

Development of Data-Flow Control Algorithm of Wireless Network for Sewage Disposal Facility

Soonho Jung^{*}, Jaekwon Shin^{**}, Jeongjin Kang^{***}, Seungyoun Lee^{****}, Junghoon Lee^{****†}

^{*}Graduate School of NID Fusion Tech., Seoul National Univ., of Science and Tech., Seoul, Korea

^{**}Fivetek Co. Ltd., Seongnam, Korea

^{***}Dept. of Information and Communication, Dong Seoul College, Seongnam, Korea

^{****}Dept. of Electrical Information Control, Dong Seoul College, Seongnam, Korea

Abstract

Recently, water sewage disposal facilities are able to manage real-time data collection and record management through compact broadband modem LAN switching technology. Therefore, it needs more stable and efficient facility management. So, we required practical use of environmental facilities convergence based on broadband integrated modem. In this paper, we proposed short distance wireless communication network of compact broadband modem for sewage disposal facilities. And it received data inside of water treatment facility using the two communication methods (IEEE802.11x and IEEE802.15.4x). Then, our proposed an data-flow control algorithm of wireless network technology will prioritize processing data when emergency happen through collecting data, analysis data and processing. Lastly, we proved usefulness by experiment and simulation analysis.

Keywords: IEEE802.11x, IEEE802.15.4x, Compact Broadband Modem, Short Distance Wireless Communication

1. INTRODUCTION

Sensor networks are applied in sewage disposal facilities such as existing wastewater treatment generates transmission delays through by the processing speed of the node that corresponds to the thin-hop in the case of transmitting the real-time traffic using the WSN. Even when the number of nodes increases in a WSN the low-speed data transmission, Traffic of the whole network by a multi-hop transmission is significantly increased. While the larger the transmission delay in the real-time traffic transmission because of an increase in number of hops. [1][2][3] Through the transmission delay, the amount of resources increases. So, as the number of nodes in a WSN increase is necessary the study of technical measures to minimize the power consumption and the real-time traffic. In a study of existing WSN academic study was conducted for the active real-time traffic. But a real-life example is very limited. In Korea, along with the standard protocol, the low-speed technology based on the IEEE 802.15.4 PHY standard is mostly used in accordance with the Mesh Network support required for low power consumption and a large network. Also, the current wireless sensor /

control networks occurs service development data traffic and data movement paths problem since the transmission data generated by the sensor in the center of the server, the server is a central structure for delivering control instructions to the Actuator.

Many improvements are needed in the state of the technology because simultaneous analysis techniques and integrated management and control system is extremely inadequate and the various sensor information is inferior in clarity to generate the data. Although water treatment facilities, this integration with the system that can be managed is insufficient. A situation that has many problems, such as ocean dumping regulation and supervision of the site map. To improve this, the plan we have any standardized middleware and integration services platform that the purpose of the various sensor networks and services can be integrated and accepted in progress. As the real-time data acquisition and traceability is possible through a compact broadband modem switching technology, Stable and efficient environment facility management and integrated broadband modem based on the applicable technology is a practical application of environmental facilities necessary condition of convergence [6] [7].

In this paper, we propose a technique for transmitting the multiple measurement data to the server based on user defined logic and workflow setup functions such as anomalies occur during prioritization as high-speed broadband technologies over the existing low-speed based technology through interoperability with IEEE802.15.4, IEEE802.11x two communication methods for the commercially available for real-time transmission technique.

The order of the paper was configured as follows: Following the introduction chapter 1, 2 presents a communication system according to the switching technology of the two events occurs, 3 section algorithm development short distance wireless communication network of compact broadband modem. Chapter 4 a simulated test was conducted to validate the usefulness of compact broadband modem, short distance wireless communication algorithm proposed in Section 3, ends of the paper concludes in chapter 5.

2. DESIGN OF DATA-FLOW CONTROL ALGORITHM ACCORDING TO THE EVENT

In this section, we propose an IEEE802.11x and IEEE802.15.4x switching technology of the event occurred. The technology to be proposed is possible to provide an efficient function that workflow system and user logic processing using IEEE802.11x and IEEE802.15.4x switching technology. It receives the real-time data from TN/TP sludge into multimeter measurement device and video surveillance camera in sewage disposal facilities. Workflow setting and user logic processing function is available to quickly cope when emergency event. It can efficiently transfer a plurality of the measurement device data since prioritize anomalies data in a sewage disposal facilities when an event occurs.

