Seoul Water's HRD Plans for Digital Transformation

2024.10.

Seoul Water
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Contents

Seoul Water

I. Introduction to Seoul Water

1. Introduction to Seoul Water

Population

9.64M

Production

3.05M/day

Monitoring Water Quality

527 locations

Length of Water Pipes

13,350km

Distribution Rate

100%

Revenue Water Ratio

95.3%

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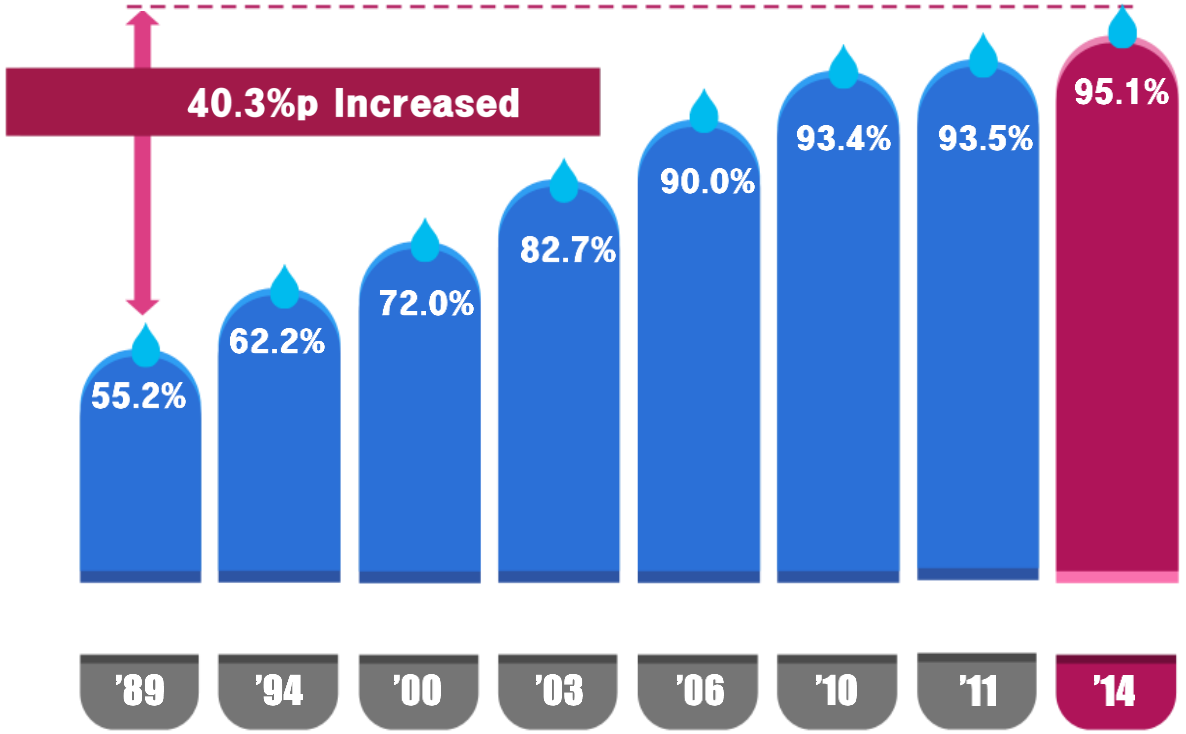
2. Revenue Water Ratio

- Revenue Water Ratio(RWR)
  - Started 55.2% in 1989 and Reached 95.5% in 2017(26 years)
  - Until now have Kept NRW staying over 95.0%



- Annual Water Production Decreased from 1.635B ton in 1989 to 1.112B ton in 2022
  => Decreased about 32%
- Carbon Emissions Reduced by 2.767M tons
- WTPs Decreased from 10 to 6

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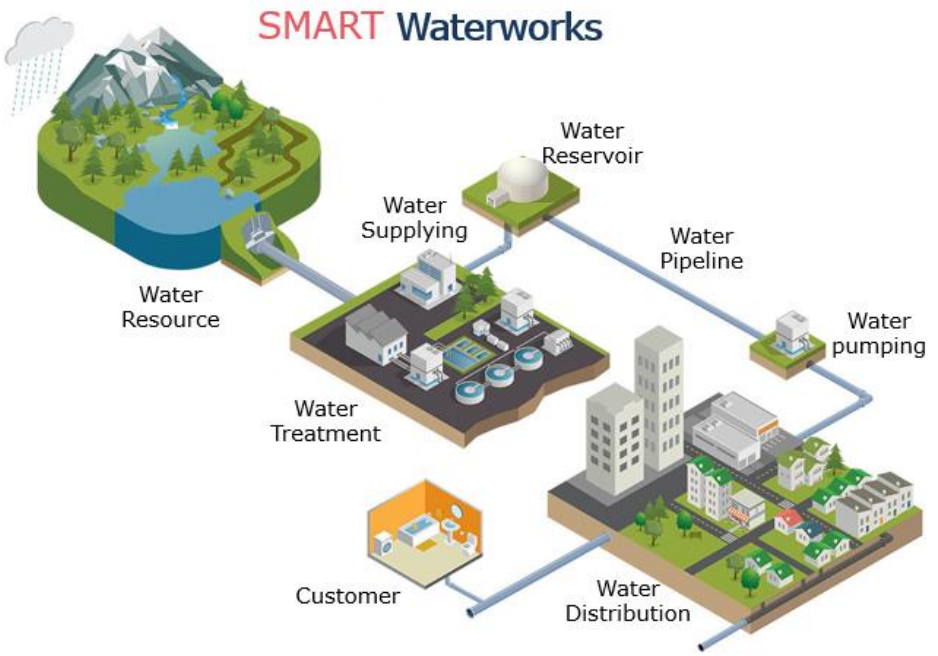
II. Computer Systems in SW

