상황인지 기반 스마트 저전력 센싱 기술

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Low Power Smart Sensing Algorithm based on Context Aware

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요 약

In this paper, we propose context-aware based on Low Power Sensing Algorithm. The proposed sensing algorithm reduces power consumptions using low-power sensing algorithms and low-power sensing protocols. Experimental results show that the average power consumption of the proposed method is up to half consumption that of the conventional method.

1. Introduction

Nowadays Ubiquitous Sensor Network (USN) has actively discussed. It is connected to the network and the sensor which senses the physical phenomenon in the world around us, so it implies the concept of real-time control and management plus the network which can be perceived information. In other words, it is a new trial to construct the ubiquitous service environment in the future in that we can recognize and control the information of thing in itself and surrounding environment such as temperature and humidity through the network in real time if sensor attaches to every things in a living space [1][2].

Therefore, it is possible to build the wireless sensor network through the sensor which has the various functions owing to development of ubiquitous sensor network. Wireless sensor network is based on the way to notice, collect and process events which occurs in the real world through the network. It will be used in the ubiquitous service environment in the future as the monitoring system of the amount of rainfall, geological conditions and surveillance of enemy country in which cannot approach directly. Also, it can be utilized as the traffic control system and the ecosystem observations system [3].

The study of constructing of ubiquitous service environment is being progressed with activity. With the advent of the ubiquitous era, the use of the sensor has increased. The construction of sensor network is necessary to live in ubiquitous era. The use of elaborate sensor through a lot of sensors gives users more convenient surroundings. The huge increase in many different kind of sensors and the amount of power used leads to high power consumptions on account of this surroundings. It is obligatory to increase the use of sensor to construct more convenient ubiquitous service environment. A number of sensor lead to high power consumptions [4].

This paper will describe the development of technique of Smart Low Power Management through context aware based on low power sensing algorithms to solve the high power consumptions in existing sensor of facilities industry. There are methods, low power technique like multi-sensor low power signal processing/processor single SoC using hardware and efficient technique like a sensing period and technique for prediction of the situation in the various circumstances in implementing low-power sensing using software, and developing core technologies combining the two techniques in intelligent sensing is required.

Intelligent Sensing has the same accuracy like the existing sensing system, and is also based on research on low power systems [5][6][7].

2. Proposed Sensing Algorithm

We propose Low Power Sensing Algorithm to reduce power waste in a sensor network.

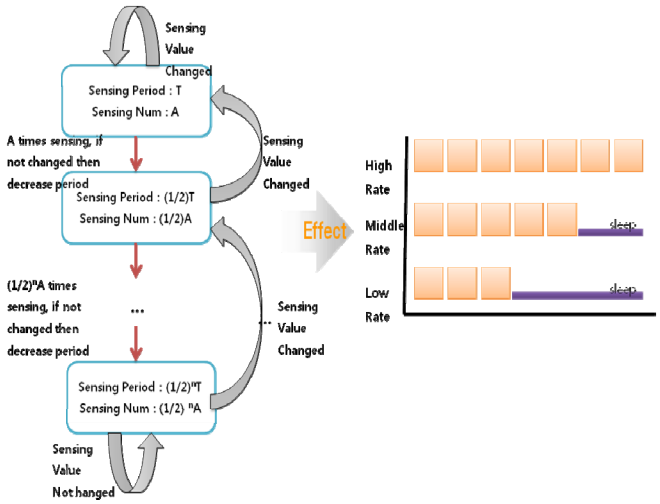
A. Low Power Dynamic Sensing Period

Low Power Dynamic Sensing makes sensing frequency decreased when the value of a sensor shows moderate changes in the number, and then the time of an activated Device will reduce. The movement of Low Power Dynamic Sensing is shown in Fig. 1. Let us suppose that the first frequency is T and the number of time is A. Device can save the certain number of sensing data, and renew the saving data in time order whenever it sense data. And, it can decide the movement according to comparison between the value of the first saving data and the one of measuring current one. The sensing frequency and the number of sensing per cycle should reduce by half if there is no change during sensing at A times with T frequency. If there is no change, it has the frequency reduced by half. More important thing is that the frequency should not be reduced less than $(\frac{1}{2})^n$ to prevent perception in late when the frequency is too low. On the other hand, if the value of sensing is changed, the frequency and the time of the sensing should be increased two times, and not be increased more than the maximum T and A.

