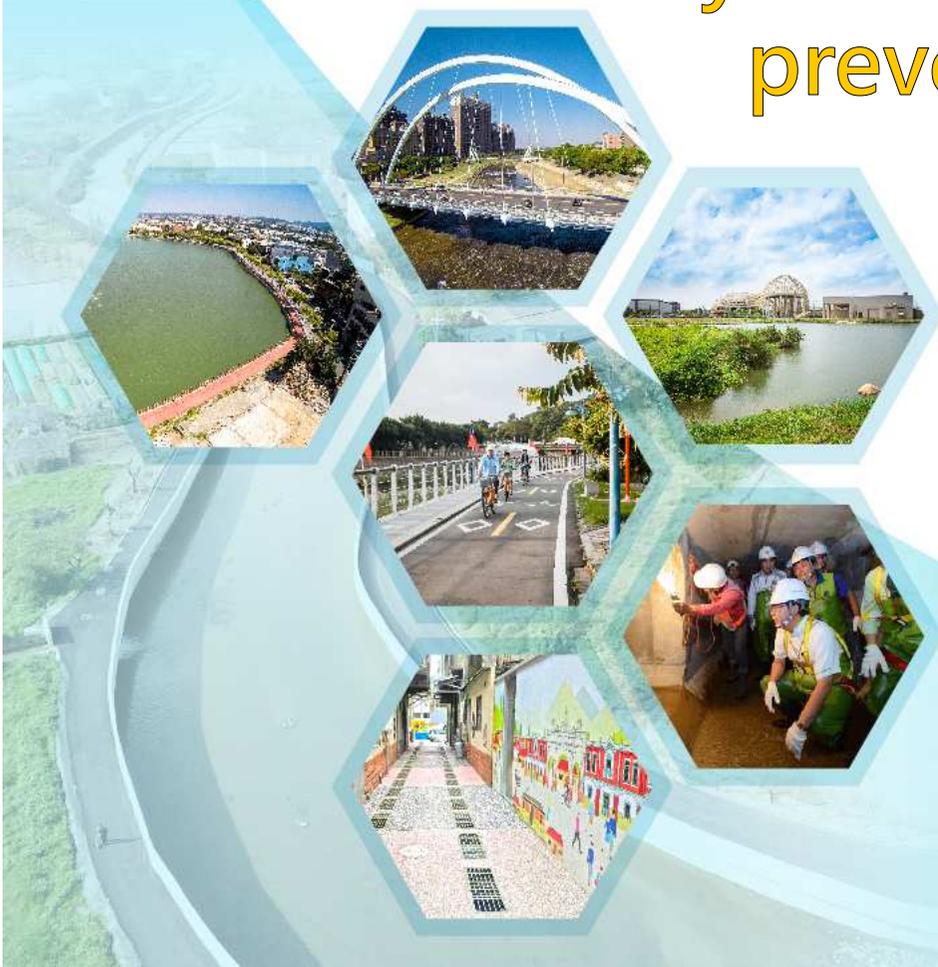
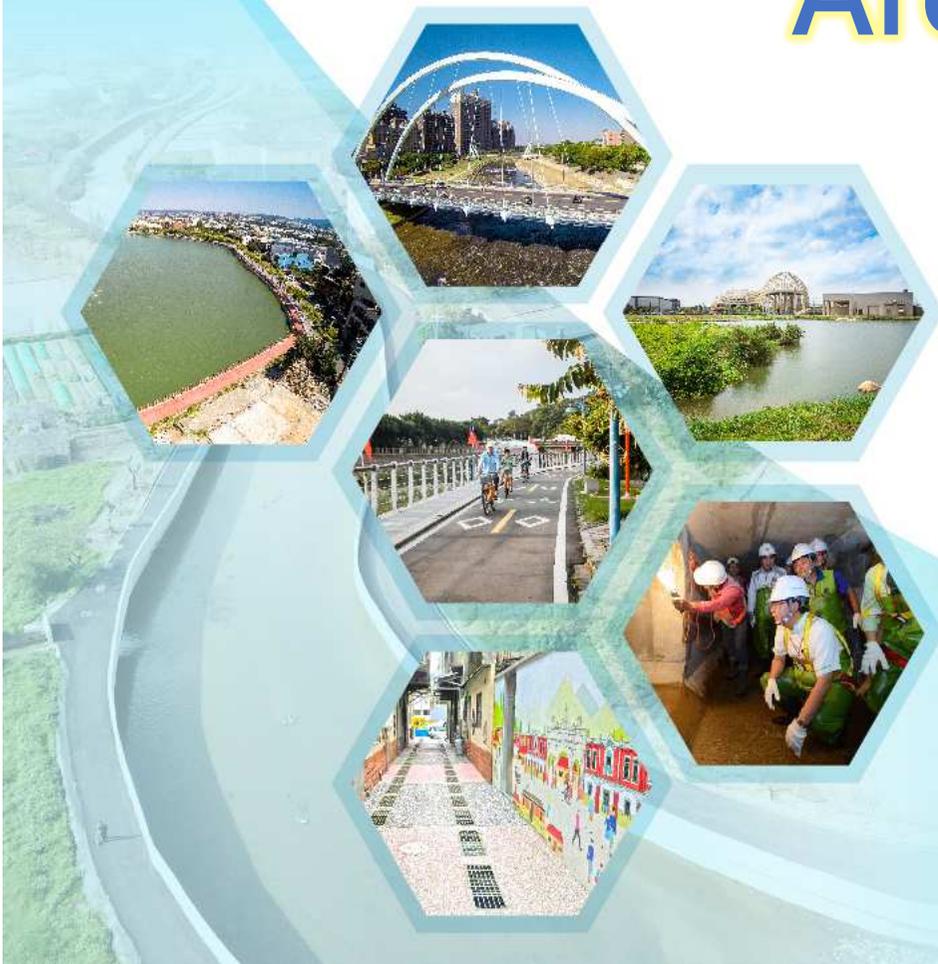