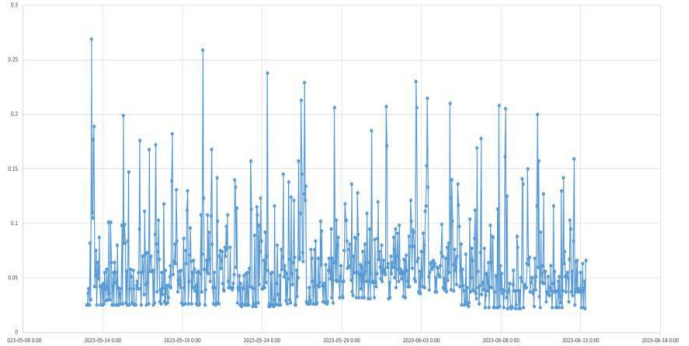
1. Computer Systems in SW

- (Production) Systems for drinking water treatment plants
  - Controlling and Monitoring processes
  - Number of tags are about 100,000.
- (Supply) GIS, Water Management Information Sys, AMI Sys
- (Water Quality) Seoul Water Now
- (Billing) Arisu Info System
  - Total Accounts, Water Consumption Data
- Customer Support System
  - Handling customer complaints (water bill, leak, rusty water, etc)



2. Characteristics of Data

- (Asset) Purchase Date, Price, Manufacturing Company,…
- (M&O) Time Series, Diagnostic Report,
- (Billing) Accounts No., AMI
- (Pipes) GIS, Leak, Flushing, Block System
- (Production) Water Quality, Flow Rate,
  Processes Monitoring
- (Water Quality) GIS, Turbidity,



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III. Big Data Analytics Examples and Challenges in SW

List of Examples

1. Predicting Household Water Consumption
2. Predicting the Conc of Taste and Odor compounds in Hangang River
3. Injecting coagulant in DWTPs by using AI
4. Indoor Leak detection in AMI system
5. Data Standardization in WTPs
6. Text Mining

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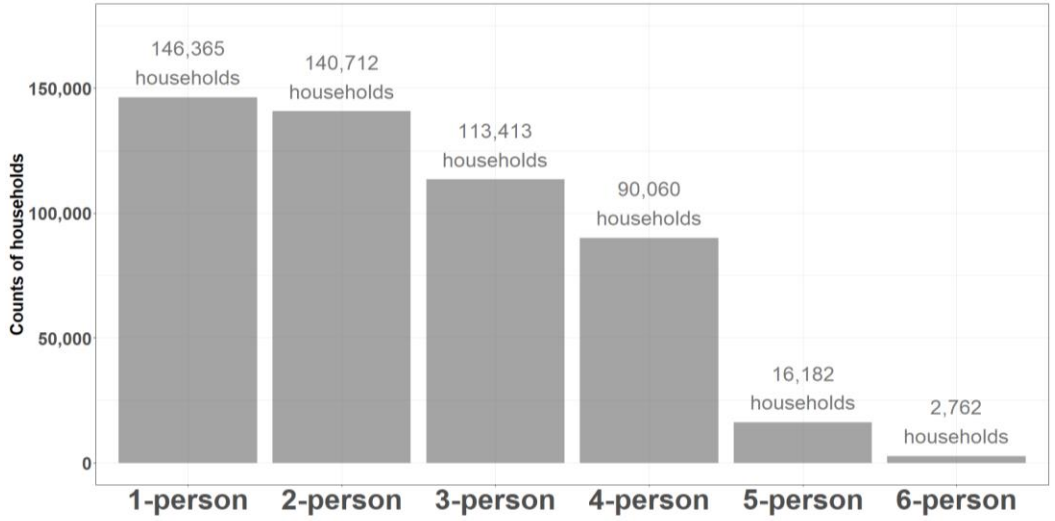
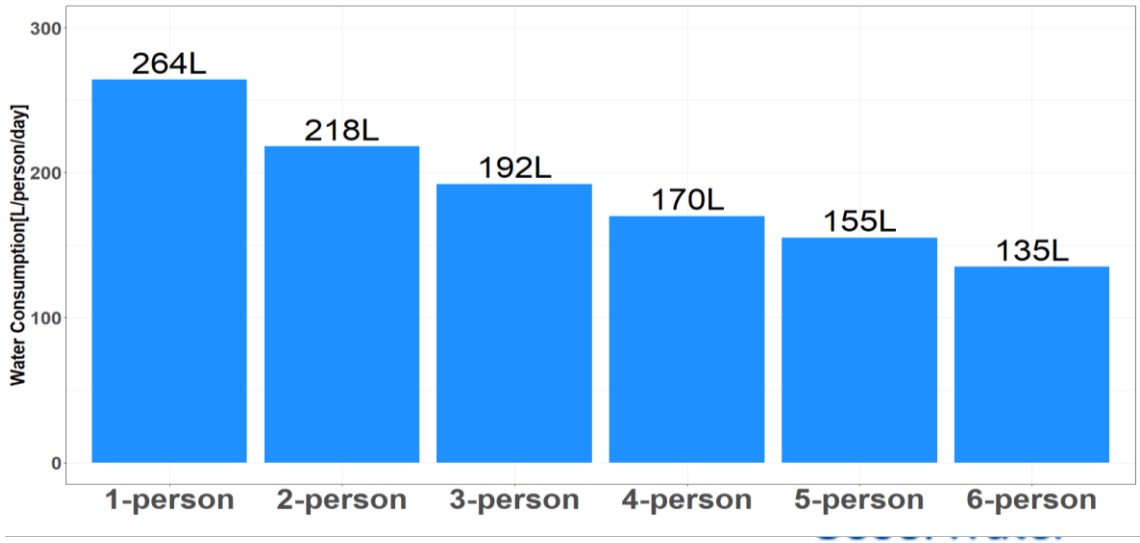
1. Predicting Household Water Consump(1/2)

