Department of Management and Information Sciences	Key words	IoT, Internet of Things, Edge Computing, Cloud Computing, Energy Management, Mobility System, IoT Education, Prototyping

Ph.D.(Information Science) / Professor

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Education

Dept. of Electrical Engineering(Master Course), The Graduate School of Eng., Toyama University. Dept. of Applied Information Science (Doctoral Course), Graduate School of Information Sciences, Tohoku University

Professional Background

Information Technology R&D Center, Mitsubishi Electric Corporation. Mitsubishi Electric Building Techno Service Co., Ltd. Part-time Lecturer at Tokyo Denki University, Invited Researcher at Waseda University, wins FA Foundation Best Paper Award, 2017.

Consultations, Lectures, and Collaborative Research Themes

IoT System Concept Making & Designing (Manufacturing IoT, Environment IoT, Mobility IoT) ,Recurrent Education for Manufacturing IoT

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Main research themes and their characteristics

「Study on a hybrid IoT Architecture that realizes Altruistic Balancing between Edge and Cloud」

It is expected that the IoT (Internet of Things) will lead the 4th industrial revolution by 2030 and will become a social infrastructure for solving various problems in Japan such as the revitalization of regional industrial and maintenance of dilapidated social infrastructure. However, the edge-centric IoT system that processes near the source of data and the object to be controlled is suitable for edge optimization in the local area, but it is difficult to deal with cloud optimization of the whole area.

In this study, we clarified the division of roles between edge and cloud in the IoT system and proposed a hybrid IoT architecture based on a stepwise distributed optimization algorithm that optimizes each the edge and the cloud altruistically.

By adopting this architecture, for example, the overall optimization of the energy management system can be realized by balancing the electric power supply and demand balance in the electric power company and the comfort and productivity in the electric power consumers. Also, in the urban traffic management system based on our proposed IoT architecture, it is expected that traffic flow will be optimized considering both traffic jam mitigation by ITS (Intelligent Transport Systems) and driver's comfort in autonomous vehicles.
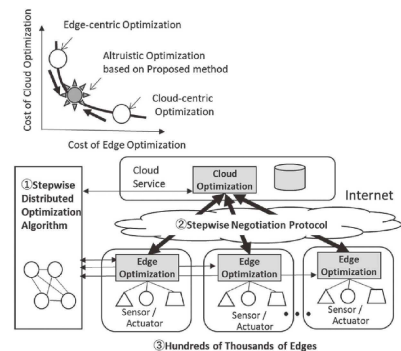

Fig.1 Hybrid IoT Architecture to Realizes Altruistic Balancing

「Study on Prototype Education Method for IoT Human Resource Development」

For the great spread of IoT systems, it is important to develop IoT human resources who have domain knowledge of the applications and can embody IoT systems optimally combining IT and OT. Here, IT means Information Technology such as network and security, and OT means Operation Technology such as electricity and machinery.

In this study, we are developing a prototyping education method and teaching materials to develop human resources who can contribute to the spread of IoT systems in the future.

Specifically, we are developing teaching materials utilizing SONY MESH to encourage the interest of elementary, junior high and high school students in IoT world, and holding AI/IoT experience labs using our teaching materials at university festivals. Also, we are developing teaching materials of mini robot development incorporating AI and IoT technologies for PBL (Project Based Learning) of our university. Further, as the recurrent education for the manufacturing industry, we prepare prototyping teaching materials for IoT systems connecting to PLC (Programmable Logic Controller) built into the manufacturing machines and are working on the revitalization of local industries by IoT.
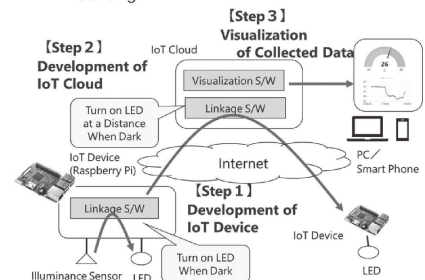

Fig.2 Examples of IoT prototype training tasks in PBL

Major academic publications

S. Kitagami, V. T. Thanh, D. H. Bac, Y. Urano, Y.Miyanishi, and N.Shiratori, "Proposal of a Distributed Cooperative IoT System for Flood Disaster Prevention and its Field Trial Evaluation," International Journal of Internet of Things, Vol. 5, No.1, pp. 9-16, 2016

T. Suganuma, T. Oide, S. Kitagami, K Sugawara, and N. Shiratori, "Multiagent-Based Flexible Edge Computing Architecture for IoT," IEEE Network, 32(1), 16-23, 2018

"IoT Technology Text 2nd Edition, " supervised by the Consortium for Promoting Mobile Computing, Rick Telecom Oct. 2018, contributed the 2nd chapter

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