Taoyuan City Intelligent disaster prevention application



Architecture



Background

1

The climate change had brought the new normal that includes extreme rainfall. For example, the hourly precipitation of 0702 Torrential Rain in Longtan Dist. had reached 133.55mm, which broke the record of 500-year recurrence interval. The rainfall had exceed the discharge system' s affordable amount.

2

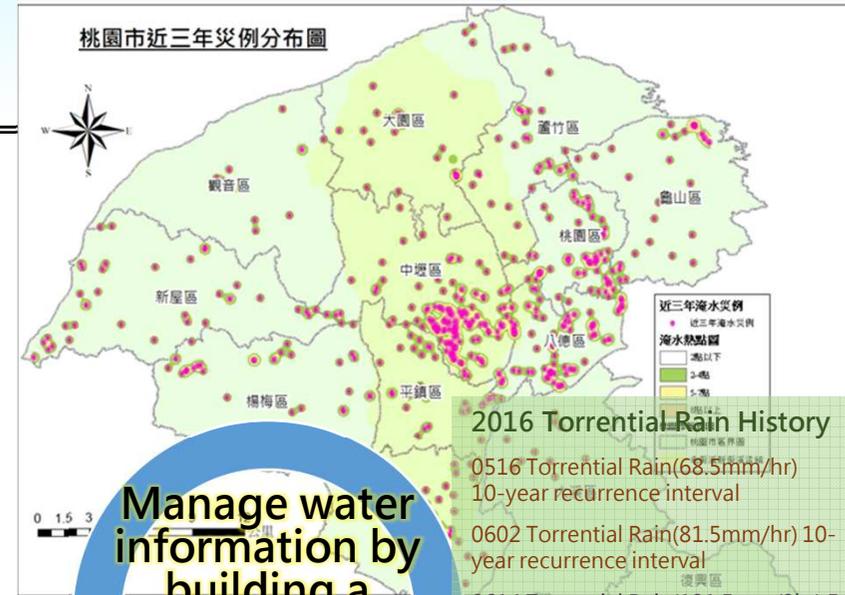
While the discharge system cannot afford the drainage, the short-duration heavy rainfall might cause flooding events. Engineering means are limited, therefore, **it would be supplemented by un-engineering means** for the purpose of disaster response.

3

In order to buy sufficient time to proceed disaster preparedness and prevention, and enhance the capability of early warning, DWRT expand the water information monitoring equipment. In addition, DWRT plan to set up various kinds of monitoring stations, establishing a dense monitoring network and **gathering big data to proceed AI analysis.**

4

Build the **"Cloud-based Intelligent Water Information System for Decision-making using AI technology"** to mitigate the disaster loss, well manage the river basin, and make proper decisions.



Manage water information by building a monitoring network.

Big data analysis and AI technology

Intelligent Integration and Control System

2016 Torrential Rain History

- 0516 Torrential Rain(68.5mm/hr) 10-year recurrence interval
- 0602 Torrential Rain(81.5mm/hr) 10-year recurrence interval
- 0614 Torrential Rain(131.5mm/3hr) 5-year recurrence interval
- 0628 Torrential Rain(117mm/hr) 200-year recurrence interval
- 0906Torrential Rain(75.5mm/hr) 5-year recurrence interval