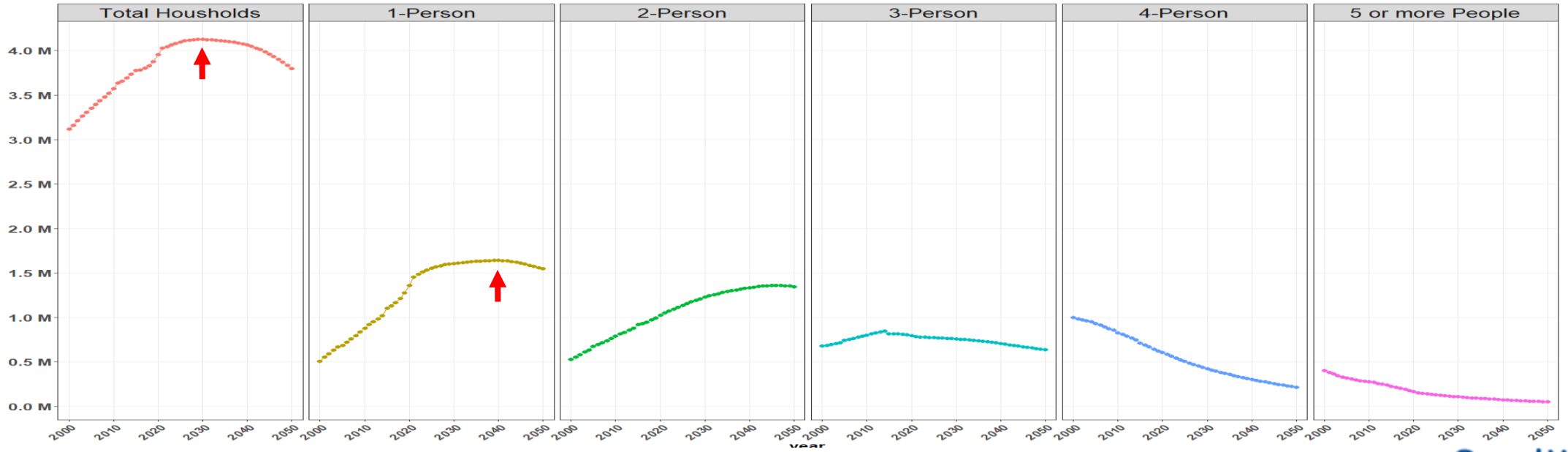
- Joining 3 DBs to analyze the Household Water Consump in 2021
  - Resident Registration Sys, Building Ledger Sys and Water Billing Sys
  - About 3.2M Seoul citizens' information extracted
  - After data pre-processing, about 510K households extracted





1. Predicting Household Water Consump(2/2)

- Household Water Consumption Prediction in 2050 is ongoing.
  - Combining 2050 Household Estimates in Seoul
  - The Max Number of total Households reached in 2029
  - The Max Number of 1-person households reached in 2040



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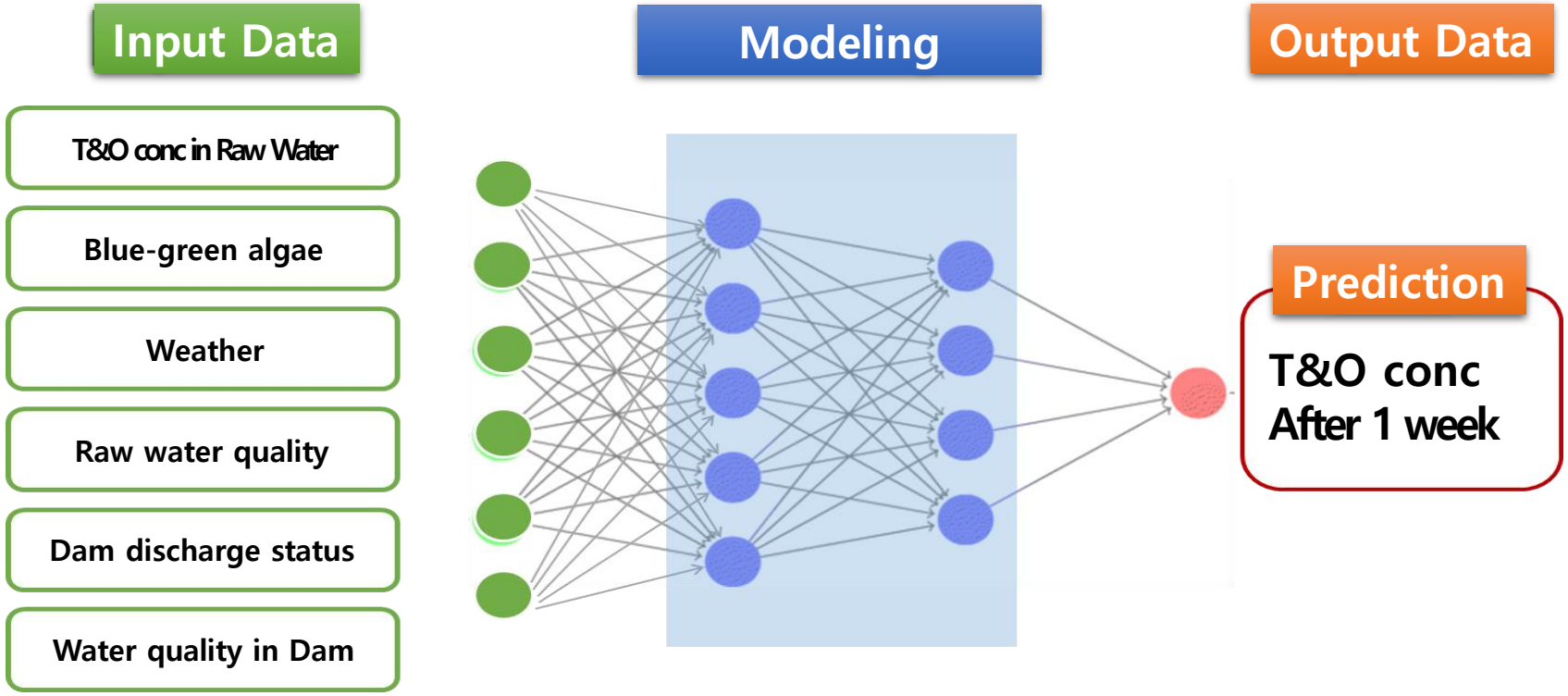
2. Predicting the Conc of T&O

- 2-MIB and Geosmin cause taste and odor in Tap Water
- Predicting two compounds' conc in Hangang River is ongoing.



