial intelligence decision support technology

Development Prototype Disaster Response Decision Support System

Determination of decision support system according to disaster type

Devise a plan to use big data for disaster

Analysis Technology Element for Disaster Response Decision Making

Establishment of response system model

Phase 2

- Algorithm applied to this project

DIAGNOSIS

Rapid situation judgment and analysis using pre-collected big data about disaster situations

Deep Learning (Convolutional Neural Network)
Data Mining from SNS

PREDICTION

Ability to provide related information by predicting the direction of disaster and the scale of damage

Reinforcement Learning

OPTIMIZATION

Analyze the optimal when the disaster happens and provide decision support information for managers

Machine Learning (Decision Trees)

Phase 2

Disaster Response Decision Support System Integration Process

- Review functions and UIs that need to be newly developed or changed when integrating through the application of standardization method of safety management system

Disaster Response Decision Support System

Integration request item

Standardization method of safety	Management system	AI-based Disaster Response Algorithm

Metadata managements

Standard term	Domain	Code
Data model	Database	Data flow
AI algorithm	Safety Management Standardization System	Decision related document

Metadata Repository (Integrated Repository)

Development / Test DB

| Standard information DB information | ✓ DDL occurrence |
| BIG Data Verification result information | ✓ Standard compliance |

GAP Analysis → Development / Test DB

Approval

DA

QA

DBA

Request for approval

Review and approval

DATA

BIG Data

DB schema information collection

DB Schema Migration Management

Account DB   Period DB

Phase 3

○ Development of Intelligent Decision-Making System for Natural Disaster

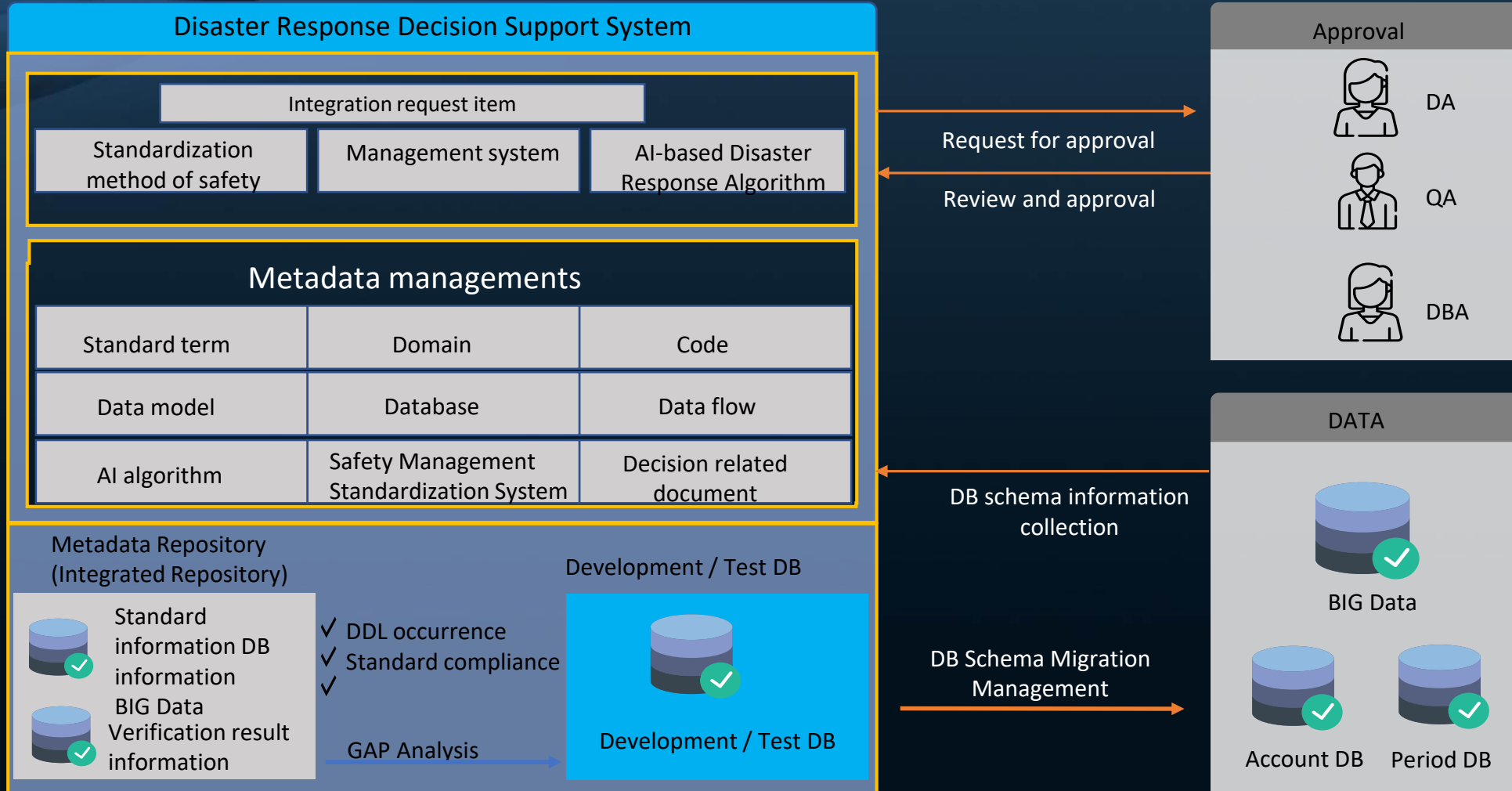Standardization method development and system verification of safety management system