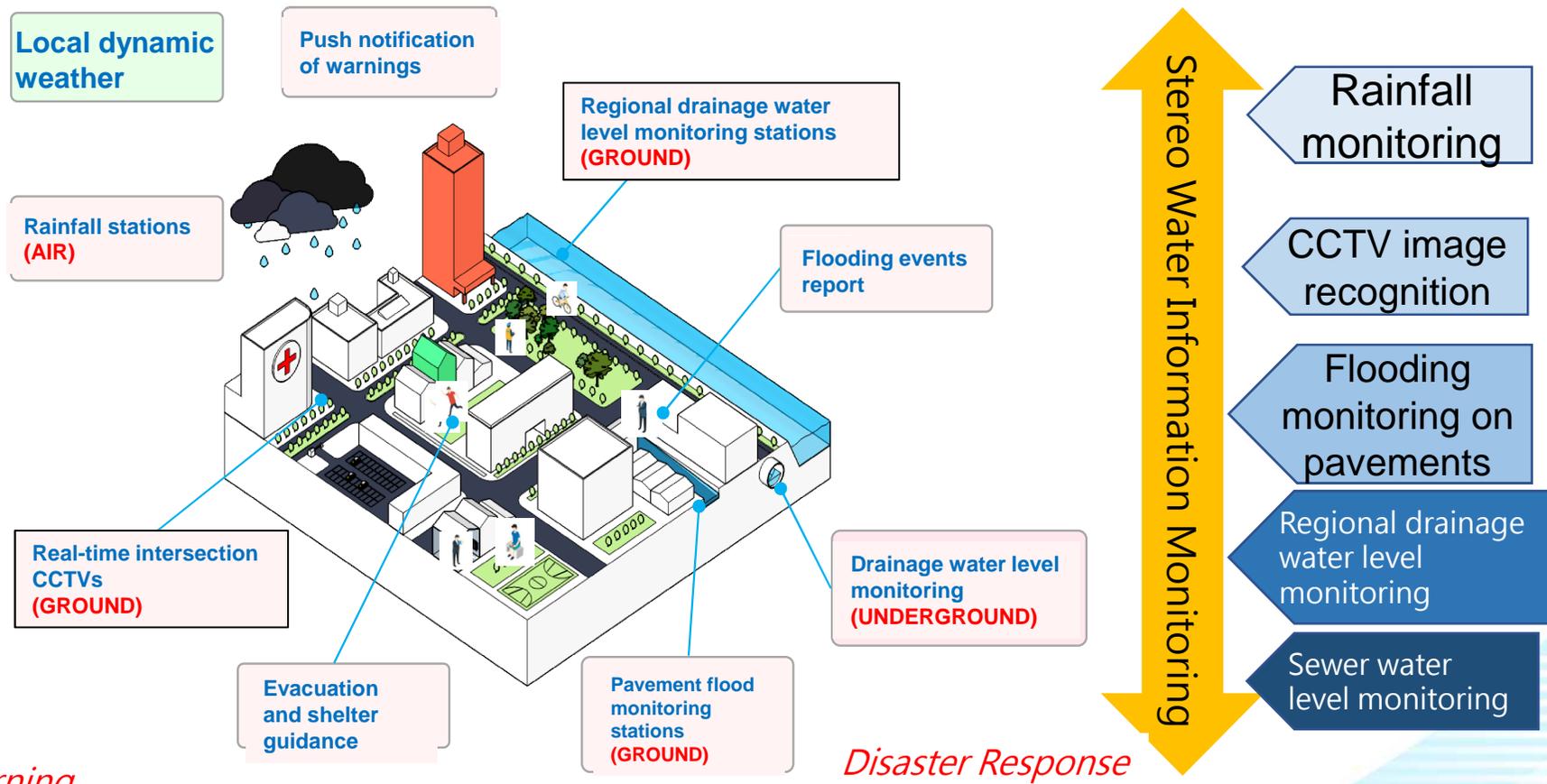
2017 Torrential Rain History

- 0601Torrential Rain(89.5mm/hr) 10-year recurrence interval
- 0614Torrential Rain(99.5mm/hr) 25-year recurrence interval

2018 Torrential Rain History

- 0517Torrential Rain(93mm/hr) 10-year recurrence interval
- 0520Torrential Rain(82.5mm/hr) 10-year recurrence interval
- 0528Torrential Rain(58.5mm/hr) 2-year recurrence interval
- 0702Torrential Rain(133.5mm/hr) 500-year recurrence interval

Comprehensive and Stereoscopic Cloud-based IoT Water Information Monitoring Network