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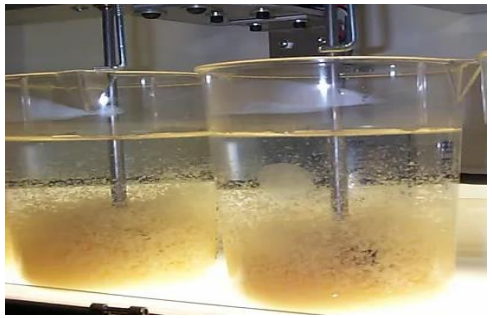
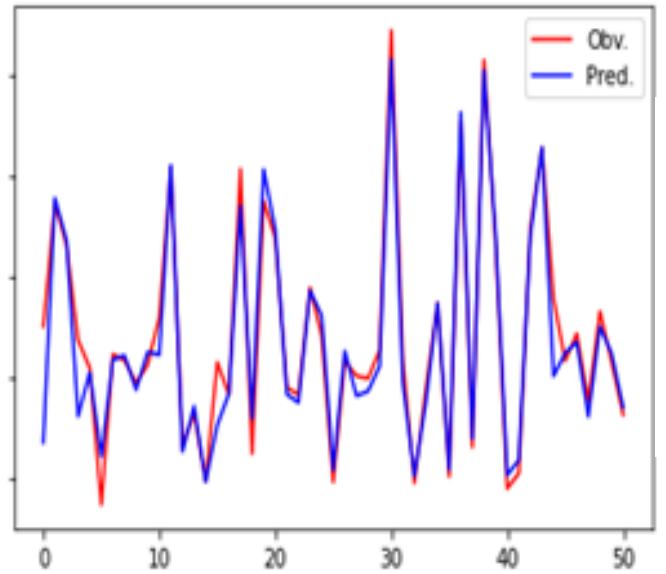
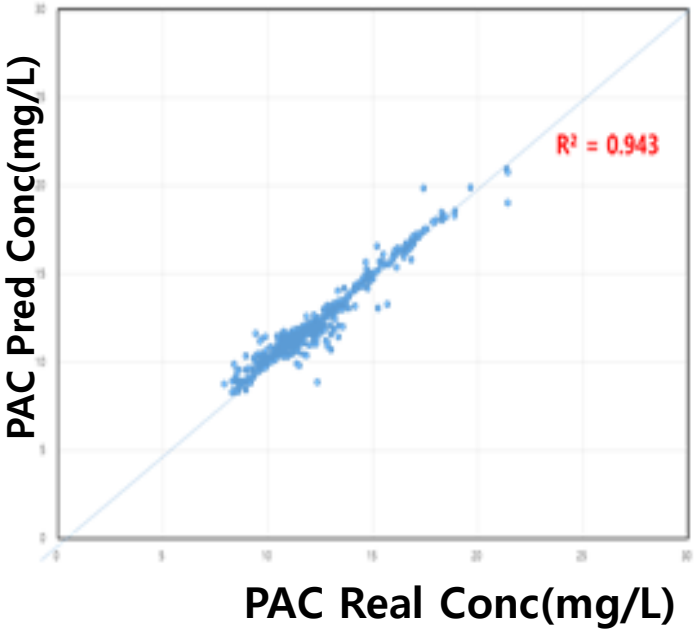
3. Injecting coagulant in WTPs

- **Injecting coagulant in DWTPs by using AI**
  - **Inputs : Turbidity, pH, Temp, Alkalinity**
  - **Models' test R^2 over 0.91**



Model	PAC	R^2(test)	R2(train)	MAE	RMSE
Ensemble -voting	XGBR-KNN	0.942	0.989	0.306	0.522
	XGBR-KNN- Linear regression	0.925	0.961	0.408	0.600
	XGBR-KNN-Random Forest	0.942	0.990	0.310	0.515
Ensemble -stacking	XGBR-KNN	0.910	0.975	0.450	0.655
	XGBR-KNN- Linear regression	0.943	0.995	0.310	0.519
	XGBR-KNN-Random Forest	0.930	0.984	0.360	0.573





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4. Indoor Leak Detection Tool(1/2)

1. Monitoring and Analyzing Water Consumption Patterns by using AMI's Data
   - Targeting Household 15mm, Finding Outliers