The following figure 1 shows a data-flow chart using IEEE802.11x and IEEE802.15.4x applying these functions when an event occurs.

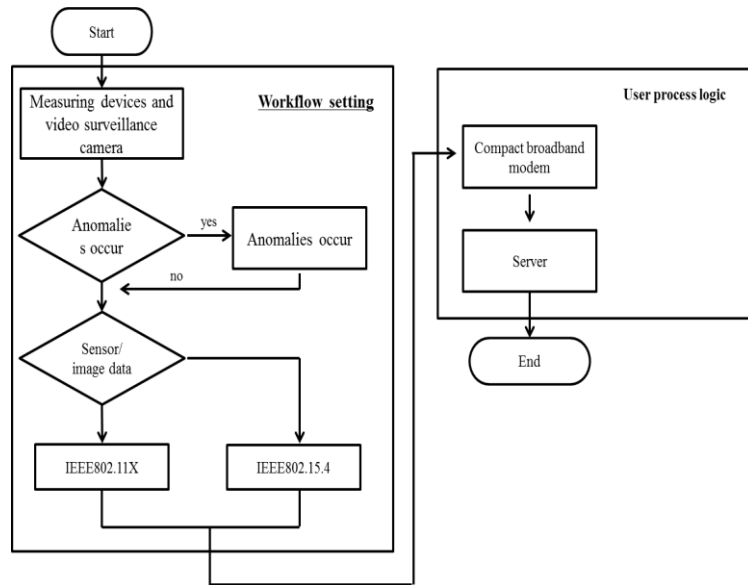


Figure 1. Data-flow Control Algorithm using IEEE802.11x and IEEE802.15.4x

Workflow setting system is possible to quickly cope with and emergency event has occurred by sending data with priority through the linkage of the two way communication with IEEE802.11x and IEEE802.15.4x. Data which the event occurred is available through a plurality of data collection, analysis and process from sewage disposal facilities. The user logic processing method linked to IEEE802.15.4x and IEEE702.11x. The above method provides ability to effectively transmit a plurality of the measurement data to sever depending on user defined logic.

3. DEVELOPMENT OF DATA-FLOW CONTROL ALGORITHM OF WIRELESS NETWORK

In this paper, it proposes a workflow setting and user defined logic functions by short distance wireless communication network of compact broadband modem. User logic processing function of the compact broadband modem is shown if Figure 2.



Figure 2 User logic processing function configuration

The user logic processing method using compact broadband modem linked to IEEE802.15.4x and IEEE702.11x. The above method provides ability to effectively transmit a plurality of the measurement data to sever depending on user defined logic. These data were received from TN/TP sludge into multimeter measurement device and video surveillance camera in sewage disposal facilities.

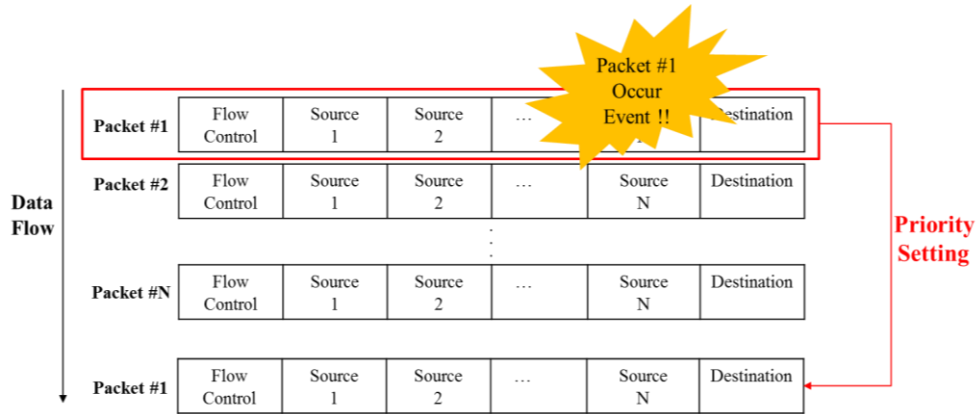


Figure 3. Work-flow setting function configuration

Workflow setting system of compact broadband modem is possible to quickly cope with and emergency event has occurred by sending data with priority. DATA WHICH THE EVENT OCCURRED IS AVAILABLE THROUGH A PLURALITY OF DATA COLLECTION, ANALYSIS AND PROCESS FROM SEWAGE DISPOSAL FACILITIES.

