

Empirical Study on B-DASH Project (Technology to diagnose facility deterioration using ICT, Sewage treatment facility operation management with AI support) (Research period: from FY2015)

TAJIMA Atsushi, Head, OHTA Taichi, Senior Researcher, YAMAMOTO Akihiro, Researcher, ISHIKAWA Takeshi, Researcher, MATSUHASHI Manabu, Researcher, YAMOTO Takatoshi, Researcher, Wastewater and Sludge Management Division, Water Quality Control Department

keywords: sewerage, ICT, AI, operation management support, deterioration diagnosis, innovative technology

1. Introduction

In order to achieve cost reduction etc. in sewerage service by accelerating research and development and practical use of new technologies, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has been implementing the Breakthrough by Dynamic Approach in (B-DASH Project) since fiscal 2011 and the NILIM has been serving as an implementing organization of this empirical study. This paper introduces the outline of the technology for diagnosing sewerage treatment works deterioration using ICT and the operation management supporting technology for labor-saving / automation of water treatment using AI (artificial intelligence) in view of the recent increase in the importance of facility management with stock management of sewage treatment works and the rising concern about the shortage of technical capabilities due to decrease in skilled engineers.

2. Technology to diagnose facility deterioration using ICT

(1) Empirical study on technologies for deterioration diagnosis and facility inspection by sensor continuous monitoring and cloud server concentration (Joint Research Organization of Swing Corporation and Sendai City) These technologies are used for upgrading the condition-based maintenance consisting of deterioration diagnosis technology and facility inspection technology, which analyze the data

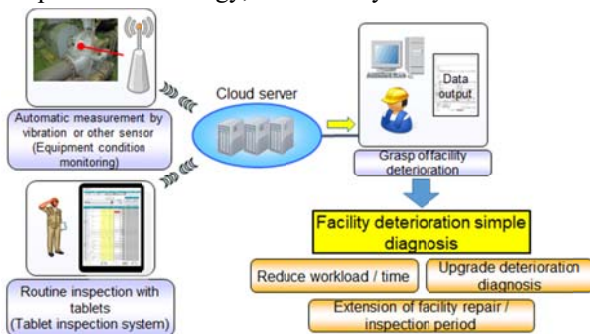


Fig. 1. Sensor continuous monitoring and cloud server concentration technique

obtained from continuous monitoring of the condition of facility using vibration sensors and the data obtained from daily inspection with tablet terminals, both of which are efficiently concentrated on the cloud server (See Fig. 1).

The empirical study aims to demonstrate the effective data extraction / analysis method for the deterioration diagnosis technology using the data collected in the cloud server, as well as the effect of workload reduction for the facility inspection technology using tablet terminals.

Use of these technologies is expected to contribute to reduction of maintenance cost in facility deterioration diagnosis, reduction of workload and time in routine facility inspection, and formulation of proper facility maintenance plan.

(2) Empirical study on technology for grasping / diagnosing deterioration of sewerage facilities by vibration diagnosis and big data analysis (Joint Research Organization of Water Agency, NEC, Asahi Kasei Engineering, Japan Sewage Works Agency, Moriya City, and Hidaka City) This technology is a combination of sensing technology and big data analysis technology and used to detect signs of abnormality and forecast deterioration by conducting an analysis (big data analysis technology) using continuous monitoring (sensing technology) data of rotating equipment using vibration sensors and a large amount of operation data

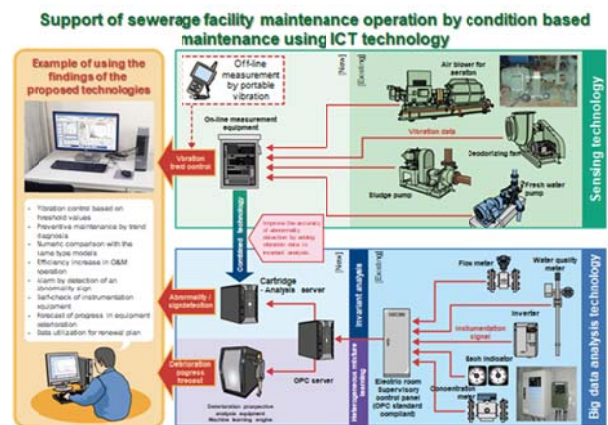


Fig. 2. Vibration diagnosis and big data analysis

in the facilities (See Fig. 2).

