WSN & Cloud Computing framework for E-medication

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Abstract—Wireless sensors networks have several applications of their own. These applications can further enhanced by integrating a local wireless sensor network to internet, which can be used in real time applications where the results of sensors are stored on the cloud. We propose an architecture that integrates a wireless sensor network to the internet using cloud technology. The collection process of patient’s information through the existing processes need a lot of effort to analysis input and collects the data. Generally these processes are prone to error and time consuming, and provide delay in information accessibility in real-time environment. These circumstances restrict monitoring and diagnostics capabilities to the clinic and hospital. Sensors are introduce for exchanging information services between inter connected on hand medical equipment’s. The introduction of this concept is based on wireless sensor networks and utility computing. The information will be stored on “cloud” which will be assessable to medical staff. The proof-of-concept aim is to integrate commodity computing to predecessor medical devices, which should ensure simple integration and cost effectiveness.

Keywords-- Cloud computing, Cloud educational operating System, Computing Model

I. INTRODUCTION

The idea of wireless networks was developed by sending messages through fire and smoke. It was a sign of presence of people in specific territory. In 80’s researches came up with the idea of TNC (Terminal Node Controller). The aim of this invention was to communicate between a computer and radio, but desired performance was not achieved. Later on in 1985 FCC (Federal Communication Commission) allocated ISM bands for different applications. The assigned ISM bands were 902 MHz and 5.85 GHz. As these bands did not require any kind of registration, most of the vendors were using these bands.

In 1997 some standards were set by IEEE (Institute of Electrical and Electronics Engineers) and access was limited to licensed users.

Wireless Sensor Network (WSN) consists of distributed nodes with the capability of sensing, computation and wireless communications. The nodes are connected in ad-hoc fashion, operating independently of other nodes. There are various factors associated with the performance of WSN such power management, data dissemination and routing of information. A lot of work has been undergoing in these areas where energy awareness of essential design issue; routing and data dissemination is application dependent. WSN architecture could be either centralized or distributed. In centralized architecture the central node is the weak point of the network. If it fails, whole network collapse. However, distributed architecture provides failure resistant sensor network [1].

Cloud computing offers the ascenable processing power and various numbers of varieties of connectable services or devices. There are many Characteristic between cloud computing and wireless sensor network that match and can work in similar nature with each other. Wireless sensor network is composed of numerous nodes that are less expensive, to reduce the cost of entire network, therefore have limited capability of processing and also have battery power, you can’t use the same node all the time for routing. On the other hand Cloud Computing have abundant of processing and the power is not issue either, and is therefore well suited for long-term interpretations and analysis. Large amount of data, which a sensor network delivers, demands a powerful, scalable storage and processing infrastructure. The current manual system of data collection, distribution and processing of the patient information is slow. Its need more human resources and also time consuming task. To tackle this problem the authors proposed to automate the system of patient data collection to remote access of data to medical staff through information distribution. In proposed solution medical center’s “cloud” is used for storage of patient information, distribution and processing. The patient’s data is collected through sensors network connected to legacy medical devices. So now sensors nodes are used for data collection, this data is then encoded and transmitted through communications channels. This data could be stored for further use and analysis. An intermediate way can be used which may involve both remote and local capabilities, known as exchange service.
The exchange service is responsible to collect the retrieve data from network nodes and passes on it suitable storage service on cloud.

The amalgamation of cloud computing with wireless sensor networks [1] provides:
- Scalability of data storage and processing power for various kind of analysis.
- Worldwide Web Based access to processing and storage infrastructure.
- Well Resource Optimization.

Tiny DB [2] provides one of the mentions services data aggregations in limited power and in wireless scattered environment. All Sensor Nodes having Tiny DB and run over TinyOS Operation System [3]. Tiny DB have very simple GUI interface along java API for queries declaration and execution in acquisitioned query language identical to SQL. Tiny DB is very easy to use and utilize available processing resources efficiently. SPINE [4] is a TinyOS software use for body sensor signal processing applications consists of signal processing components for node running TinyOS [2], environment along java module for the management of nodes from central nod. Such kind of framework provide sensor data classified services which operate in scattered mode on individual node and base station, such approach not consider aspects like scalability and data security.

II. WSN IN E-MEDICATION

Traditional health system having manual note taking, updating the record to the computer and maintaining these records by assigning a unique id to every patient Figure 1 shows process of entire traditional health system in a hospital or healthcare center that using manual system[5].

