Technology Development of Streamlining/Sophistication/Automation for Facilities Operation Management

(Research of FY 2017-2021)

1. Purpose

Recently, ICT (Information and Communication Technology), IoT (Internet of Things), IoT (Internet of Things), AI (Artificial Intelligence), Robotics, etc. have been more and more introduced in the field of wastewater. These innovative technologies aim to streamline, sophisticate, and automate the operation management of the wastewater facilities. This study aims to investigate and consider the applicability of these innovative technologies and make the feasibility study by such as joint research with private companies.

2. Outcomes of this year

(1) Prediction methods and accuracy were theoretically considered and verified for "Feasibility study on supporting technology for the operation control of wastewater treatment using AI"

The FS has been carried out as a B-DASH Project(Breakthrough by Dynamic Approach in Sewage High Technology Project) promoted by MLIT(Ministry of Land, Infrastructure, Transportation, and Tourism.)

(2) Followed by the last year, the demonstration was made at the actual facilities for "Efficient sewage treatment control technology using process control and remote diagnosis with ICT" as independent research after B-DASH Project.

(3) Researchers organized research reports of the national government and municipalities for issues on the wastewater projects, especially O&M and operation management. Besides, a hearing survey was carried out at the Ban-nan WWTP consulting JS for its O&M. Based on the results of the survey, AI, Image data processing, and Robotics technologies were chosen as solutions for extracted resolvable issues. Table 1 describes information regarding the latest technology trend and the applicability of each technology to wastewater systems.

Table 1. Examples of technology having applicability to the field of wastewater

Technical field	Elemental technology	Contents	Application	Benefits
AI	Sign detection	Extract key patterns from acquired time series data	Pre-grasp of the damage patterns of equipment	Streamline operations
	Control	Stabilize input/output parameters for the whole system optimization	Optimization of aeration volume, etc.	Automate operations
	Machine learning	Repeatedly learn data to find its property and regularity	Adjustment of the operation parameter of wastewater treatment facilities	Streamline operations
Image data processing	3D measurement	Measure 2D image (RGB) and depth	Measurement of the locations of the sludge interface at the settling tank, etc.	Streamline operations
	Image sharpening	Sharpen the indistinct image because of turbidity of water, etc.	Inspection of submerged equipment	Streamline operations
	Narrow space photographing	Photograph narrow spaces where people can not come in	Inspection of dangerous locations or narrow spaces	Labor-saving of operations
Robotics	Submergible robot	Automatically travel underwater to photograph still or moving images	Inspection of underwater equipment, grasp the conditions of sludge sedimentation inside the water tanks	Streamline operations
	Automatic navigation	Automatically travel even without GPS while assuming its location	Inspection of dangerous places and narrow spaces	Automate operations
	Assist robot	Assist people in their dangerous works	Removal of clogging in a dewatered cake conveyor	Labor-saving of operations

3. Future plan

The investigation will continue at the actual facilities to know the practical conditions of the deterioration environment of organic acid. For carbonic acid, a field survey is scheduled at the actual facilities.

> Keywords: **ICT, IoT, AI, Image processing technology, Robotics**