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A novel Way of Context Inference for the Enhancement of the Smart Distribution Panel Function

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ABSTRACT : *In this study, we considered each sensor as a factor of change in working out the target situation. Using this, we calculated the event data detected and reported by each sensor as a complex factor affecting the target situation. In this paper, we propose a new method to detect a target situation based on only the measurement value of a single sensor. However, It can be deduced as an arithmetic method. This shows that it can be helpful to take action on the current situation and to take action on the target situation*

KEYWORDS: *IOT, Smart Distribution Panel, Data Stream, Context Awareness, Event*

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I. INTRODUCTION

In recent years, studies have been actively carried out for the safe consumption of electricity for consumers who use electricity, and attempts are being made to apply artificial intelligence to study the intelligent and efficient recognition of the condition of the switchboard of the consumer. These intelligent applications are always executed based on the connected sensor network and the sensing data of the sensor. In recent years, stabilization of wired and wireless data communication networks has been a great help for the development of the smart age. The research issue for intelligent application is sensor data processing and utilization. An advanced situation inference method is needed to improve the function of the smart switchboard system which intelligently recognizes the state of the switchboard and the safety of the electric equipment connected to the switchboard.

The goal of the smart switchboard is to recognize and manage the status of the switchboard and all electrical equipment without user intervention. To recognize the status of the switchboard and the electrical equipment, existing applications recognize the field as a result of detection by a single sensor. One of the measures that can be taken to improve the function of smart switchboards is to use sensors with higher performance than before. A robust sensor can provide better information or less error-prone data. Better performance sensors or more powerful sensors can be costly. The adoption of a better performance sensor will require consideration of the appropriate decision between cost and actual required performance. It will take time for the better sensor to be cheaper. Another way to improve the functionality of smart switchboards is to use the same level of sensors as before, or inexpensive sensors, to efficiently process the data detected and reported by the sensors. The efficient utilization of sensor data is based on the premise that the hardware performance, type, and quantity of the sensor do not change.

This study limits the research environment to the sensors installed in existing switchboards and the sensors related to the condition of the electrical equipment. In the environment where no new sensor or high-performance sensor is added, the data processing side can be adjusted to recognize the condition of the switchboard and electrical equipment and to perform better than the existing one. This study should deviate from the use of the previously adopted sensor values and situations in a one-to-one correspondence manner. It is assumed that the function of the smart switchboard is to be improved but limited sensors are utilized. The goal of this study is to improve the situation recognition performance by analyzing the physical changes related to the situation and the detection results of the sensors that detect chemical changes.

This study is composed as follows. Chapter 2 summarizes related research. In Chapter 3, we propose a situation inference method for improving the function of Smart Switchboard. In Section 4, we conduct experiments and evaluations of the proposals and conclude in Section 5.

II. RELEVANT STUDIES

2.1 Real time data stream processing

Stream Objects In the Internet environment, data sensed by a sensor requires real-time processing, and there is a large amount of continuous data continuously and it is difficult to store. Efficient information processing and processing of large-capacity data of real-time sensor data is required. The Storm architecture, a distributed framework for processing stream data, has Hadoop's Nimbus daemon and the Supervisor daemon. Data processing in the Storm application topology solves the problem of processing large amounts of data in a batch format from Hadoop and enables real-time analysis of stream data in the Internet environment of objects. However, it is difficult to maintain and expand the stream sensor data while moving it [1].

Kang Yoonhee designed a software architecture for processing sensing data collected in the IoT environment and described the application configuration of Storm, an open source framework. After collecting data through the Sensor Gateway, it converts the live streaming data into a pipe-filter style. The sensor gateway passes it to the collector through the NoSQL repository. The collector performs a filtering function that extracts and transforms specific data of the data through the converter. The results were stored in a NoSQL repository for use in real-time data applications and visualizers [2].

Research is underway to integrate semantic web technology for the interoperability and value of sensor data in the Internet environment. Semantic transformation of data for convergence of sensor data and service domain knowledge is required. The technique of converting static metadata to semantic data (RDF) cannot handle real-time, large-volume data properly in the Internet environment of objects [3].