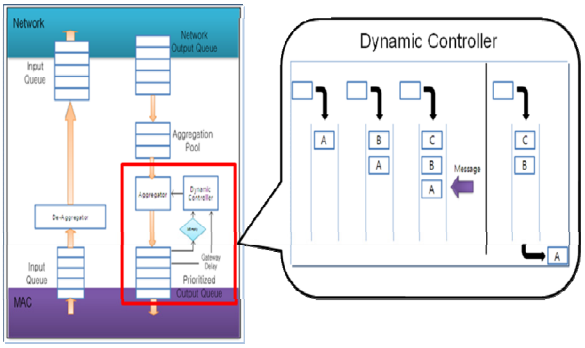
B. Low Power Adaptive Application Independent Data Aggregation

We propose Low Power Adaptive Application Independent Data Aggregation Algorithm to reduce power waste in sensing, depicted in Fig. 2. It has a separate buffer which a node has, and is used the way to transmit data when application requests it. Therefore, this Algorithm has the virtue of only accepting the possible data which can be processed as much as application requests it.

It is the way to request the buffer to fill the data after a while as much as application requests it after testing whether buffer is empty or not



(Figure 1) Dynamic Sensing Period



(Figure 2) Data Aggregation

3. Proposed Sensing Protocol

We suggest Low Power Sensing Protocol to reduce power waste in sensing. It applied for communication between a sensor and a middle ware using a SNMP.

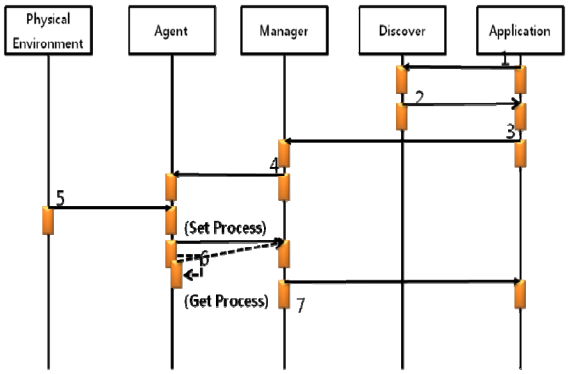
There are 4 operators, GET, GET NEXT, SET, TRAP, in SNMP. GET is used to request certain information from Manager to Agent. Basically, GET NEXT is the same function like Get. However, each information in SNMP is handled within hierarchical structure, and can be used to get every information existing in the hierarchical structure. Operator Set can be used to set up certain value and to move from Manager to Agent. Operator Trap can be used to inform the situation to Manger when some information that has to be reported to Agent occurs. It can be used to inform asynchronous events while the other requests is synchronous requests. These operators are suitable to apply in the communication between sensors and middle wares. We can organize 3 communication mechanisms to transmit data from the sensor to the middle ware.