Development of decision support system UI

Determination of decision support system according to disaster type

Heat wave and cold wave response manual and guide development

Phase 3

⦿ Representative UI screen for this project

- Due to the great complexity and abstraction of data, visualization is important to make decisions faster and more accurately. By expressing a large amount of data through GIS, visualization displays data in a visible form for people, thereby providing insight and helping to make decisions through interaction with data.
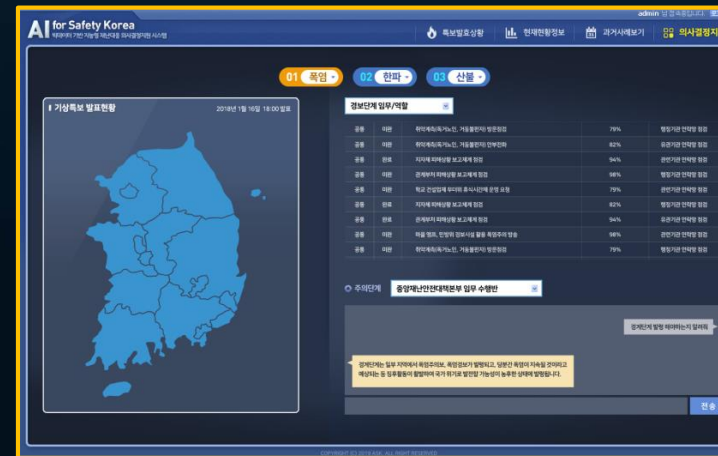
IV. Conclusion

Conclusions, expected results and future work

- In this case, the data included past weather data, terrain data, collapse and flood, wildfire history data and real time CCTV, satellite in the disaster areas, after have data a database will be construction and the development of intelligent decision-making system using big data and artificial intelligence algorithms. When the disasters happen, this system can predict, visually display the disaster and its location accurately in real-time with the aims to reduce the human and properties damages when disasters occur.

- In the future work, the system and algorithm will be tested with real events to gradually increase the accuracy by diversifying input data and correcting algorithm.

EXPECTED RESULTS

| Nation's ability about responding to disasters will be improved | Decision making process for disaster response is carried out using standardized method | Use in the process of compensation, compensation, and lawsuit | It can be extended to various types of disasters. |

THANK YOU FOR YOUR ATTENTION!