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Integrating Wireless Sensor Network into Cloud Services for Dynamic Environment Monitoring

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Abstract

In this paper, the data acquiring capability of the Wireless Sensor Networks (WSNs) and the data storage as well the data services of Mobile Cloud Computing (MCC) has been mainly utilized. The main goal of this paper is to process the sensory data along with the integration of WSN-MCC to monitor the environmental conditions actively and to provide an alarm for the system. The wireless sensor networks senses the surrounding's physical conditions by deploying sensor nodes. These sensory data will be gathered, maintained and monitored frequently. The deviation in the environment could be recorded dynamically and the specific data reaches the concern authority through mobiles. In this proposed work, it makes known the improper conditions of the environment and reduces the utilization of the bandwidth requirement of sensory data transmissions.

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Keywords: Wireless Sensor Networks (WSNs), Mobile Cloud Computing (MCC), Data Processing, Integration.

1. Introduction

1.1. Wireless Sensor Networks

Wireless Sensor Networks which consist of collection of smart sensory nodes along with the CPU's embedded, radios with low power, sensor field and the sink node. Increasing economic requirements and regulatory by the human beings made the environment to look up the contaminated components in water, air and soil gets polluted. The network topology changes and allows peer to peer communication. Radio frequencies are used in the wireless networks to transmit the data in air instead of transmitting the data using the cables physically. This is the main advantage of using the wireless networks which reduces the maintenance cost and the number of cost effective cables used. The vast amount of data produced by the thousands of sensor nodes deployed will benefit the end user in an effective manner. This process indicates that the compressed spatial and temporal infield data is used to

remove redundancy and enable correlations by employing data-centric communication.

1.2. Mobile Cloud Computing

In Cloud Computing, the general configurable computing resources such as storage, processors, networks, services and applications are offered to the end-user whereby instantly provisioned through the Internet which is provided as on-demand service with the minimal management effort. There is no such necessity to direct investment, lower operational expenses, more scalable, minimized business risks and maintenance costs for the user demanding computational services. **[1]** Mobile cloud computing, which inherits the advantages of CC and overcome many limitations of a mobile device such as battery, storage capacity and processing power with offloading most of the data processing and storage from mobile devices to powerful computational platforms positioned in a cloud.

1.3 Integrating WSN with MCC

WSN integrated with the MCC to mainly focus on monitoring the sensory data after the data transmitted to the cloud.

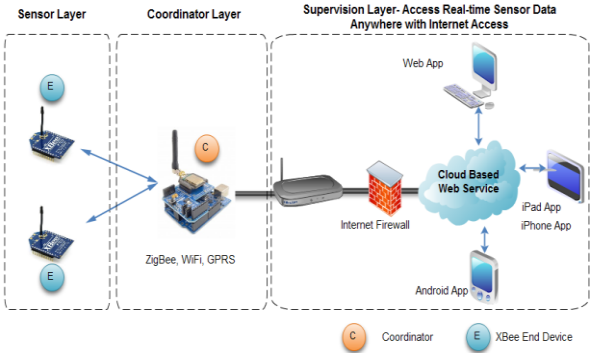

Fig.1. Integration of WSN and MCC

The goal of the framework is to sense the data filtering with the sensor gateway when integrating WSN and MCC. Initially, there is a sensor gateway for each cluster of the WSN. Each and every sensor gathers the sensory data and passes the sensory data directly into the gateway accordingly.

Then the sensor gateway collects the sensory data and process the data using the following components: data traffic monitoring, data filtering, data prediction, data compression and data encryption.

2. Proposed Framework

The outer layer consists of sensors that will interact with the environment which means that every sensory node was integrated with the end devices. The end devices are in the form of Mesh Topology to send the gathered information from one device to another till it reaches its base station.