- **Polling**: The way to accept unconditionally the noticed sensor data in the middle ware

- **Notification**: The way to let the middle ware know when an event occurs at a sensor

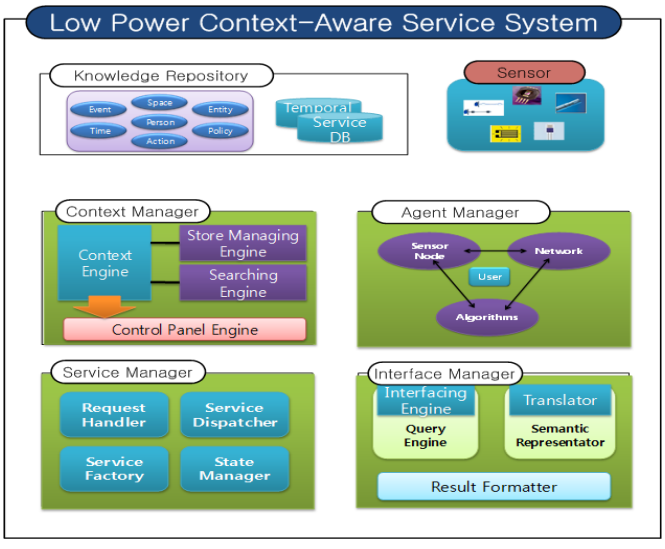
- **Query**: The way to get data which are needed in middle ware from a sensor

Among them, using polling method should be given useless data, because it should receive the regular data from the sensor. That is why sensor wastes energy and middle ware also wastes time to get useless data while sending data. Therefore, as a communication mechanism between the sensor and middle ware, they are suitable for 'Notification' and 'Query' method except the polling. It is suitable for the operators GET and Trap among these SNMP operators. The operator GET sends the message of SNMP Request using the equipment having the agent SNMP to get information which a management system wants to gain. After that, agent SNMP sends the required data with the message of SNMP Response. Also, the operator of Trap can be used in urgent events through sending notification from SNMP agent to management system.

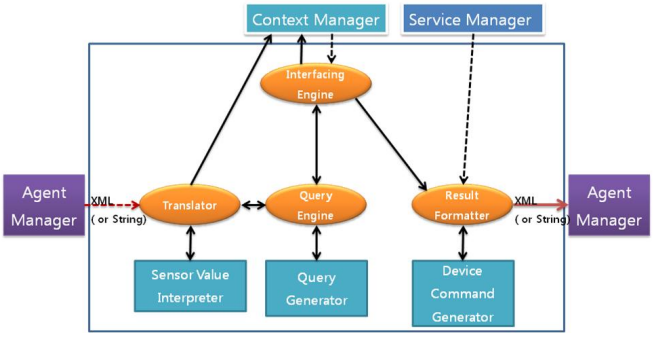


4. Low Power Context-Aware Service

We propose LPCAS to provide low power adaptive application.



Interface Manager is the module that carry out to convert the output resulting in the system into the output such as control instruction and audio output as well as to forward the converted input such as the order of user and the value of the sensor to provide the service.



In addition, the Interface Manager has the function of Convergence Interface, the formation and analysis of Query and Result Formatting. The Result Formatting is characterized by adjusting different communication protocol. It means that the Interface Manager is used to convert the various information and different communication protocol into common format. Convergence Interface is to change or forward parsing of the input of the information in Low-Level context from Agent manager to the instance of Context model and deliver high ranking context resulting in the implement of Semantic Representation to Query Engine. The function of the formation and analysis of Query is to transform user commands into Query form or convert the order from Context Manager into the Query form. The function of Result Formatting serves as the role of changing high ranking context from the Service Manager to the proper low ranking context.

Context-aware should handle the different situation effectively to provide the intelligent service.

- **Search Engine**: Searching Engine is a kind of module providing the function of searching the various situation as well as retrieving meta-data within the DBMS.

- **Store Managing Engine**: Store Managing Engine can control a filling system, directory and saved contents and maintain schema and DBMS.