Early warning

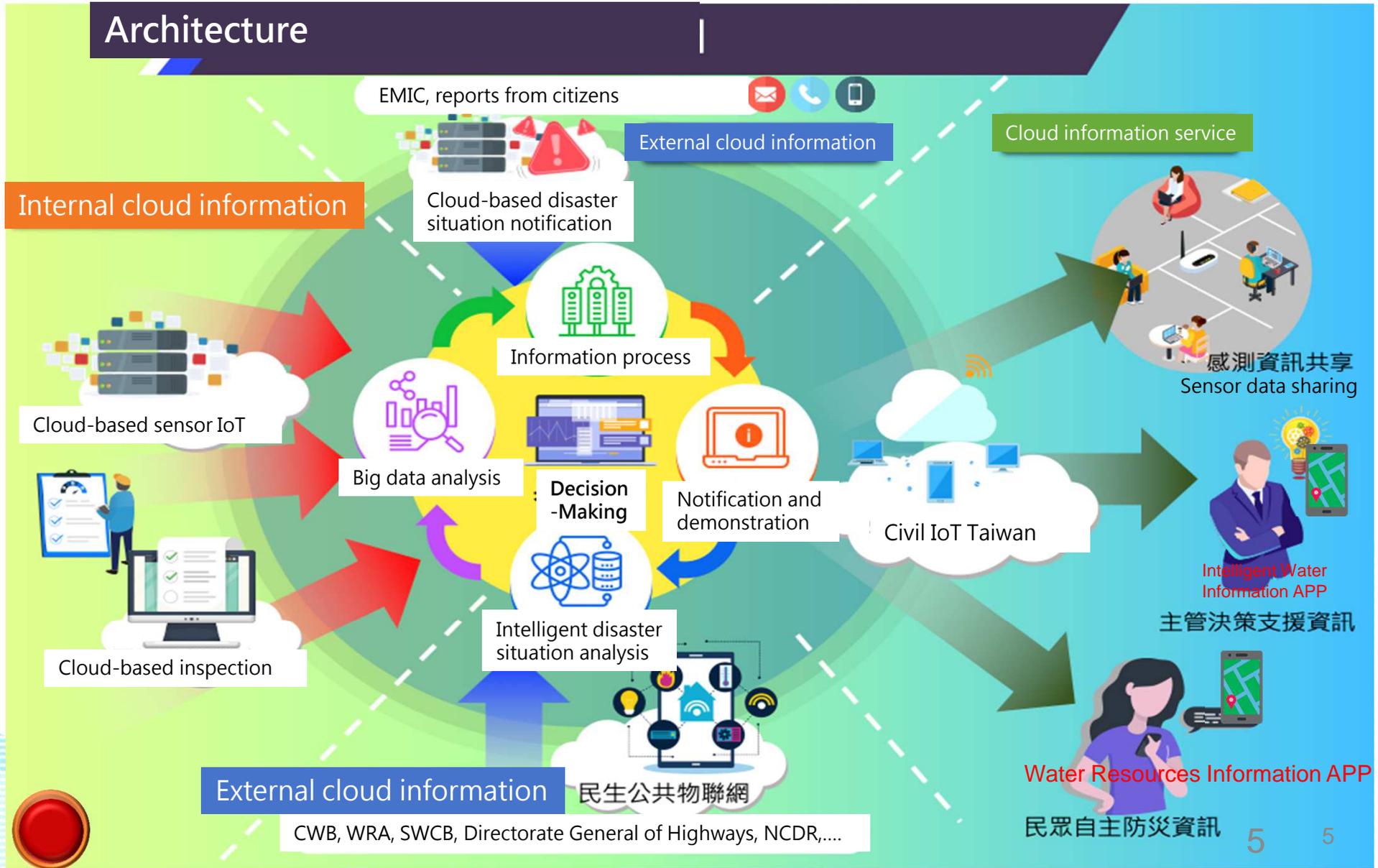
Disaster Response



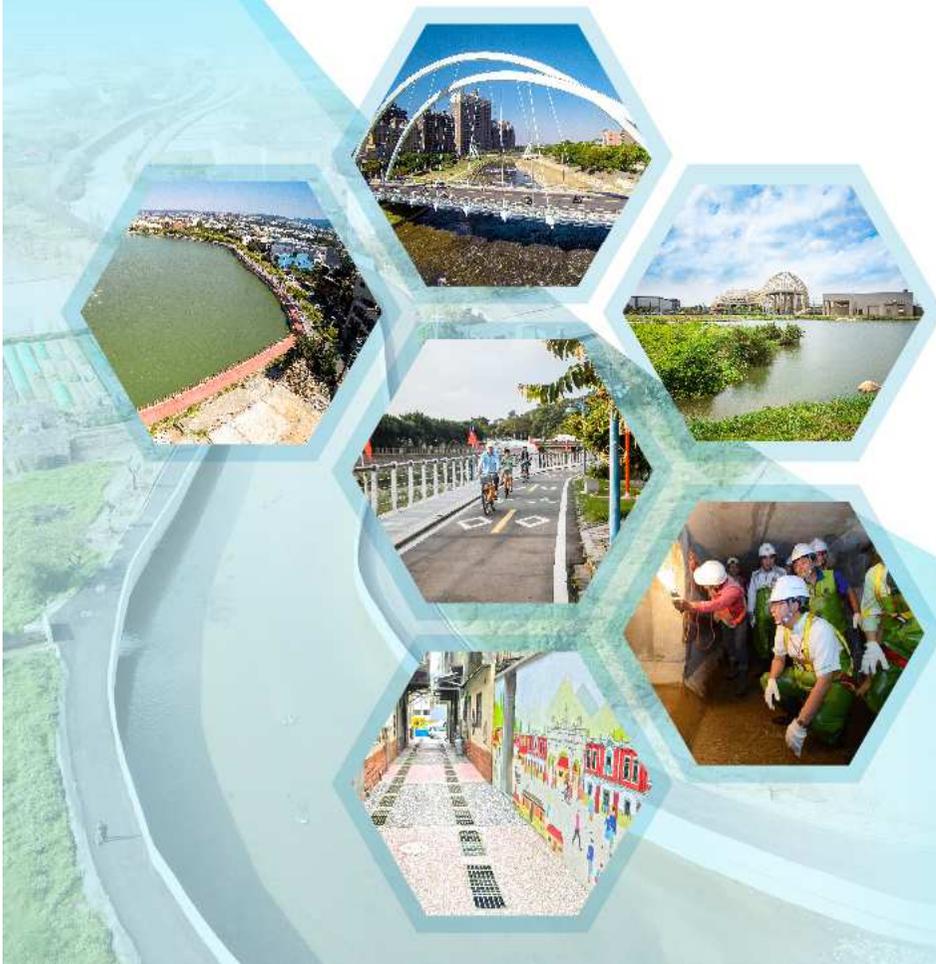
Events and Timeline

Intelligent Cloud-based Water Information System for Decision-making using IoT technology

Architecture



Sensors and Results



Cloud-based Water Information Sensor IoT

- ✓ Comprehensive information
- ✓ Remote water gate switch
- ✓ Predict flooding events with sensor data

Rainfall and water level stations provide real-time information for flooding control.



Drainage facilities control stations are set up near the important water gates for intelligent remote control.



Drainage system monitoring stations are set up near the sewer system for control the situation of inner and external water.