4. EXPERIMENT

In this section, a simulation test was conducted in order to verify the usefulness of the data-flow control algorithm applying the workflow settings and user defined logic functions. The experiment was conducted using the data-flow control program. In addition, IEEE802.11x and IEEE802.15.4 were installed in the transmission for minimize losses when transmitting the video and sensor data. The test results are shown in Figure 4.

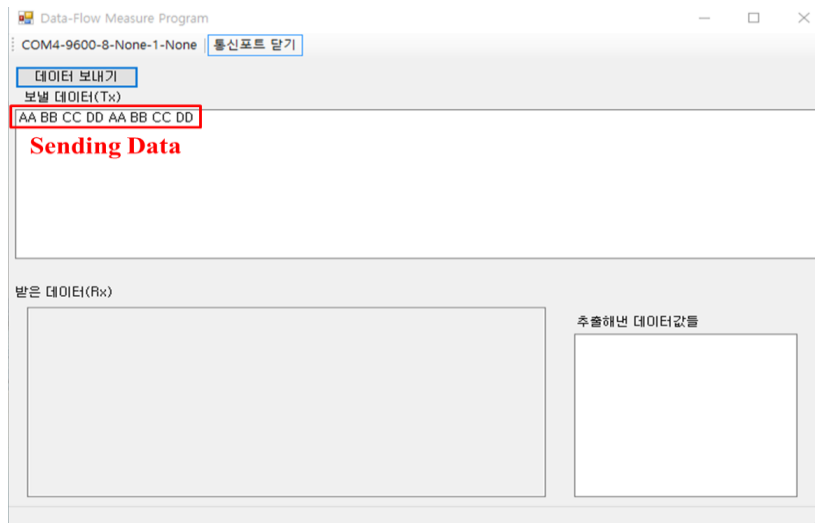


Figure 4. Data-Flow Control program for Image and Sensor Data Transmission

Figure 4 is data-flow control program for sensor and image data transmission. The data-flow control algorithm to transfer data to the server consists of the integrated control center by applying the workflow setting of the image and sensor data from the measuring device and user logic processing through linkage with IEEE 802.11x and IEEE802.15.4x.

