Integration of Wireless Sensor Network with Cloud

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Abstract

The maximum benefit out of the recent developments in sensor networking can be achieved via the integration of sensors with Internet. The real-time specific sensor data must be processed and the action must be taken instantaneously. The integration controller module of the proposed architecture integrates the sensor network and Internet using Cloud Technology which offers the benefit of reliability, availability and extensability.

Keywords: ***Sensor network,integration controller, cloud computing,Internet.***

1.0 INTRODUCTION

The industrial application process parameters such as temperature, pressure and level are time critical and they have been traditionally monitored at the control centers. These industrial applications require the acquisition of precise data measurements over time. While these measurements can sometimes be accomplished at a distance using remote sensing techniques, it is often necessary to collect data using in-situ sensing, where sensors are placed directly in the area to be monitored [1]. But for such applications, sensor networks can not operate as stand-alone networks; there must be an effective way for user to gain access to the data produced by the sensor networks.

The integration of Sensor Networks with Internet is one of the open research issue in wireless sensor networks. At the same time, it is envisioned that sensor networks are to be pervasive and ubiquitous. It makes a lot of sense to integrate sensor networks with Internet [1]. We can not give an IP address to every sensor node for their large numbers, thereby making it impossible to directly connect sensor networks with Internet by TCP/IP.

The proposed work provides the solution of integrating the industrial sensor networks with Internet through SOA paradigm, and with cloud technology. In the proposed work, an integrated solution with application server (providers), integration controller (through which consumers contacts), and a register agent (registry), is designed. The Integration controller is responsible for storing sensed data and provides recovery system.The main job of IC is uploading sensed data to internet through cloud technology, So the authorized user can access sensed data from any where in the world. Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services.

2.0 RELATED WORK

Since the energy saving is a crucial requirement for sensor networks, the short range hop-by-hop communication is preferred over direct long-range communication to the destination. Therefore, the dissemination of information is carried out by passing data through the several nodes which perform measurements and relay data through neighboring nodes until reaching one or more sink in the network. Data sent by different nodes can be aggregated in order to reduce redundancy and minimize traffic and thus energy consumption. To enable data aggregation in network in an efficient way, applicationspecific code, such as data caching and collaborative signal processing are to occur as close as possible to where data is collected. Such processing depends on attribute-identified data to trigger application-specific code and hop-by-hop processing of data [2].

3.0 ANALYSIS

In this proposal NPMS utilizes wireless sensor networks. However, especially in distributed manufacturing processes we expect a growing need for information from multiple sources of specialized sensor networks. In the following we explore how sensor networks can contribute to a NPMS and what technical problems still have to be solved to enable an effective use of WSN technology in this application area.

3.1 APPLICATION ANALYSIS

Sharing sensor networks yields several advantages for NPMS. Firstly, sensor networks allow a continuous and direct monitoring of items during the manufacturing process.[3]. Secondly, through specialization in manufacturing more and more parties are involved, e.g. producers, freight carriers, suppliers etc. As a consequence, detailed and electronically processable information originating from various sites is required to ensure in-time delivery and production quality throughout the process. Sensor networks may automate processes by seamlessly share detailed process information at the point where it is really needed. Thirdly, monitoring and automatic processing of current data from sensor data across large sites allows manual maintenance inspections to be reduced to a minimum, leaving the manufacturing process as automated as possible. Manual action is then only required in cases of unrecoverable exceptions. Figure 1 illustrates an example process sharing information from different

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wireless sensor networks. Each part of the manufacturing process resides in a different location and utilizes different types of sensor nodes. In location A, the manufacturing process is sensitive to temperature. A deployed sensor network of temperature sensors around the items monitors, that certain ranges are met. After the transport of the items to location B, the process now becomes sensitive to humidity. Humidity sensors deployed in location B check for violations of given thresholds. Throughout the process, quality management is always directly applied on the items during the manufacturing. Sharing this information contributes to the guarantee that the product complies to required quality at the end of the process chain.

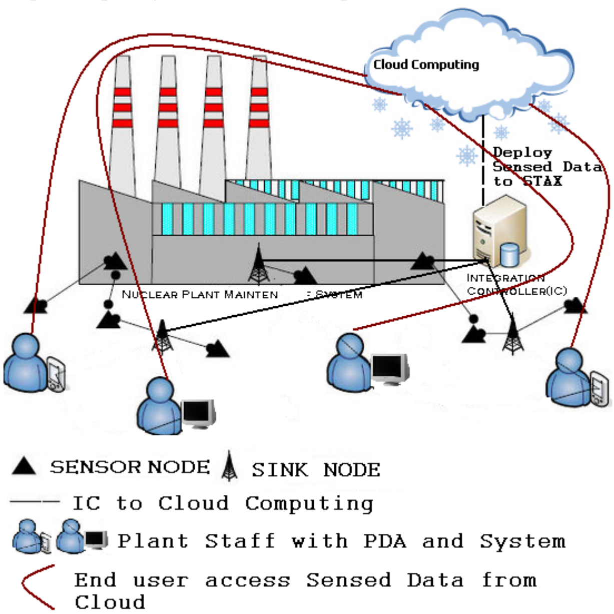

Fig 1. Example of a NPMS

3.2 TECHNICAL ANALYSIS

Heterogeneity. This problem arises from the diversity of information presentation in factories and/or organizations involved in a NPMS. E.g. sensor network platforms may use different data format. Applications, like monitoring applications, need a clear interpretation of data from multiple WSNs. Consequentially, heterogeneity demands a standardized abstraction to enforce understanding between the different expressions of sensor information.

Authentication. When designing systems that communicate data across multiple users, and thus security domains, controlling the information flow is an obvious problem. Therefore, we finally see the need for data centric access control, that ensures that only data critical to the distributed process is forwarded.