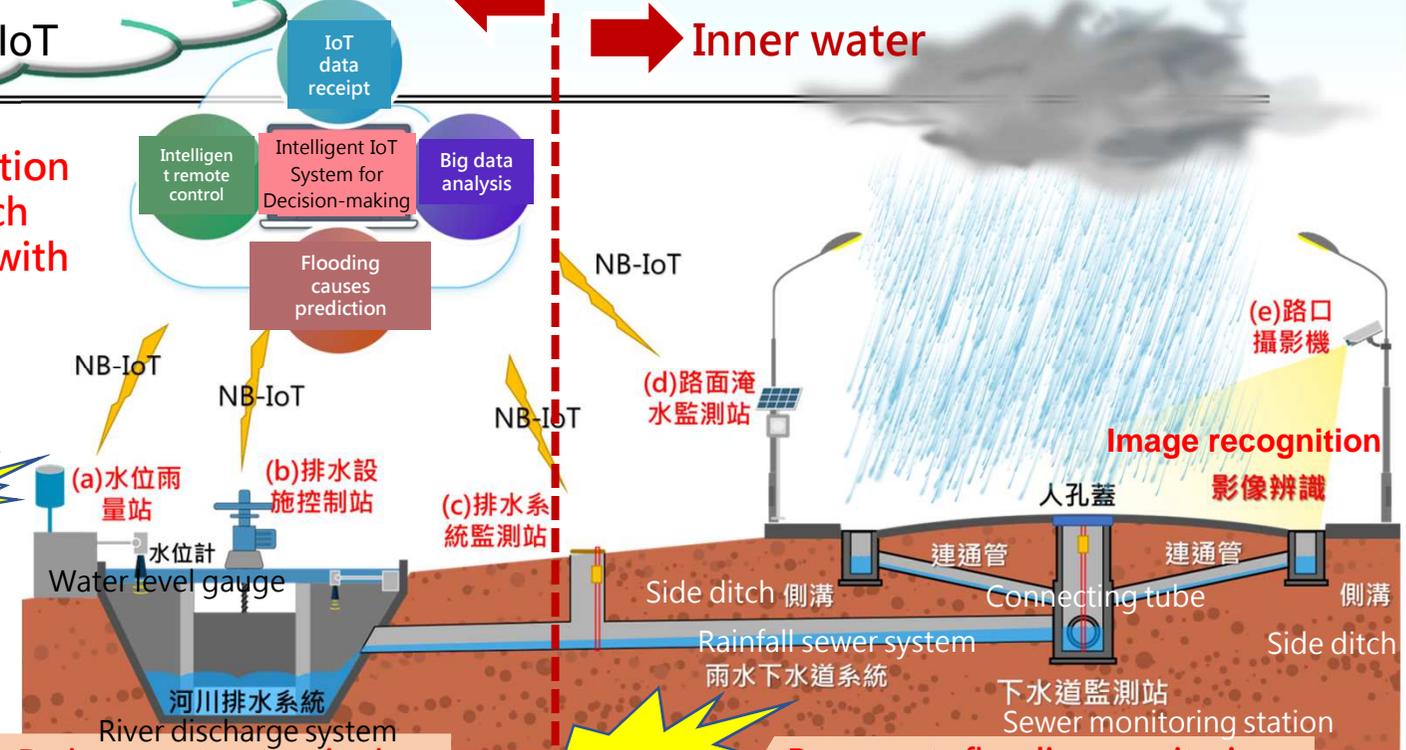


Pavements flooding monitoring stations and CCTVs are mainly set up on the utility poles in the flooding-prone area.



External water

Inner water



Disaster preparedness application - Dashboard system for decision-making

The integrated information is obvious at a glance.

Description

Preparedness

- The preparedness situation of facilities and constructions are demonstrated in statistic charts.

Response

- The statistics of disaster situation from each administrative area and handling progress are shown by charts.
- The real-time data gathered from each water information stations are shown by charts.

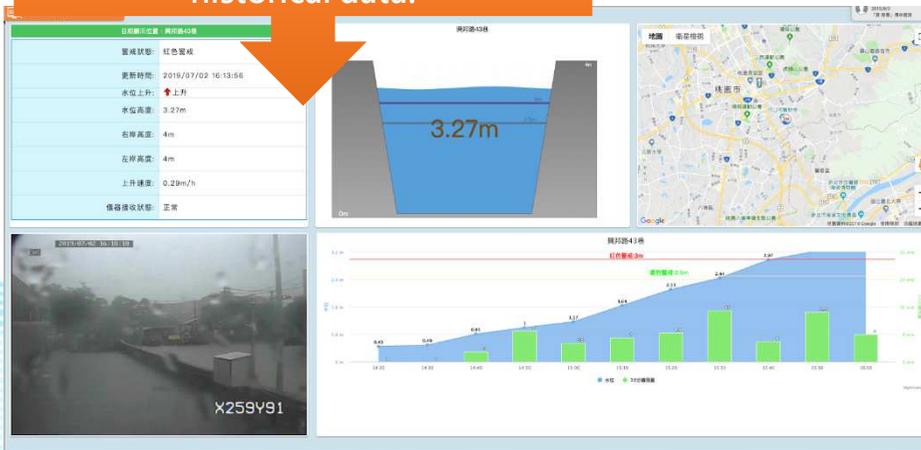
Accelerate the process of viewing significant water information monitoring stations status and historical data.