Steps involve in manual data collection in a hospital or healthcare center.

- First the nurse used to write down the patient data, this data collection is purely manual and just piece of paper is used.
- This manual data can be feed into terminals via typing.
- In this way data is allowed to get into database server, now the data is centralized.
- Data is available cross the network to all the staff members and doctors and thus data can have the shared view.

III. EXISTING WORK

Initiative has already been taken in the integrated services of WSN and Cloud computing. But this work is only in initial stages and facing challenges of the real world. We already have studied the existing models and work to conclude some real tough challenges of the existing work Wireless sensors network have been deployed in various application domains, including health care system that monitor human health and provide life care services. Current system is based on the central server i.e. all the monitoring and respective services are stored and processed centrally. This leads to couple of high risk factors associated with it such as low performance, prone to failure, high maintenance cost and limited services. For example, Korea u-Care System for a Solitary Senior Citizen (SSC) provides 24/7 monitoring and safety and emergency connection services at home. This paper proposed a Secured WSN-integrated cloud computing for u-life care (SC³). The system not only provides secured services but it also provides low-cost, high-quality services. The author proposed architecture is breakdown into two phases, where the first phase concentrated on the integration of WSN with cloud services. It also includes implementation of activity recognition algorithm, access control protocol and services for Alzheimer’s disease patients. Figure 2 shows this functional architecture. At first, all the data captured through devices or camera is transferred to the cloud gateway which further classifies the data i.e. embodied or video and stores it locally. The filtering module is responsible for filtering the noise or redundant data in order to reduce the communication overhead. Query/response manager is responsible to fetch the data on request from the local database and send it to the appropriate user. Activity Recognition Engine resides in cloud and is responsible for predicting the activity of the monitored user. Ontology Engine is responsible for inferring complex activities. It requires activity and context as input for further processing. Doctors and nurses should authenticate themselves to access the data. On successful authentication Access Control Module gives respective access control privileges, and then the data is forwarded to authentic user.

The functional architecture has implemented sample scenario for Alzheimer’s disease patient. The SC³ monitors the patient health conditional and daily activities such as taking medicine, exercise, reading book and watching TV. Doctors and nurses have access to their respective patient’s data on the cloud through web 2.0 interface. The implementation results have shown that it took at maximum of two seconds to respond to patient’s actions. Activity recognition accuracy varies from 76% to 99.23%. The accuracy can further be improved with the development of different activity recognition techniques. The second phase will answer such
enhancements. The following are the services that SC3 has deployed for u-life care.

**Safety Monitoring Services for Home Users**
The proposed system can be deployed at home where the sensed data is uploaded on the cloud and various life care services can be used such as emergency services.

**Information Sharing Services**
The patient data can be access globally and can be share with a group of hospitals in order to diagnose it properly. SC3 can provide flexible platform for public-health departments to upload real-time health data and for the early identification and tracking of diseases outbreaks.

**Emergency Connection Services**
The system can be deployed for emergency connection services at real time such as alarm system connects user, u-119 police department for emergency situation alert.

**Users can Monitor their Home anywhere anytime with any device**
SC3 allows the user to monitor their environment with any device connected to the internet such as cell phone, laptop, computer, PDA etc.

![Fig. 2 Abstract Architecture of CS3](image)

**Lack of Dynamic Collaboration between Clouds Provider**
The use of Cloud services starts form the user agreement, this agreement is service level agreement, and if Cloud services provider fails to provide the services to the end user satisfactory level, can cause service level agreement violation. This violation may results in costing money to the Cloud services provider. This problem could not been arise if the service provider was in collaboration with other services providers. So a lot of the issues can be solved if the Cloud services providers’ collaboration is practiced.

**No infrastructure to support WSN integration to Cloud**
This technology is relatively new so infrastructure is one the problems. As wireless sensor network is weak in processing and power so they need to be utilize properly. You cannot extend its range to communicate, because on doing so you may put an extra burden on sign strength that could possibly eat up enough power of the specific node. So when one want to step in this technology, needs to verify that the network works smoothly and accurately. Too many parameters can be obstacle on doing so. One example could be electric interference, so one should make sure that how to make it happened.