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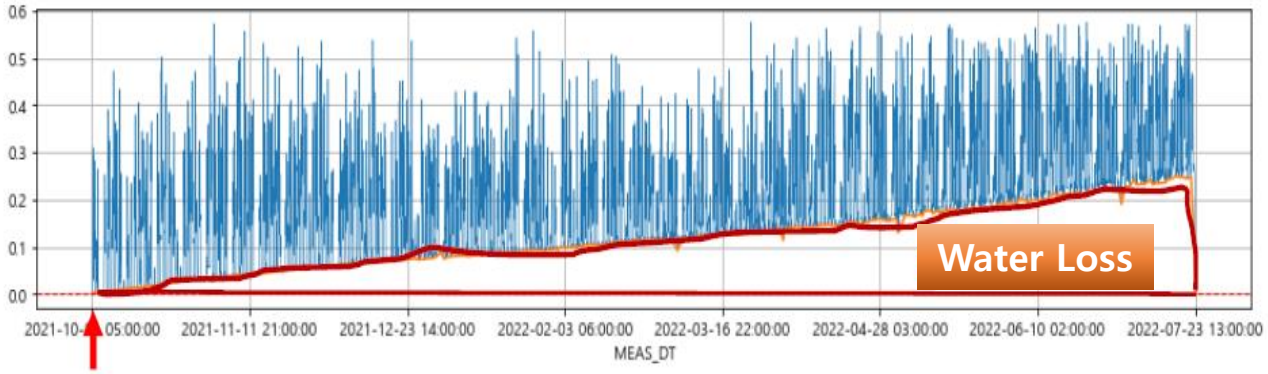
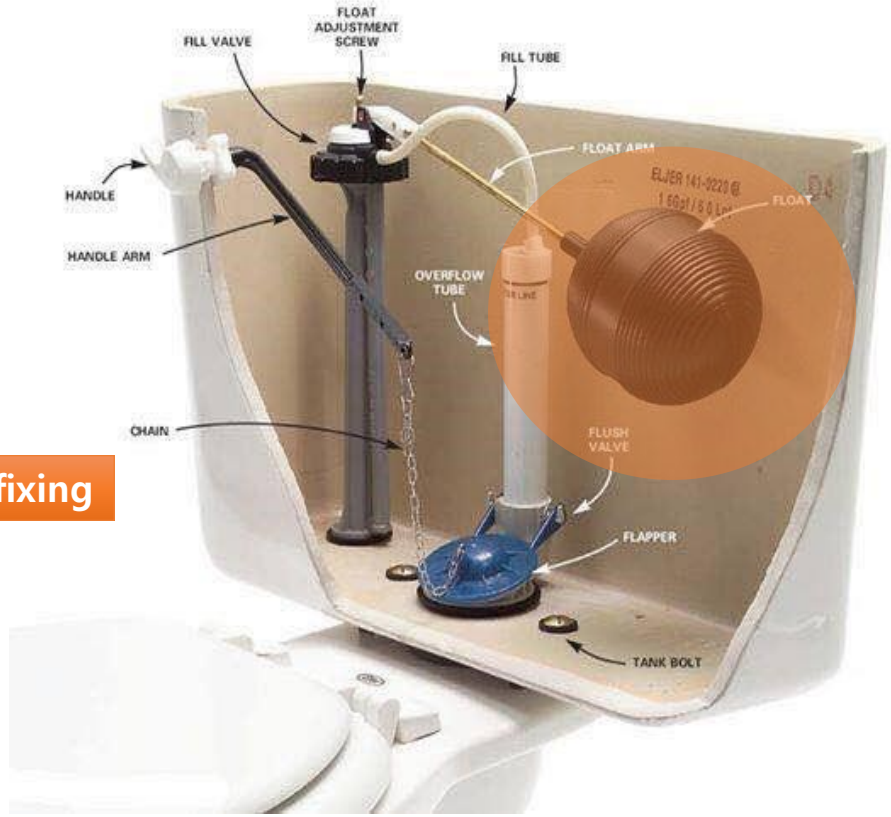
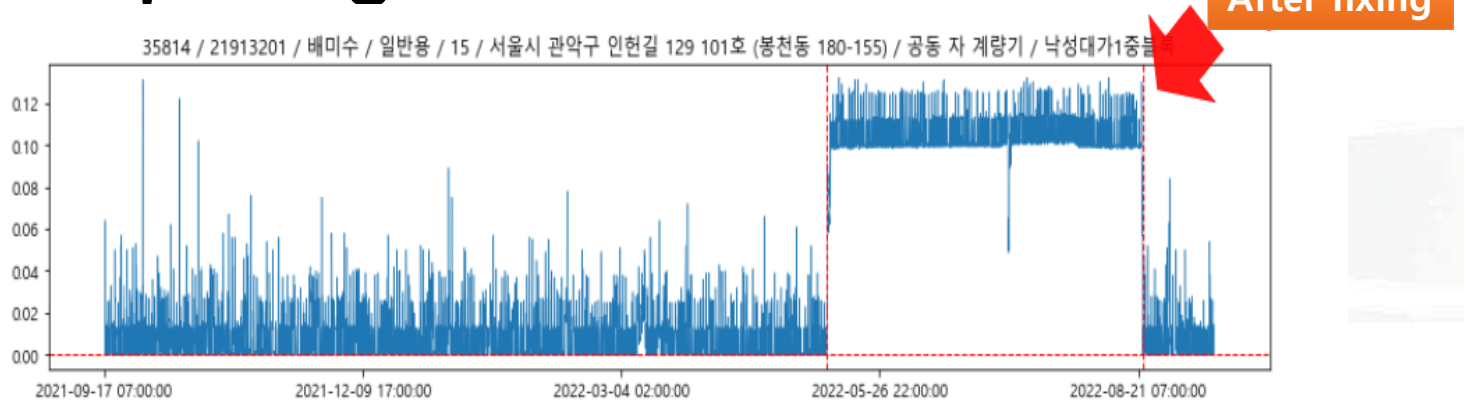
4. Indoor Leak Detection Tool(2/2)

1. Detecting the Indoor Leak





2. Repairing the leak



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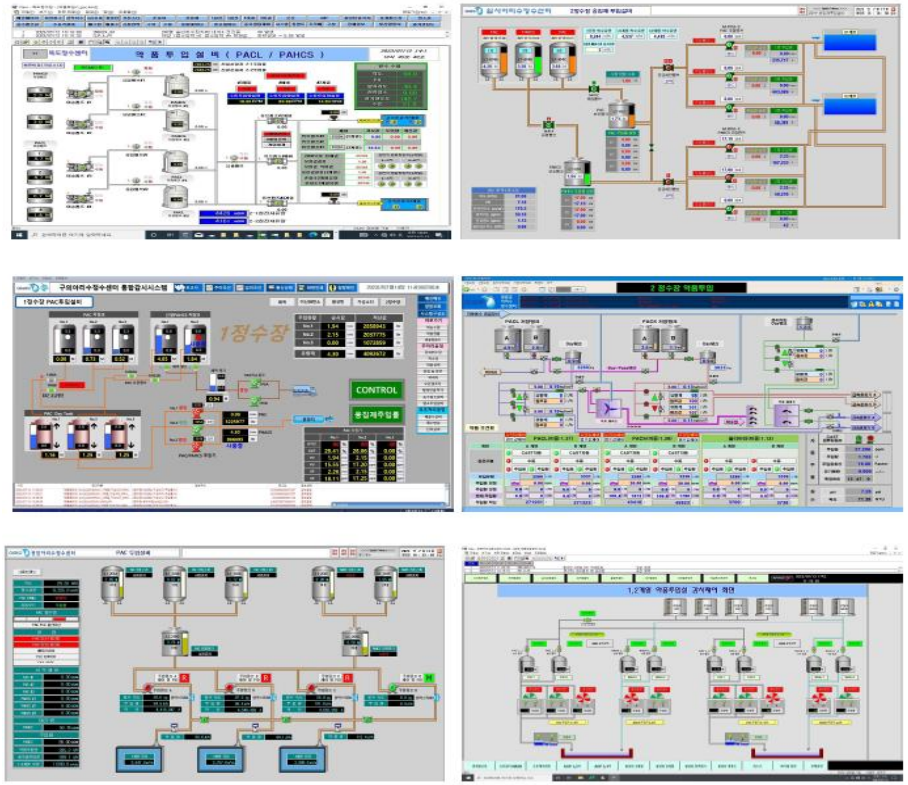
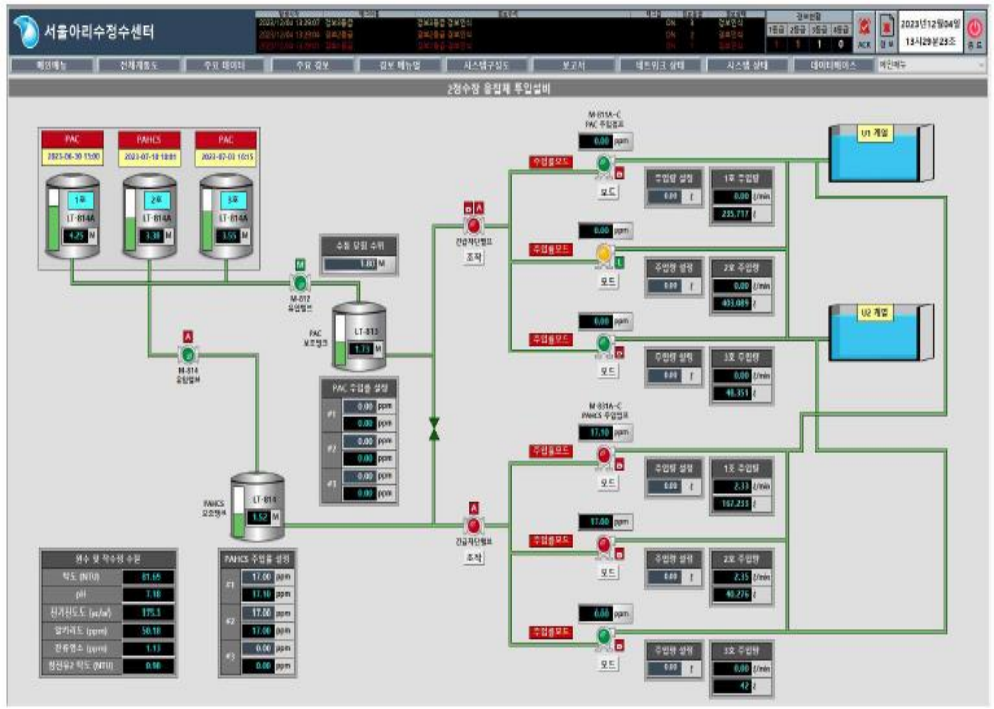
5. Data Standardization in WTPs(1/2)