The empirical study aims to demonstrate (i) the equipment trend control and condition based maintenance using vibration data for the sensing technology and (ii) grasp of the sign of equipment abnormality and forecast of progress in deterioration using various types of operation data for the big data analysis technology.

Condition-based maintenance with these technologies is expected to lead to effective detection of equipment abnormality and to the effect of reducing maintenance cost.

3. Sewage treatment facility operation management with AI support

(1) Study on automation / labor-saving technology for sewage treatment facility operation with AI (Joint Research Organization of Meidensha Corp., NJS, and Hiroshima City)

With regard to AI technology for deducing automatic grasp of treatment condition, necessity for operation improvement, and response method using the historical data of sewage treatment facility operation, water quality data, image data of treatment condition, etc., this study examines verification of technical performance, possibility of automation and labor-saving, reliability for practical use, and introduction method (See Fig. 3).

This technology enables efficient operation according to treatment situations by judging operation status and treatment situation and providing necessary operation / response with operation / image processing AI and deducing causes of abnormality and response method with response & judgment AI when abnormality occurs, and is expected to be used as an operation management support technology that can solve the shortage of technological capability due to decrease in skilled engineers.

(2) Study on the technology using AI for supporting sewage treatment facility operation management (Joint Research Organization of YASKAWA Electric Corp., Maezawa Industries, Inc. and Japan Sewage Works Agency)

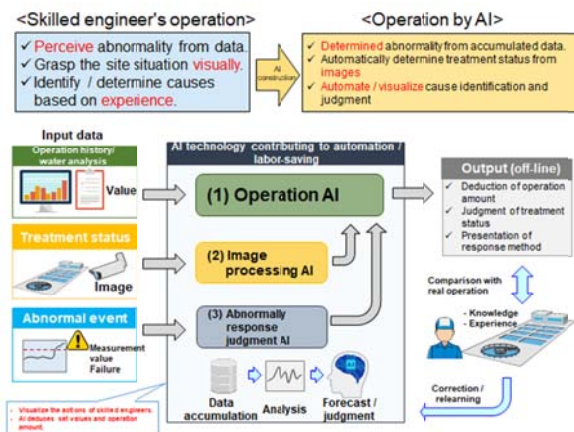


Fig. 3. Sewage treatment facility operation management with AI support

With regard to "Water treatment control support technology," which supports decision of the control set values for water treatment facilities using AI technology and "Image diagnosis technology," which supports decision of the state of activated sludge treatment, this study aims to check technical performance, etc. using operation control data and image data of actual facilities and examine the effect of introduction and possibility of dissemination (See Fig. 4).

Application of these constituent technologies to operation management of sewage treatment facilities is expected to improve efficiency / labor-saving in operation management and to contribute to realization of continuous operation management because transfer of technical know-how of skilled engineers, which has been an issue to solve, will be facilitated.

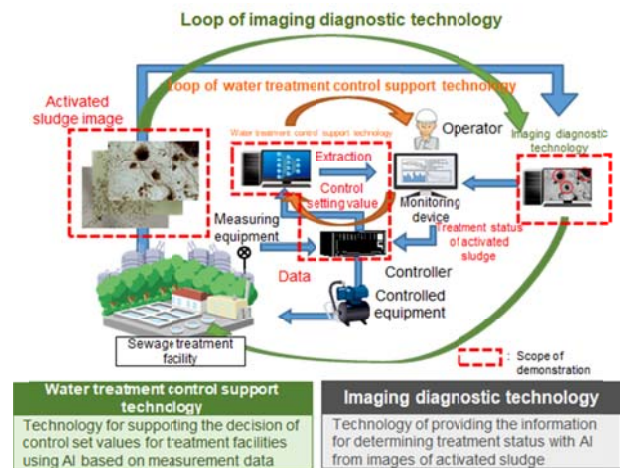


Fig. 4. Technology using AI for supporting sewage treatment facility operation management

4. Future development

NILIM continues to lead the B-DASH project and promotes dissemination of innovative technologies obtained from research findings. For the empirical study on the facility deterioration diagnosis technology using ICT and FS (feasibility) research on the sewage treatment facility operation management with AI support, we continue to collect data and organize them together with the data so far obtained. With dissemination and development of these technologies, we aim to contribute to reduction of sewage facility maintenance cost and improvement of productivity in the whole sewage works.

See the following for details.

[Reference] Website introducing B-DASH
<http://www.nilim.go.jp/lab/ecg/bdash/bdash.htm>