Kwon, SoonHyun, and three others converted the semantic data through real-time and parallel processing of large-scale stream sensor data generated in the Internet environment of objects. Define sensor, event, and context ontology models and transformation rules. It builds a translation knowledge base (Translation KB) and constructs Translation Topology based on Apache Storm real-time and parallel framework. Performs collection, conversion, and storage of real-time sensor data with reference to the conversion knowledge base. To improve performance, each conversion task was processed in parallel using Apache Storm, a big data real-time analysis framework [4]. The heterogeneous stream transmitted from the sensors is converted into context-aware data and stored. The sensor stream processing system manages information between sensor streams and provides a boolean function, an operator and a continuous query. The situation stream processing system consists of a sensor stream catalog manager, a sensor stream analyzer, a sensor stream continuous query manager, and a sensor stream converter. Park et al. [4] implemented a stream data management system that stores the data read from the sensor network processes the query efficiently, and outputs it to the upper application or the web [5].

2.2 Smart Switchboard Safety Inspection System

Damage caused by fire or power outage caused by an electrical equipment accident has a very large ripple effect. Equipment accidents in switchboards are caused by various stresses during the short and long term. Insulation failure, natural deterioration, and overload. A performance verification method based on representative international standards for low-voltage switch-gear and control-gear assemblies has been established [6].

Kim diagnosed various electrical safety conditions such as deterioration state, defects, and electrical connection status of terminals by measuring the temperature distribution signal generated from the electrical equipment in real-time. The number of electrical equipment for hospital medical equipment, the deterioration condition of electrical equipment was diagnosed after telescopic measurement of surface temperature distribution image by using high-performance infrared thermography camera of incoming cable, breaker, insulator, and power cable of substation facility[7].

Increase the design life by preventing the accident beforehand by recognizing the signs of insulation deterioration in the switchboard of the electric room beforehand and taking measures early. The degradation of high-voltage equipment in the switchboard is caused by long-term deterioration due to electrical, mechanical, thermal and environmental stresses. In the course of the evolution from the deterioration to the accident, electromagnetic waves are generated in the initial stage, and after a lapse of time, a relatively low frequency is generated, and leakage current is generated by overheating. Byeon Kwon et al. [1] pointed out the importance of switchboards in the industrial field and proposed preventive maintenance activities of high-voltage facilities by measuring and analyzing the partial discharge of switchboards at the water intake point [8]. Partial discharge can be detected using HFCT, UHF sensor, TEV sensor. HFCT is the most widely used sensor in power cable diagnosis, UHF sensor can detect the electromagnetic wave radiated when PD occurs, and TEV sensor can detect a signal that radiated electromagnetic wave is moved along metal enclosure [9].

There were applications to add control and communication functions to the switchboard technology. The current and voltage sensors were optimized for the high-voltage switchboard, integrated with digital relays and open communication. It should protect the load from electrical accidents and smooth power supply [10].

III. A NOVEL WAY OF CONTEXT INFERENCE FOR THE ENHANCEMENT OF THE SMART DISTRIBUTION PANEL FUNCTION

In this paper, we propose to integrate the sensing results into the context recognition. Sensor detection is often not the case. It is the role of sensors to detect and quantify physical and chemical phenomena in response to changes in circumstances. Therefore, what the sensor detects is not the situation itself, but it provides the basis and data to infer the situation. In the case of a sensor that detects a fire, it detects the occurrence and increase of CO_2 associated with the fire or detects a sudden increase in temperature, rather than detecting the fire itself. In the case of sensors used for monitoring the switchboard and electrical equipment, the situation itself was detected. Detecting the overcurrent phenomenon can be detected through the current sensor, and the temperature sensor used for detecting the heat due to the resistance of the facility detects the heat itself. However, the context awareness of the smart age is advancing to a wider variety, and it is necessary to utilize the sensing data of the sensor in a complex way. Even with limited types and quantities of sensors, more inferences are made. In this study, we propose the same method. The algorithm for the combined use of sensor data proposed in this study is as follows.

1) s1, s2, s3 are different sensors.
2) ds1, ds2, ds3 are the data sets reported by each sensor.
3) e1n, e2n, e3n (n = 1 ~ n) are events detected by each sensor.
4) CA1 is a tool for situational awareness
   CA1 (t) = an • e1n • t
   CA2 (t) = an • e2n • t
   CA3 (t) = an • e3n • t
5) e1n ds1, e2n ds2, e3n ds3
6) CI1 is the context information, and CI1 (t) = CA1 (t) + C • Fe (t) At this time,
   E2n + e2n + e1n•E3n + e2n• E3n + e1n• E3n• E3n

What should be noted in this algorithm is Fe (t). Fe (t) is expressed as follows.
E2n + e2n + e1n• E3n + e2n• E3n + e1n• E3n• E3n
When the number of sensors is n, we have 2n element sets (f is relevance index).