Effectiveness

Cut down the personnel cost
 $5 \text{ times} \times 5 \text{ days} \times 5 \text{ staffs}$
 $= 125 \text{ days of personnel cost are saved in a year.}$

Cut down the time cost
 $450 \text{ chiefs of villages or districts} \times 5 \text{ times} \times 10 \text{ notifications} \times 2 \text{ minutes for once}$
 $= 750 \text{ hours are saved in a year.}$



Disaster preparedness application - Dashboard system for decision-making

Cloud-based preparedness and inspection

Description

Preparedness

- Disaster prevention personnel, inventory of supplies
- Report the real-time situation of each hydraulic construction and in-progress construction.
- Preparedness of each district office
- Preparedness situation of relevant units. (Airport, Metro, Disaster prevention communities, etc.)

Response

- Provide comprehensive disaster situation.
- Provide handling status from each area.

Overlay the map layer to support analysis and decision-making.

Real-time situation of preparedness

Intelligent preparedness and inspection of disaster prevention facilities and constructions

ID	Location	Action
118	老街溪左岸4k200m	打卡
119	老街溪左岸4k300m	打卡
120	老街溪左岸4k400m	打卡
121	老街溪左岸4k500m	打卡

Disaster preparedness application - Intelligent water gates remote control system

- The water information APP and its system can remotely switch the water gates.
- There is no need that the staffs operate on site in case anyone gets hurt.
- Lots of time, personnel, costs can be reduced.
- Automatically switch the water gates to cope with the rainfall and the water level.



Description

Automatically control or remotely switch the water gates while the torrential rain approaches.

benefit

Immediately proceed flooding control and dredging.



[其他單位]化校
截流

[其他單位]西坡
埭塘

[其他單位]國產
社區400巷

[其他單位]國產
社區490巷

[其他單位]游泳
路

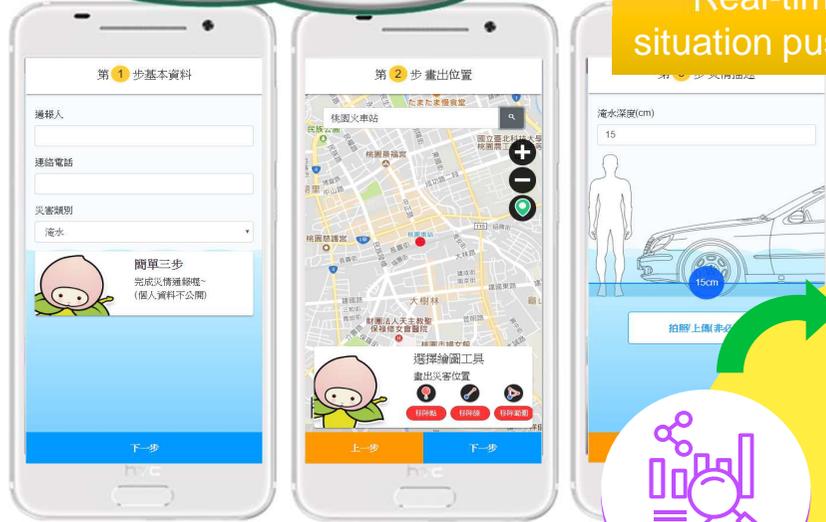
[其他單位]新光
廠區

[其他單位]龍岡
路

Disaster response application- Diversified report platform

IoT services interface and integration

Real-time disaster situation push notification



EMIC Disaster situation notification

事件代碼	事件名稱	事件代碼	事件名稱	事件代碼	事件名稱	事件代碼	事件名稱
10702	042019070000147	07-02	基隆中區	水災	基隆中區	07-02	基隆中區
10702	042019070000149	07-02	基隆中區	水災	基隆中區	07-02	基隆中區
10702	072019070000038	07-02	基隆中區	水災	基隆中區	07-02	基隆中區
10702	042019070000149	07-02	基隆中區	水災	基隆中區	07-02	基隆中區
10702	042019070000149	07-02	基隆中區	水災	基隆中區	07-02	基隆中區

Data process

Intelligent IoT System for Decision-making

Report and demonstration

Intelligent disaster causes prediction

Big data analysis



政府 民眾 產業 學術界

Disaster response application-Image recognition

Image recognition

- Predict the flood level by recognizing the height of water floods the tires.
- Supplemented by the virtual water level ruler and the road marking.



- Interface the image recognition data from WRA to improve the accuracy.



Disaster response application- Image recognition

IOT物聯網

監測設備

2019-07-02 15:45:00 興邦路、興邦路43巷口



Add recognition technology of road markings and flooding range.

Merge diversified recognition technologies to improve the accuracy.