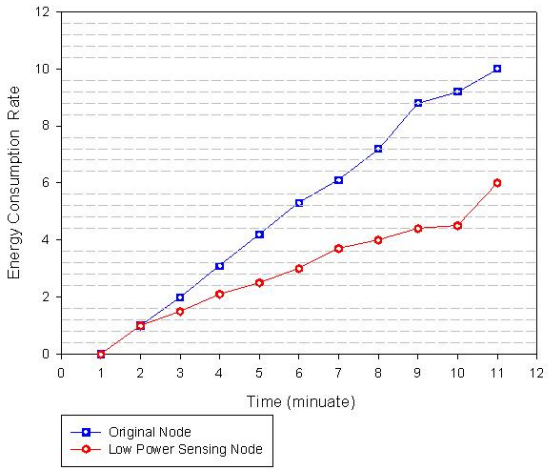
- **Control Panel Interface**: Control Panel Interface can be provided Searching Engine and interface which can access Store Managing Engine.

The service Manager manages various Agent and Device mutually, and provides common serve for low power intellectual sensing in the industry of the facilities. Also, it is the module serving as the combination and administration of a unit of service to solve the problem of collision. The Service Manager is the last engine to play the role of observing and maintaining the sole task and a unit of service to supervise devices, spatial information and policy. It is used to be linked to each module and engine, so order each Actuator to plan, decide and provide the substantial service.

The service manager establishes Action plan based on the data from the context manager. then, it makes new session if there is not the previous session after checking. After that, the Service Manager checks the Task list which exists relevant data, and decides whether the new Task produces or not. Also, it registers Action to operate the Actuator. Each action is operated according to their schedules. The information of sensor is very important to apply the service. Therefore, Service Manager has to always keep the latest information when it apply in service. Service Manager gets the information of sensor which can be linked with Context Manager, and serve low-power sensing using the information.

The Agent Manager is the associated structure which is connected to centralized processing system and distributed processing system. Centralized processing system can send all data collected from the existing many sensor to mid- middle ware, and deal with them in a mump. On the other hand, distributed processing system is that all sensor nodes carry out to collect and process data separately. Also, the Agent manager is a hybrid structure. It can analyze the collected information through communicating and dealing with sensor nodes. After that, the output which comes out these processes delivers to a central control system. Therefore, it is composed of the proper combination of the sensor network Topology and Algorithm in sensor Node

5. Performance Evaluation and Conclusion



This paper is about the system composed of using the context aware based low power sensing Algorithm. We have suggested the way to minimize the wasteful resources using an arbitrary buffer and the means to be induced to the low power sensing through the control of the number of sensing dynamically. In addition, We have proposed the protocol which can maximize the function of the low power sensing. We have made the system for the efficient low power sensing through the four module, Context Manager, Agent Manager, Service Manager and Interface Manager, to provide the service.

If you use this, you can use the effective electric power compared with the existing sensing. Also, you can consist of the efficient ubiquitous sensor network net in the ubiquitous computing society in which people will use a lot of the sensing.

Reference

[1] Sangheon Pack, Min Zhang, Dukhyun Chang, Kideok Cho, Yanghee Choi, and Taekyoung Kwon, "A Survey on Integration Sche1` mes of Wireless Sensor Networks and Internet for Ubiquitous Sensor Networks," SK Telecommunications Review, Vol. 15, No. 2, April 2005.

[2] Jones, C.D., A.B. Smith, and E.F. Roberts, *Book Title*, Publisher, Location, Date.

[3] Sangheon Pack · Min Zhang · Dukhyun Chang · Kiduck Cho Yanghee Choi · Taekyoung Kwon “A Survey on Integration Schemes of Wireless Sensor Networks and Internet for Ubiquitous Sensor Networks”

[4] Seyoung Park, Taekhyun Kim, Hoon Choi, Yunju Baek “Design and Implementation of Low Power Container Security Device(CSD)”

[5] Seyeol Ahn, Hak-Gyoon Kim, Yeong-Joon Jeong, Myoung-Wan Koo " Recent Technology Advances in Multimodal Context-aware Interface "

[6] JongHyun Park “Sensor Middleware System research”

[7] Sungchan Park, Sangkeun Lee, Sang- goo Lee "Research on Issues in Practical Scenarios for Realizing Context Aware Services "