**Weak Privacy Support**
One of the greatest threats to the healthcare services is the weak privacy support. One of the US largest health care insurance company WellPoint reported that about 130,000 of customers records has lose the private state and are now publically available at the internet. Getting any patient data publically while it is requested to be kept private is one of the issues. That may happen due to the weaker administration qualities or lack of technical skill to handle the technology. Privacy is the major concern of the people now a days and they are not ready to share their private data to anyone they don’t know. Worst, it is available to anyone at the internet. That can damage the image of technology and make the common man away from the use of Cloud services.

IV. PROBLEM STATEMENT

Traditional healthcare system are paper oriented manual system by collecting note and updating to computer to maintain records, such kind of process are consider error prone and time consuming process before the data get ready to present in front of medical professionals due to error factor data is very sensitive and doctor making decision about medication base on those statistics. Our objective here is to propose such system that will allow patient to not visit hospital frequently and provide fast, corrects statistics of patient health status to medical professional and they make right decisions and allow patient to have secure access to data as it become available to achieve such kind of objective we use wireless sensor network and cloud computing. There are two kind implications indoor patient and outdoor in both cases the patient and doctor don’t need to be with each other all the time the doctors can monitor patient health status by reading available run time statistics which is less error prone as no manual process involve. Additionally as the patient is not within hospital, our objective is to identify the emergency quickly and provide require help as soon as possible.

V. PROBLEM IN EXISTING WORK

Integration of WSN with Cloud Computing is not that simple, as the model or the framework that support this integration is not yet available. Although a few giants organizations like Google, Microsoft have already stepped into the run but this technology is still much new to adopt. People are still talking about the security in using this technology, as the data is available on the wide and huge network. In few occasions it did happen that the private data get public and the privacy rules were violated. Devices connected to Cloud Network though internet and sometime internet response may not be great, which can cause dis-connectivity on regular interval. Continuously reconnecting process may not assign the same Internet Protocol address all the time. So the communication may be refused by the Cloud.
network because of change in IP Address. That may cause in failure of using data transmission.

VII. PROPOSED SOLUTION

We have proposed an architecture which integrates wireless sensor networks running on smart phones, with cloud computing. The health data obtained from the healthcare apps running on the smart phones needs to be processed and based on abnormality of the data, necessary actions needs to be taken. A copy of the sensor data is sent to the cloud from where the hospital accesses it. The proposed framework integrates the smart phones and cloud solves the problem using the proposed filter system. If there is any abnormality in the health parameter, the smart phone sends an alert SMS to the healthcare organization. HIPAA [6] defines a set of rules on who has access to the patient’s health records. Therefore, only authorized medical personnel should receive the alert SMS sent by the smart phones. The proposed key search and priority ranking algorithm solves this problem by finding the highest weighted list of medical personnel to whom the alert SMS needs to be send.

A. Proposed Framework Overview

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B. Technical & Application Analysis

The above analysis and figure shows that all the sources of wireless sensor networks are heterogeneous. In order to process the data it is necessary to enforce standard abstraction on information on all sources. Moreover, data is communicated among intermediate nodes in path to reach the destination.

This may lead to a security flaw, and in security applications it becomes necessary to control the flow of information. Thus, there has to be data centric access control to ensure the forwarding of critical data only. Besides, context aware attribute of the system allows the user access to data anywhere and anytime. NPMS can benefit from the integration of Wireless sensor networks. First, it allows a continuous monitoring of the critical parameters during the manufacturing process [20]. Second, NPMS can monitor in time delivery and product quality by mentoring detailed and electronically processed information by various manufacturing parties such as producers, freight carriers, suppliers etc. Third, monitoring of data from large sites leads to reduced manual maintenance inspection and thus leaving the manufacturing process automated. Figure 1 shows the information sharing mechanism from different wireless sensor networks.

VIII. CONCLUSION

Both wireless sensor network and Cloud Computing technologies along with their applications are discussed in this paper. We gave an overview of architectural extension to wireless sensor network. Application of cloud computing to enhance the reliability and availability of wireless sensor networks is discussed with special emphasis on its application in distributed manufacturing engineering. The proposed system is based on ideas taken from an in depth study and support of various technologies. The proposed system has its useful applications and important role in medical sciences field. It is supposed to help in efficient cure of Strokes and Parkinson. However the security issues involved in the integration process are of key importance and need critical focus. We suggested an automatic process of collection and delivering that data by the use of technology. We used the advantages of Wireless Sensor network and cloud computing and merge them to make them work together. And the results are more improved, so wireless sensor network used to collect the data.

REFERENCES


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