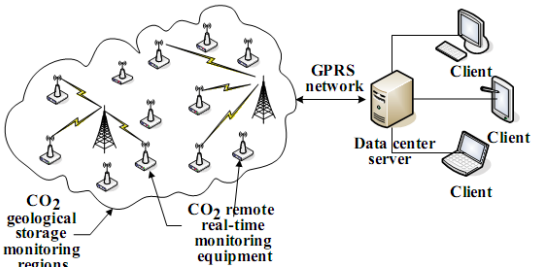

Fig. Proposed Framework

The information from the sensor networks is stored temporarily into buffer and it is transmitted to the Web Server to connect and publish the sensor data on the Internet. Finally this information has been recorded in the database to generate the statistics.

3. Proposed System

In the present days, there is none of the system to monitor the leakage of humidity, gas like CO_2 in the storage tanks automatically. Manually monitoring the areas might be with the possible of bugs. The main focus of this paper is to make use of WSN-MCC to automate the environment by monitoring and recording the current threshold level and updating into the record. This is recorded and maintained in the database by interacting with the Application Programming Interfaces (APIs) and is also been implemented in the developing environment. It is easily accessible and interoperable in nature. For this data processing, the gateway will perform the encryption and decryption to ensure the data has to be processed. Instead of using RSA algorithm for data processing, Frequent Pattern algorithm has been used to generate the pattern dynamically. In case of abnormal conditions found, the information automatically triggers the concern authority to take the necessary action and remedy for the issue. The alarm invoked based on the environmental conditions using GPRS service which identifies the current location.

4. Algorithm

FP Growth Algorithm stands for the Frequent Pattern Growth Algorithm which is an efficient and scalable method for mining the complete set of frequent pattern by pattern fragment growth, using an extended pre-fix tree structure for storing the crucial information about frequent pattern tree. It invokes the short patterns recursively and then concatenating them into the long frequent patterns for offering good selectivity.

The source code is divided into three main packages. They are of the following:

FP growth: contains the mail file that implements algorithm

Tract: manages item sets and reports

Util: facilities to be used in FP growth.

The syntax to call this implementation, from the OS command line, is:

```
>fpgrowth [options] infile [outfile [selfile]]
-t#      target type                    (default: s)
        (s: frequent, c: closed, m: maximal item sets)
-m#      minimum number of items per item set     (default: 1)
-n#      maximum number of items per item set     (default: no limit)
-s#      minimum support of an item set           (default: 10%)
        (Positive: percentage, negative: absolute number)
-e#      additional evaluation measure            (default: none)
-d#      minimum value of add. Evaluation measure (default: 10%)
-g       writes output in scalable form (quote certain characters)
-H#      record header for output                 (default: "")
-k#      item separator for output                (default: " ")
-v#      output format for item set information   (default: "  (%1S)")
-q#      sort items w.r.t. their frequency        (default: 2)
        (1: ascending, -1: descending, 0: do not sort,
         2: ascending, -2: descending w.r.t. transaction size sum)
-j       use quicksort to sort the transactions   (default: heapsort)
-a#      variant of the fpgrowth algorithm to use (default: simple)
-x       do not prune with perfect extensions
-z       do not use head union tail (hut) pruning
        (only for maximal item sets, option -tm)
-b#      blank   characters                (default: " \t\r")
-f#      field   separators                (default: " \t,")
-r#      record separators                 (default: "\n")
-C#      comment characters                (default: "#")
-!       print additional option information
infile   file to read transactions from          [required]
outfile  file to write frequent item sets to     [optional]
selfile  file stating a selection of items       [optional]
```

5. Conclusion

This paper is proposed with the flexible architecture for the integration of Wireless Sensor Networks and the Mobile Cloud Computing to enhance the security on the sensory data processing. It is mainly focus on monitoring the environmental conditions and providing alarm for the concern authority to avoid huge accidents and

disaster. Specifically, the sensory nodes will invoke less bandwidth for the data processing. The large processing capability of the cloud has been utilized for maintaining the processed data to verify whenever it is been need. Encryption and Decryption are performed in both the WSN Gateway as well in the Cloud Gateway to ensure and enhance the capacity.

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