- Standardizing HMI(Human Machine Interface)



- Six WTPs are using different HMI.



- Shortened the time to adapt to the system after moving in

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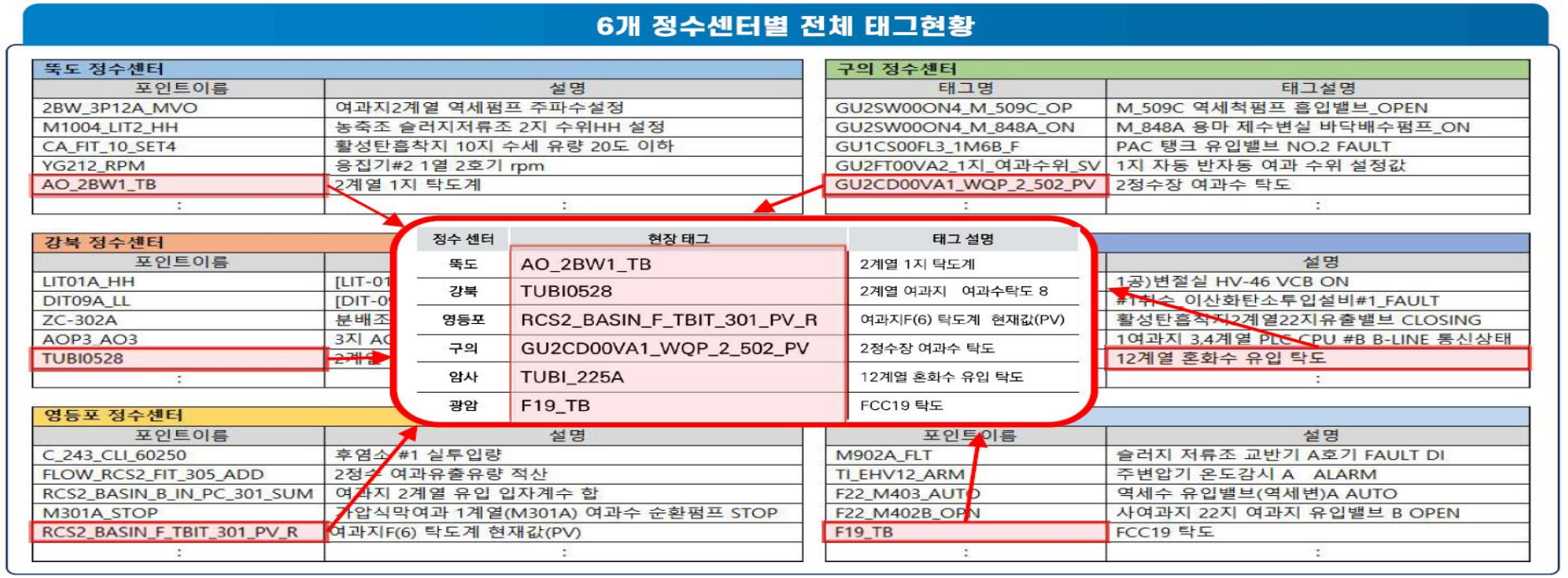
5. Data Standardization in WTPs(2/2)

- Standardizing Tag names, words, domains and so on
  - Six WTPs are using different Tag names.
  - Easy to extract data from WTPs by using the same Tag names



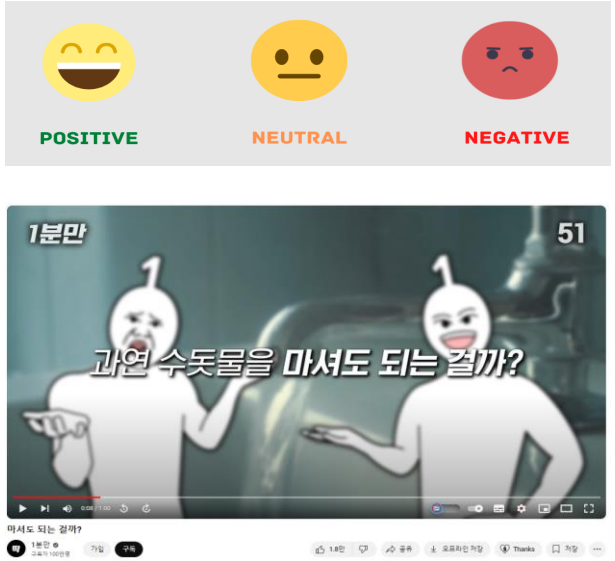
6. Text Mining to surveying Consumers' Drinking Water Perception