In this paper, we propose a method to detect the target situation using multiple sensors. It can take into account the phenomena that affect the current situation and can help to take action on the target situation. It also has the advantage of being able to measure the progress of various situations and situations. When artificial intelligence advances in science and technology are imitating human intelligence, it is true that people and other creatures use a variety of information channels as a phenomenon. Thus, acquiring event data through various sensing mechanisms, such as human situational awareness, and performing contextual reasoning involving multiple elements may be beneficial in improving the performance of smart devices. Since this study supports the data stream processing technology required to realize smart switchboard, it is necessary to include a complex element to recognize the target situation. The suggestions in this study are shown in the following figure.

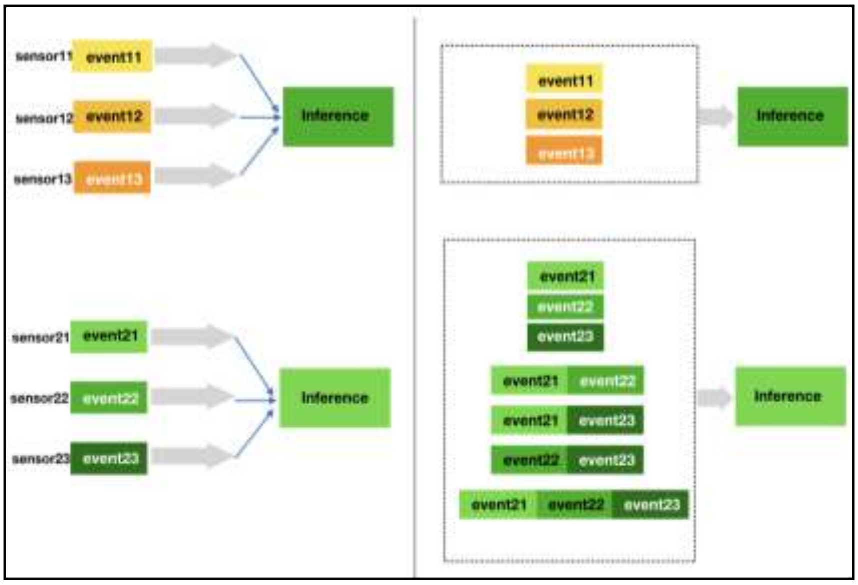

Fig. 1. Calculating the complexity of the sensor's sensed data

IV. EXPERIMENT AND EVALUATION

In this chapter, a method for calculating multiple events to improve the performance of situation inference in smart switchboard is experimented and evaluated. The sensor was adopted in mind to be installed in smart switchboard. The data processing device uses raspberry pie, and the sensor adopts a temperature sensor humidity sensor and vibration sensor. The data obtained from each sensor is shown in the following figure 1.

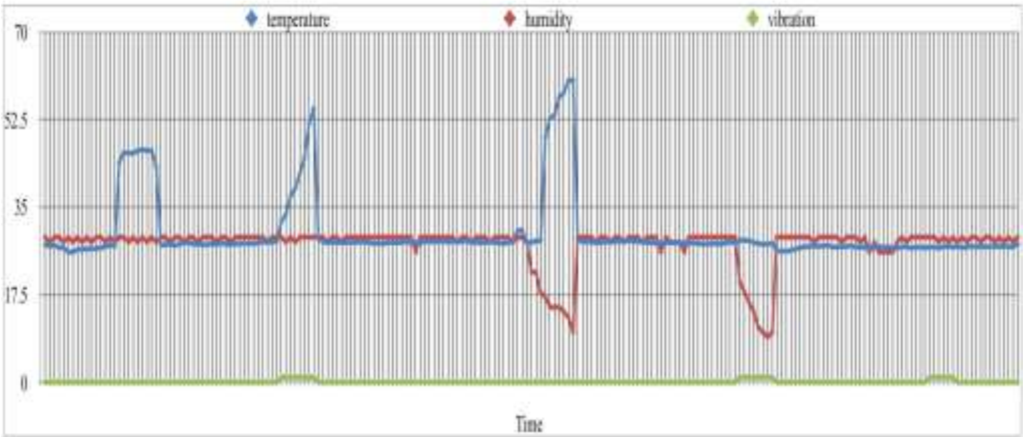

Fig. 2. Data detected and reported by the sensor

The blue line shows the change in the value reported by the temperature sensor. The red line shows the change of the value reported by the humidity sensor, and the green line shows the value detected by the vibration sensor.When the situation is recognized using this value, the following table can be obtained.

