Low Power Sensing Algorithm based on Context Aware

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Abstract. 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 sensing protocols. Experimental results show that the average of power consumption of the proposed method is up to half consumption that of the conventional method.

Keywords: Context aware, Sensing algorithm, Sensing protocol

1 Introduction

This paper describes a development of smart low-power management system based on low power sensing algorithm techniques to reduce the energy consumption in a wireless sensor network area. There exist several methods that reduce the energy consumption technique, such as multi-sensor signal processing and processor SoC solution based on hardware method [1][2]. In this paper, we proposed the method to reduce energy consumption based on software method; sensing period and technique for prediction of the situation in the various circumstances in implementing low-power sensing method 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.

2 Proposed Sensing Algorithms

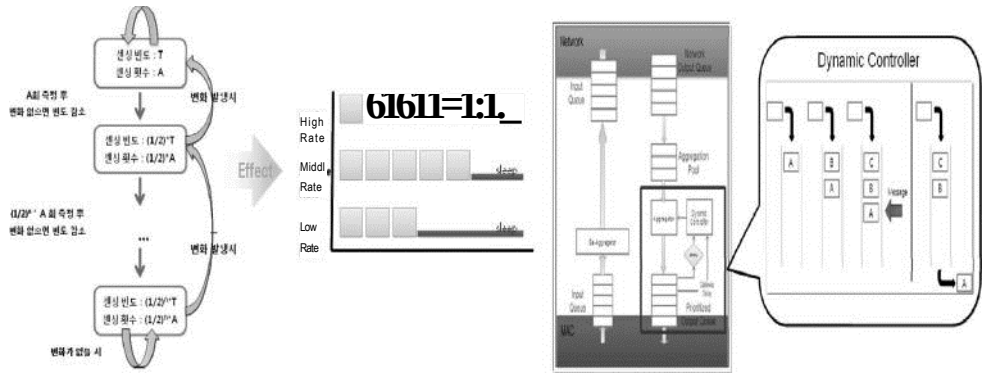
2.1 Low-Power Dynamic Sensing Period Technique

Low Power Dynamic Sensing (LPDS) makes sensing frequency decreased when the value of a sensor shows moderate changes in the number, then; the time of an activated device will reduce. The movement of LPDS 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 $(1/2)^n$ 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.

2.2 Low-Power Adaptive Data Aggregation Technique

We propose Low Power Adaptive Data Aggregation Algorithm (LPADA) to reduce power waste in sensing. 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.



(a) Dynamic Sensing Period (b) Data Aggregation

Fig. 1. Low Power Dynamic Sensing Algorithms

3 Proposed Sensing Protocols

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, NEXT, SET, and TRAP, in SNMP. GET is used to request certain information from manager to agent. Basically, GET and NEXT is the same function like Get. However, information in SNMP is handled within hierarchical structure, and can be used to get 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 are synchronous requests. These operators are suitable to apply in the communication between sensors and middleware. We can organize 3

communication mechanisms to transmit data from the sensor to the middleware.

- **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 middleware 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

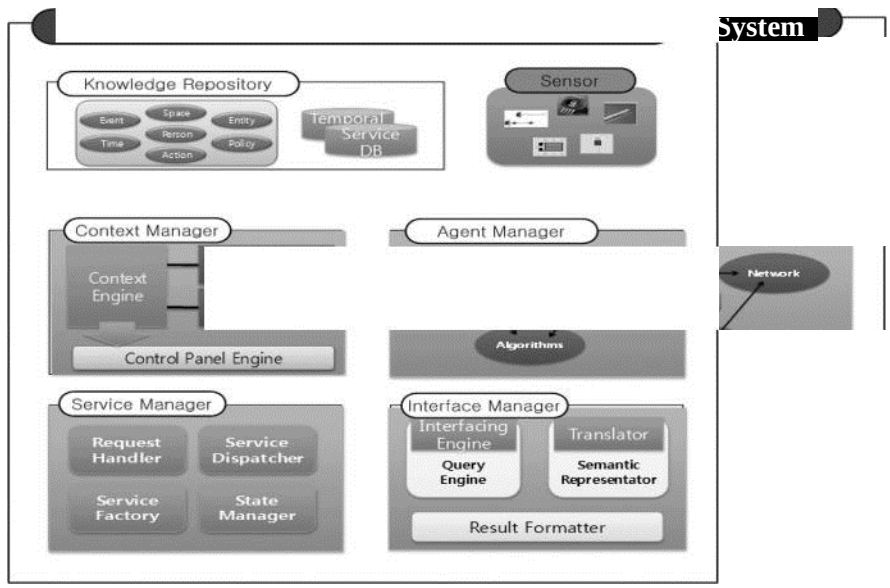


Fig. 2. Low Power Context-Aware Service

We proposed Low-Power Context Aware Service (LPCAS) to provide low-power adaptive application, depicted in Fig. 2. 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 Forrmatting 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 functions of Result Formatting serve 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 situations 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 applies 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 this process 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 Analysis and Conclusion

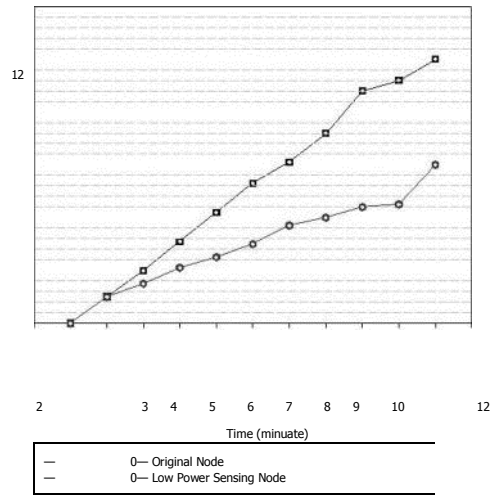


Fig. 3. Performance of the Proposed Algorithm

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 modules, 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 conventional sensing system, depicted in Fig. 3. 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.

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