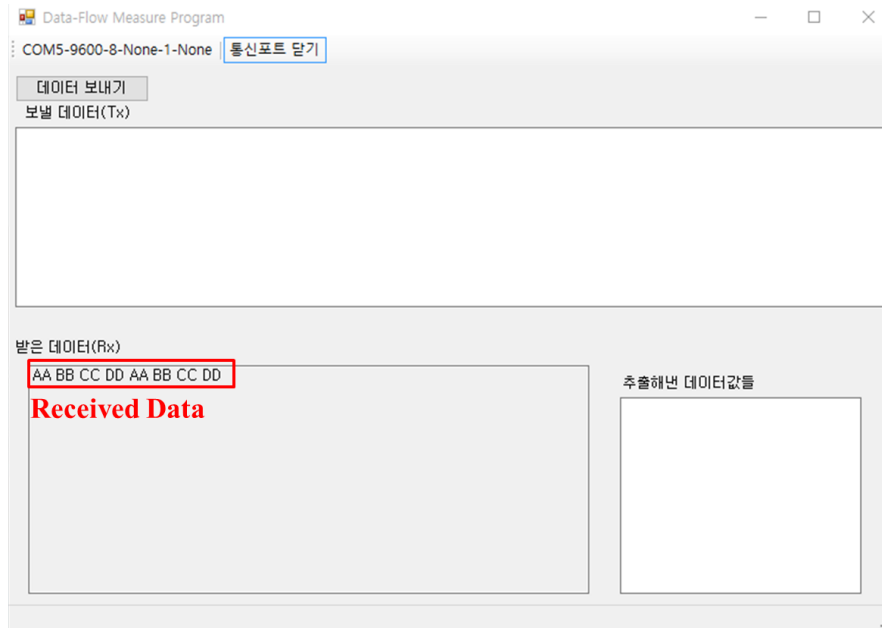


Figure 5. Data-Flow Control Program for Received Image and Sensor Data

Figure 5 represents the Received Data via data-flow control program applied to data-flow control algorithm. Image and the sensor data can be confirmed to be received image and sensor data when sending a request signal using a data-flow control algorithm for sewage disposal algorithm.

5. CONCLUSION

In this paper, we propose data-flow control algorithm of wireless network can be applied sewage disposal facilities. We propose a switching technology through the linkage of the two communication methods that IEEE802.11x and IEEE802.15.4x by the building measures and communication system when an event occurs. There is the workflow functionality in the event of anomalies by the collection of data, analysis and processing which it is received from the sewage disposal facility. So send to sever according to a number of measurement data to a user-defined logic. The availability was verified through simulation tests using the data-flow control program applied to data-flow control algorithms.

ACKNOWLEDGEMENT

This subject is supported by Korea Ministry of Environment as "Global Top Project"(Project No.:GT-11-B-02-014-3)

REFERENCES

- [1] Ministry of environment, "The status report on the operation and management of sewage treatment plants in korea," pp. 8, Ministry of environment, Seoul, 2011.
- [2] Korea environment corporation, "The report on the propriety of energy saving project in the sewage treatment plant," p. 51, Ministry of environment, Seoul, 2008.
- [3] S. Kang, H. Lee, J. Kim, and K. Han, "Application of Microfiltration and Reverse Osmosis System to Sewage Reuse for Industrial Water," *Membrane Journal*, Vol. 12, No. 3, pp. 151-157, 2002.
- [4] James F. Kurose, Keith W. Ross, *Computer Networking 3 edition*, 2005
- [5] K. Kim, A. Ahmad, and K. Kim, "A Wireless Multimedia LAN Architecture Using DCF with Shortened Contention Window for QoS Provisioning," *IEEE Communication Letters*, Vol. 7, No. 2, pp. 97-99, Feb. 2003.
- [6] Shinjae Kim, Younggyun Kim, Wanjjic Lee, Bumju Shin, Seokyeol Heo, "Design of Ondemand Routing Protocol for Sensor Networks," *Journal of Korean Institute of Information Technology*, pp. 320-324, June 2009.
- [7] Jongwan Yoon, Yongki Ku, Kakyung Oh, Dongryeol Shin, "Middleware for Home Monnitoring System over Heterogeneous Network Environments," *Journal of the Korea Academia- Industrial cooperation Society*, pp. 283-286, 2009.
- [8] Wu Woan Kim, Sang Dong Jang, Jung Hwan Park, Eun Jin Jang, "Development of a Remote Monitoring and Management System for Sewage and Waste Water," *KIISE Fall Conference* Vol. 31, No. 2, pp. 397-399, Oct. 2004.
- [9] Ji-Tae Kim, Haeyoung Hwang, Byungpyo Hong, and Hongsik Byun, "The Background and Direction of R&D Project for Advanced Technology of Wastewater Treatment and Reuse," *Membrane Journal*, Vol. 21, No. 3, pp. 277-289, Sep. 2011.
- [10] Korea environment corporation, "The report on the propriety of energy saving project in the sewage treatment plant," pp.51, Ministry of environment, Seoul, 2008.
- [11] The National Energy Technology Laboratory (NETL), *A Vision for the Smart Grid*, 2009.
- [12] Lee D.S. and Vanrolleghem P. A. "On-line monitoring equipment for wastewater treatment processes: state of theart," *AutMoNet*, Vienna, Australia, 2002.
- [13] C. Liting, "Wireless Mesh Monitoring System for Sewage Treatment Plant," *International Colloquium on Computing, Communication, Control and Management*, IEEE, pp. 351-353, 2009.