Context Aware. The end user can get the details of sensed data any where and any time

4.0 PROPOSED SYSTEM

The sensed data is very important in remote sensing industrial applications to know the status of machines or place or environment. But the sensed data do not get stored in anywhere in our existing system [3].The stored data can be used to gain the knowledge from sensed data for taking a correct decision. Even in the case of failure we need to recover and provide data to users without any interruptions. The proposed system takes these issues and implement a recovery system and data storing facility available in integration controller.

4.1 System Architecture

In our system we are combining two architecture models 1.SOA Roles in proposed Architecture 2.Internet and Integration Controller interaction Architecture(IICiA) (using cloud technology)

4.1.1 SOA Roles in proposed architecture

The sensor nodes and integration controller can interact through SOA architecture. Sensor nodes are service providers and sink nodes are consumers and they get the information through Intregration controller. The sensor services are deployed into the application server as service description which has the location information and provides a service end point, a target namespace and a transport name. This component makes use of message exchanges in the xml data format. Since programming sensor networks remains too complex with existing programming languages and techniques, using XML messages [4] in sensor networks will optimize the way of getting information from the network. To facilitate orchestration and aggregation of services into processes and applications, an eb-xml-registry-repository (register agent) is used. The registry-repository provides a single view of all services. The sensor services are published into the eb-xml registry using wsdl.

The lists of services are discovered and invoked by the sensor applications (client),using SOAP messages. The client communications are passed through the Integration Controller. The IC also takes care of the authentication of the users and delivering the required parameters using push interaction pattern. This pattern can be triggered by multitude of events, here an auditable event, trigger (when the process parameters exceeds some threshold) the message sent to the client. The following code listing shows the SOAP message for the temperature sensor:

SOAP Request message:

```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/encoding/"><SOAP-ENV:Header/><SOAP-ENV:Body><ReadTempFile xmlns="urn:bul"/></SOAP-ENV:Body></SOAP-ENV:Envelope>
```

SOAP Response message:

<SOAP-ENV:Envelope
xmlns:env="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:enc="http://schemas.xmlsoap.org/soap/encoding/"
xmlns:ns0="urn:bul"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"><env:Body><ns0:ReadTempFileResponse><result>96degreeKelvin 2009-11-14 11:13:43</result></ns0:ReadTempFileResponse></env:Body></env:Envelope>done

4.1.2 IICiA

This architecture presents the Integration Controller and Internet can interact using cloud technology. Cloud computing is a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. The proposed IICiA Enables users to easily collect, access, process,visualize, archive, share and search large amounts of sensor data from different applications. Supports complete sensor data life cycle from data collection to the backend decision support system. Vast amount of sensor data can be processed, analyzed,and stored using computational and storage resources[5] of the cloud.

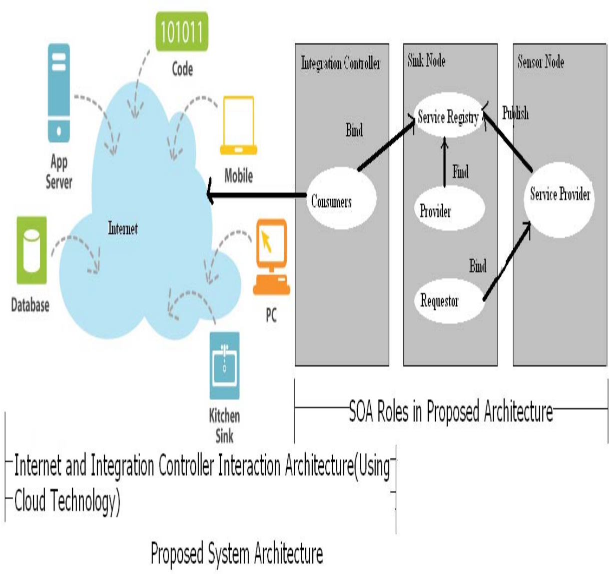

Fig 2. Sensor Cloud through SOA

Allows sharing of sensor resources by different users and applications under flexible usage scenarios.Enables sensor devices to handle specialized processing tasks.In this architecture the IC will upload the sensed data to STAX Figure 3 shows our implementation of sensor information in stax proxy.

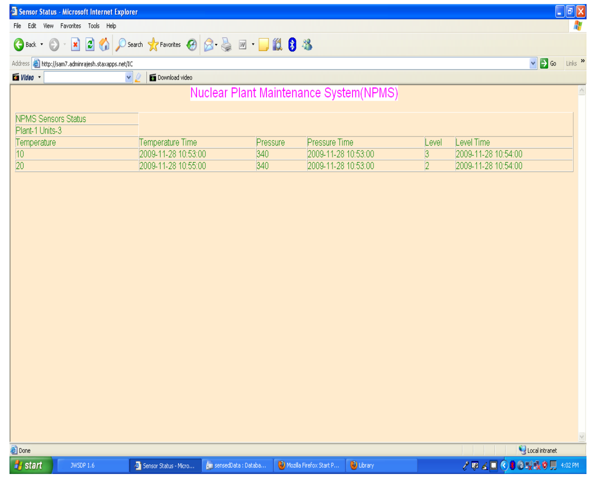

Fig 3 Sensor information in Stax available through web

5.0 CONCLUSION AND FUTURE WORK

The proposed paper aimed at working on applying and extending the service oriented paradigm to sensor network application engineering such as distributed manufacturing, we derived the requirements for the sharing of sensor networks as new resources in this domain. The necessary abstraction was implemented using the service oriented process parameters, which lead to the intelligence integration into the Internet. This solution has been extended to sensor clouds, which leads to high availability and hence reliability is achieved.

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