2019-05-17 09:46:19 福州路、中北路二段口



2019-05-17 13:14:23 福州路、中北路二段口



3 YEARS
IN A ROW!

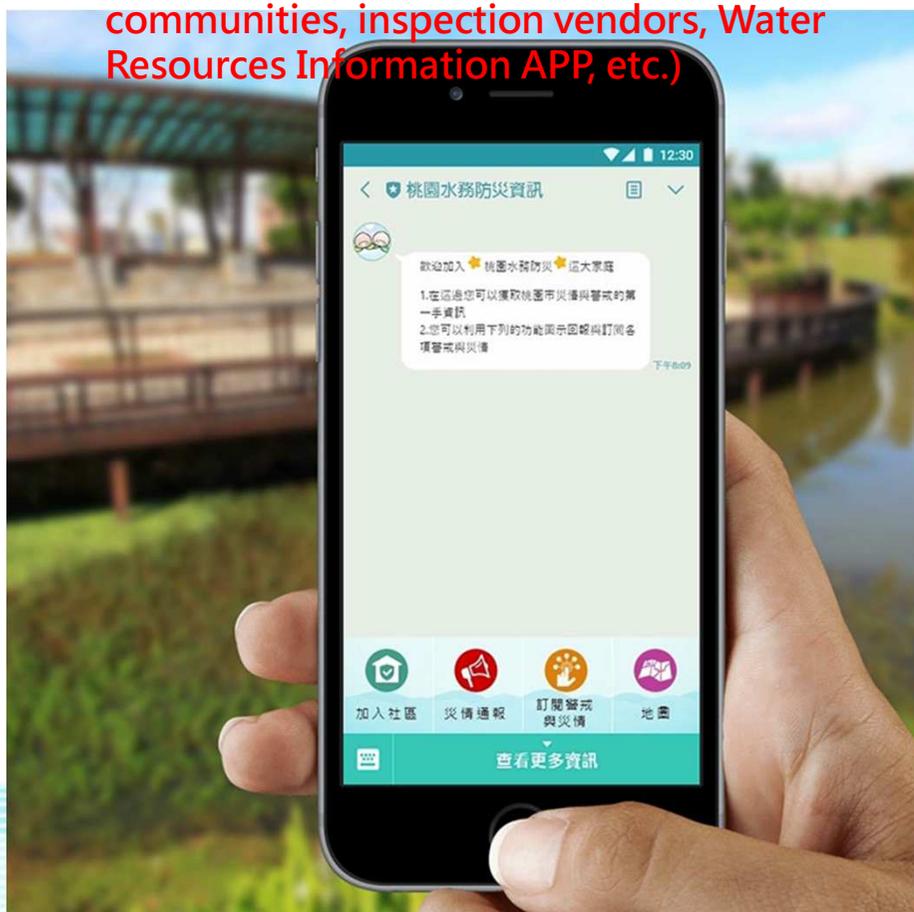
Distinguished County Award

benefit

Effectively communicate with local autonomous disaster prevention communities.

- Cooperate with autonomous disaster prevention communities
- Integrated resources (from EMIC, flooding monitoring stations, autonomous disaster prevention communities, inspection vendors, Water Resources Information APP, etc.)

- *Develop Line BOT to assist citizens with disaster notifications and reports.*



Flood disaster cause prediction- Central flooding management module

經度:121.32367 緯度:24.97513 時間: 2019-05-17 13:09:16

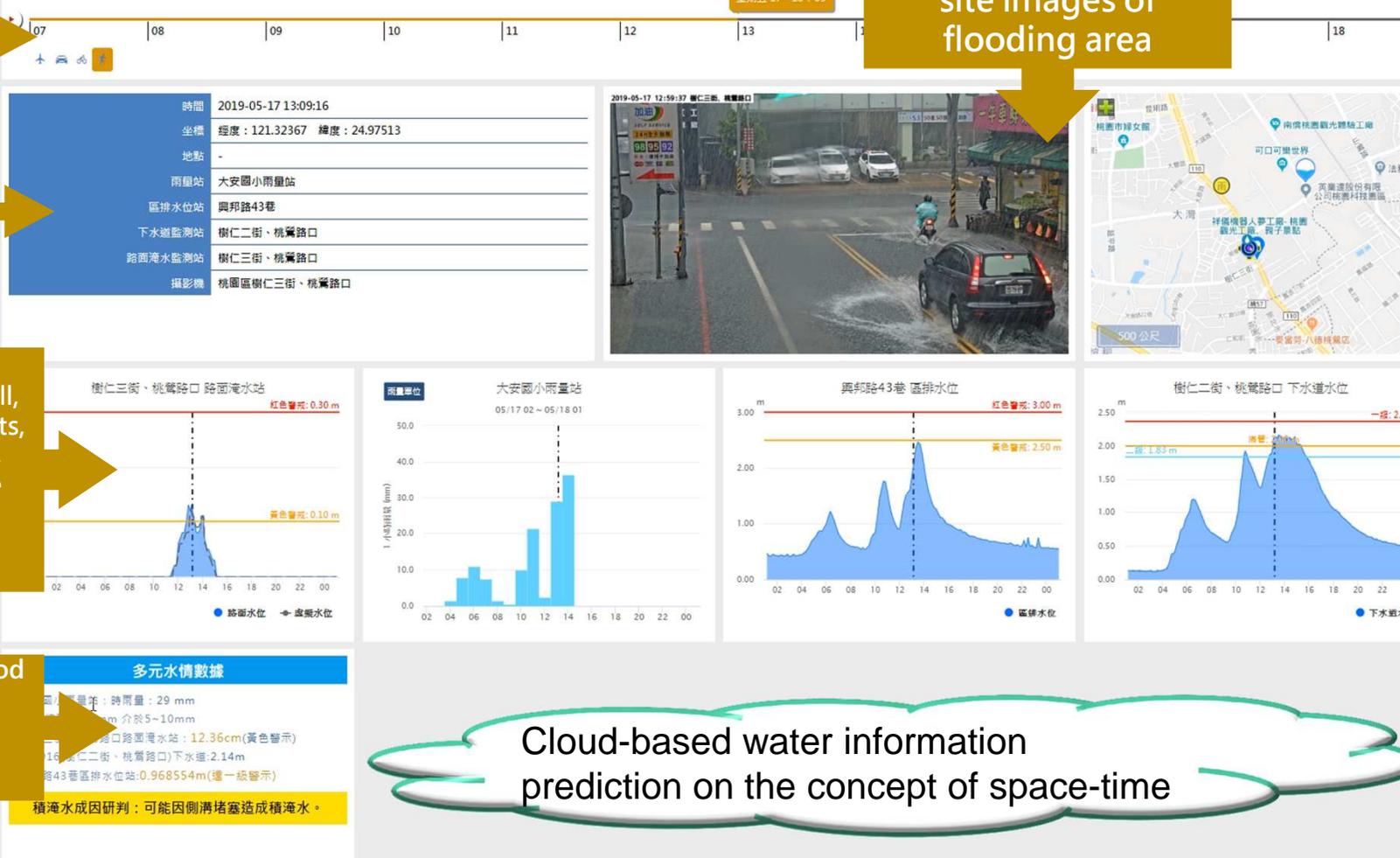
Real-time and on-site images of flooding area