- Consumer Perception Inspection on Drinking Water is ongoing.
  - Targets : Tap water, Water Purifier, Bottled Water
  - Methods : Crawling News and comments, YouTube, etc
  - Analyzing Keywords and Sentiment

Tap Water

Water Purifier

Bottled Water



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List of Challenges

1. Predicting Reddish Tap Water Areas
2. Water Pipe Lifespan

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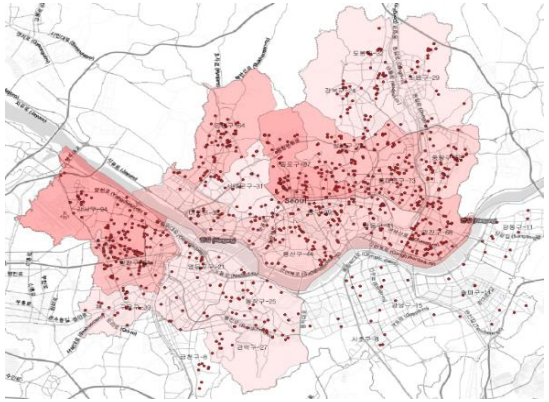
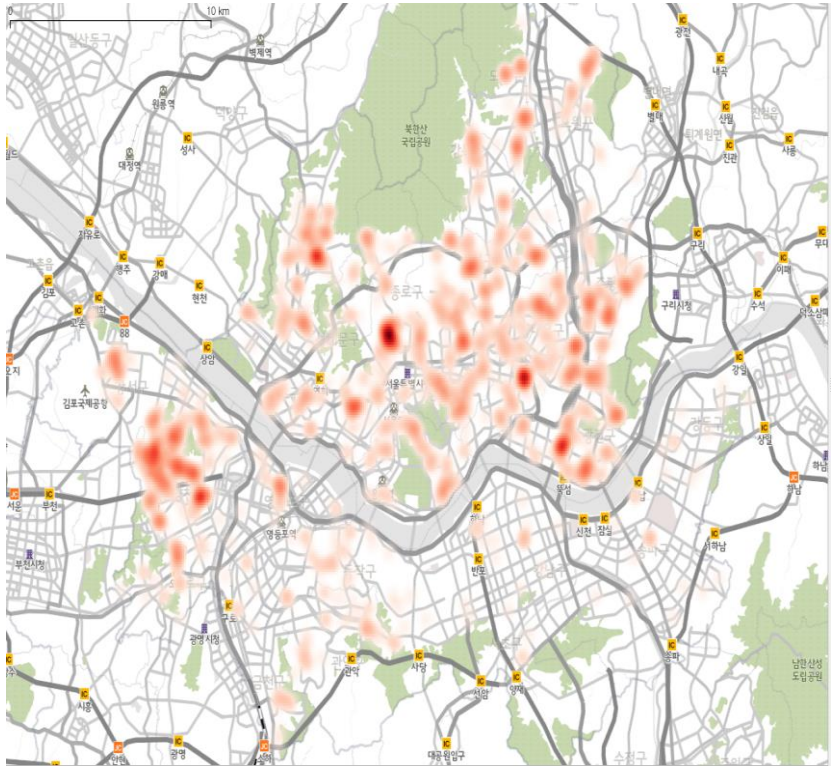
1. Predicting Reddish Tap Water Areas

- Water Quality Complaints
- Flushing
- Maintenance
- Water Pressure
- etc





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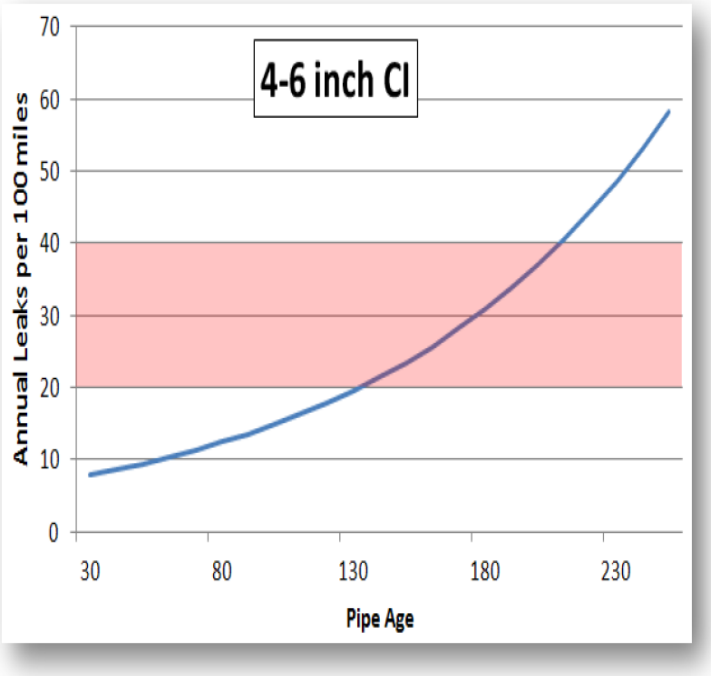
2. Water Pipe Lifespan

- Leak and Break Data
- Soil Condition
- Traffic Data
- Weather Data
- Water Pressure
- Risk Evaluation
- etc