Table. 1 Situation inference using temperature, humidity, vibration sensor

case	time	temperature	humidity	vibration
1	2.2~3.8	Big Event	None	None
2	7.2~8.5	Big Event	None	Vib
3	11.2~11.5	None	Event	None
4	14.5~16.8	Big Event	Big Event	None
5	19~20	None	Event	None
6	21~22.2	None	Big Event	Vib
7	25~26.5	None	Event	None
8	27~28	None	None	Vib

Table 1 shows how to recognize the situation in the existing system. In Case 2, Case 4, and Case 6, when there is a complex sensor sensing activity, we performed simple reasoning that states that there are only two symptoms. The following table deduces the situation based on the suggestions in this study.

Table. 2 Context Reasoning Using Composite Elements

case	time	Events		Context
1	2.2~3.8	temperature	o	Context=Temperature
		humidity		
		vibration		
2	7.2~8.5	temperature	o	Context=temp+vib+(temp•vib)
		humidity		
		vibration	o	
3	11.2~11.5	temperature		Context=Humidity
		humidity	o	

		vibration		
4	14.5~16.8	temperature	o	Context=temp+hum+(temp•hum)
		humidity	o	
		vibration		
5	19~20	temperature		Context=Humidity
		humidity	o	
		vibration		
6	21~22.2	temperature		Context=hum+vib+(hum•vib)
		humidity	o	
		vibration	o	
7	25~26.5	temperature		Context=Humidity
		humidity	o	
		vibration		
8	27~28	temperature		Context=Vibration
		humidity		
		vibration	o	

We have performed complex computations for contextual reasoning on the data thus obtained. Context inference could contain complex elements in contextual reasoning, unlike existing systems.

V. CONCLUSION

So far, the existing switchboard management system showed that the events detected by a single sensor only apply to the target situation. In this study, we considered each sensor as a factor of change in working out the target situation. Using this, we calculated the event data detected and reported by each sensor as a complex factor affecting the target situation. In this paper, we propose a new method to detect a target situation based on only the measurement value of a single sensor. However, It can be deduced as an arithmetic method. This shows that it can be helpful to take action on the current situation and to take action on the target situation. Also, it was confirmed that there is an advantage of measuring the progress of various situations and situations

REFERENCES

[1]. Kang,Y.H.,:New Approach to the Platform for the Application Development on the Internet of Things Environment, Journal of Platform Technology, vol.3, no.1, 21-27(2015)

[2]. Kang, Y.H.,:Handling Streaming Data by Using Open Source Framework Storm in IoT Environment, Transactions on Computer and Communication Systems, Software and Data Engineering, vol.5, no.7,313~318(2016)

[3]. Lee, H.K., Marie,K., and Bang,H.C.,: IoT Techno-logy Trend and Development Direction, Korea information processing society review, vol. 21,no.2, 14-21(2014)

[4]. Kwon,S.H., Park,D.W., Bang,H.C., and Park,Y.T.,:Real-time and Parallel Semantic Translation Technique for Large-Scale Streaming Sensor Data in an IoT Environment, Journal of Korea Information Science Society,vol.42, no.1,54-67(2015)

[5]. Park,E.J., Byeon,J.W., Choi,D.S., Kim,J.H.,and Oh,R.D.,: An Effective Stream Data Management System for the Incomplete Stream Data on Sensor Network, Proceedings of the Korean Society of Computer Information Conference, vol.22,no.1,125-126(2014)

[6]. Jung,H.S.,: Study for performance of the low-voltage switchgear and controlgear assemblies, The Korean Institute of Electrical Engineers,809-810(2016)

[7]. Kim,S.G.,: Thermal Image Diagnosis of Power Supply for University Hospitals using infrared Thermography, Proceedings of KIIEE Annual Conference, 129-129(2015)

[8]. Lee,J.K.,and Im,J.Y.,: Detection and responses of PD signal in the cubicle of electric control room, The Korean Institute of Electrical Engineers, 1570-1571(2014)

[9]. Park, S.H.,: On/Off-line Measurement Results Comparison and Hybrid Type Diagnosis System Application, K-water Technical Report, (2013)

[10]. IEEE Std 400.3-2006,:IEEE Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment,(2006)

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