Flooding event history

Information of disaster location

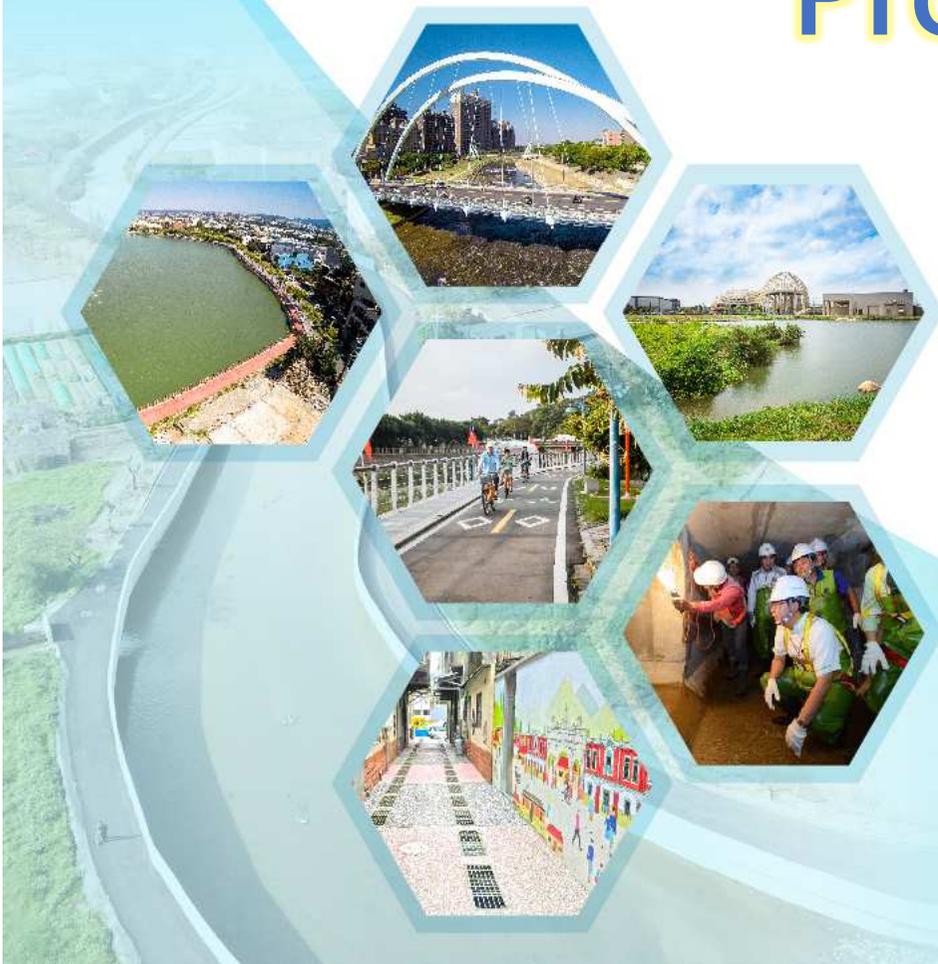
Diversified water information (rainfall, floods on pavements, sewer water level, regional drainage water level) demonstrated in statistics charts.

Comprehensive flood disaster cause prediction using diversified water information



Cloud-based water information prediction on the concept of space-time

Prospect



Intelligent Control System in Dongmen River Basin

Intelligent basin control system

Manage water information from upstream, midstream, and downstream

Combine with AI prediction

Provide suggestions according to the prediction

Estimate the available flood detention amount

Intelligent and immediate control during disaster



Irrigation and drainage section of upstream

The detention basin can be remotely switched through remote water gate system.

Sewer system of midstream

It is planned to set up a remote water gate switch, making the sewer an underground detention basin when it's necessary.

Sewer system of midstream

The water gates can be switched remotely in the future.

Irrigation and drainage section of upstream

The water level data can be the reference for controlling detention basin.

Drainage system of downstream

The water level data in downstream area can be a reference for controlling discharge of upstream area.

Sewer system of midstream

Monitor the sewer water level, understand the discharge status, the received data can be the reference for management.