EWEB

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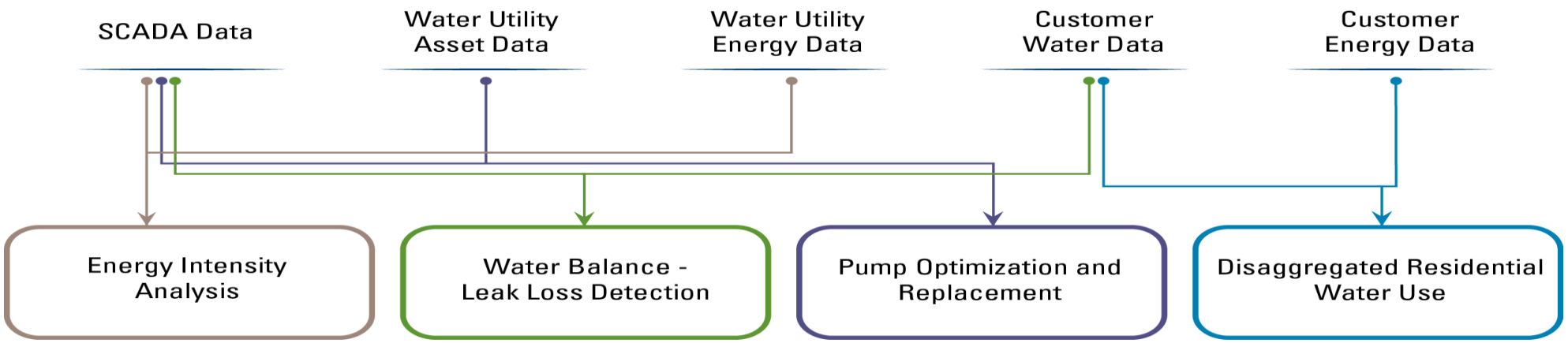
IV. Why does SW strengthen Digital Education?

1. SW's Data(1/2)

- **(Internal) Large Volume, Data interconnected**
  - Asset(price, date, manufacturer,…)
  - GIS(latitude and longitude)
  - Time, Flow Rate, Pressure, Energy(KWh),…
  - Water Quality(Turbidity, pH, Temp,…)



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1. SW's Data(2/2)

- **(External) Unpublished SW's Data**

  - National security facilities

  - Only local Govt or K-water run water utilities exclusively

    (It means, their staffs having the Domain Knowledge in water utilities)

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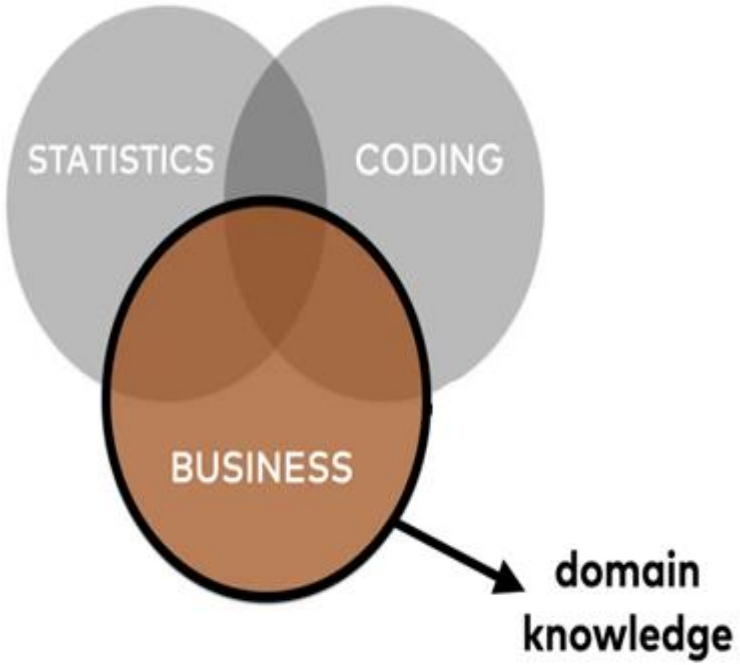
2. SW's Human Resource

- Employees having High Domain Knowledge
  - SW training them periodically
- However, lacking Big Data Analysis Skills

=> SW opening various training programs



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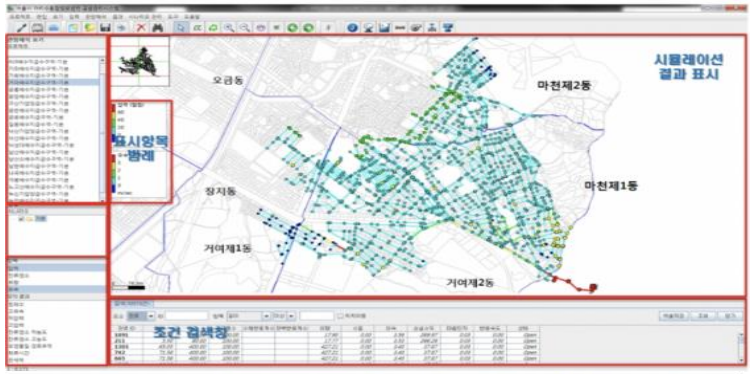
V. SW’s HRD Plans for DT

1. SW's HRD Programs(Short Term)

- Purpose Helping Understand and Familiarize SW's Systems
- Making and Announcing an Annual Training Plan
- SW's Curriculum
  - How to use GIS
  - Water Quality Monitoring System
  - SCADA system used in DWTPs
  - AMI
  - Big Data in Waterworks
  - Water Supply Network Analysis
  - Arisu Integrated Information System



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2. SW's HRD Programs(Long Term)

- **Beneficiaries of Domestic University and Graduate School Tuition Assistance Program ('20 ~ '24)**

No. in total	No. of Graduate School Applicants	No. of University Applicants	No. of Short Course Applicants	No. of Digital Related Major Applicants
84	29	51	4	8

- Examples of Digital-Related Majors

: Computer Science / Big Data AI Business Information / Mechatronics Engineering / Mechanical Convergence Engineering / Mechanical Engineering / Smart Electrical and Electronic Engineering

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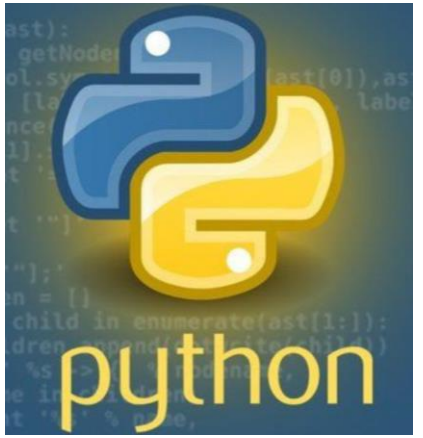
3. SMG's HRD training programs

- **Focusing on How to use Big Data Analysis Tools**
- Making and Announcing an Annual Training Plan
- SMG's Curriculum
  - R, Python Programming
  - How to Use ChatGPT
  - SQL Practice
  - GIS Program
  - How to Analyze Big Data



ChatGPT

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Thanks