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CPEGASIS: Efficient Data Retrieval in Wireless Sensor Networks Using Cloud Computing Environment

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Abstract: A contemporary technical world sensor network is very important role because each and every technology like IOT, embedded system, robotics is based on Wireless Sensor Networks (WSN). In the Last decade IT products based on sensor networks and so many research is going on agriculture, Healthcare and smart city are depends on WSN in WSN mechanism have many research challenges in routing algorithm, data dissemination, data gathering and reporting mechanism. In this study, we plan to merge sensor networks and cloud computing because the purpose of storing data in cloud storage that is called as Wireless Sensor Cloud Environment (WSCE). Here, we use the CPEGASIS(Cluster Power Efficient Gathering in Sensor Information System) routing algorithm for efficient data transmission and processing, second thing is reporting mechanism for getting acknowledgement from destinations so proposed model is improve the performance of WSN in cloud environment.

Key words: Sensor networks, routing, cloud computing, processing, environment

INTRODUCTION

Cloud computing is emerging technology in last decade. In cloud service the cloud service providers like AWS, Microsoft azure cloud, rackspace etc, they offering services to clients. The cloud service is based on software, platform infrastructure, networks, data and analytical everything as a service. In proposed methodology we are going to use storage service in a cloud and service providers they are offering the storage based on the data volume. Another perspective of cloud model is private cloud environment in this the organization they construct their own cloud setup based on secure data communication in the network. This type of cloud storage the information transmission is processing in highly confidential if the client need additional storage or centralized communication the private cloud is adapt with public cloud environment. The proposed model we integrate wireless sensor networks with cloud computing.

The main task of WSN is sense the respective information and collecting the information from the target location and communication the information to destination (Han *et al*., 2014). The important operations in WSN are data dissemination and data gathering. Data dissemination is a process by which information and instructions of data routed in the sensor network. Data gathering is collecting the relevant information from the base station and the recent research challenges in sensor networks is network scaling, time varying characteristics and sensor application data models (Sasikumar and Khara, 2012).

In this study, we are integrating sensor networks and cloud storage (Alamri *et al*., 2013; Dewan and Hansdah, 2011) here, we are using PEGASIS (Sharma *et al*., 2015) (Cluster power-efficient gathering in sensor information system) routing algorithm this algorithm is an improvement of LEACH (Low-Energy Adaptive Clustering Hierarchy) algorithm (Al-Karaki and Kamal, 2004). PEGASIS is a chain hierarchy based routing algorithm. The working model sensor is sense the information from target and transfer the information to destination then the role of reporting mechanism is after data reached it is send the acknowledgement to sender (Ahmed and Gregory, 2011).

Literature review

Cloud computing: Cloud computing is the emerging technology in last decade in technical aspect cloud computing is a combination grid and virtualization. Basically key feature of cloud computing is offering the services based on money and its own characteristics (Ryoo *et al*., 2014). The characteristics of cloud is on-demand capabilities, broad network access, resource pooling, Rapid elasticity and measured service so depends on these characteristics cloud service providers

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offering the services to cloud clients. In proposed system we using storage service in cloud (Dewan and Hansdah, 2011). The storage service is under the category of platform as a service model in this service user can store large amount of data directly to the cloud. Storage service is offering based on user data size and type of data, it will be offer depends on the usage, size of the application or data and time. Current technical world service providers are protecting the data and applications in a cloud environment because data security is highly important (Alamri *et al*., 2013).

Wireless sensor networks: Wireless sensors are used to monitor the particular environment or physical condition and the sensor nodes are connected one to another (Han *et al*., 2014). The main goal for the sensor nodes monitor the environment and sense the data from that location finally transmit the data to Base Station (BS). Basically the construction of sensor networks is based the following process (Aslam *et al*., 2012):

- Node deployment
- Energy consumption without losing accuracy
- Data reporting model
- node/link heterogeneity
- fault tolerance
- Scalability
- Network dynamics
- Transmission media
- Connectivity
- Coverage
- data aggregation
- Quality of service

Another aspect of WSN is how to route the information in the network and transfer the same information to based station. The purpose of routing is communicating the data packets in a network with a shortest path as well as minimum time. Routing protocols can be classified into two methods one is network structure another one is protocol based routing. Network structure can be a form of flat network routing, hierarchical network routing or location based routing. Second type of routing is protocol based that is multi-path based routing, query based routing, QoS based routing and coherent based routing.

In this study, we are integrated the WSN with cloud storage (Madria *et al*., 2014) the design and construction of sensor networks we explain in session three proposed system and we used the existing PEGASIS routing algorithm with reporting mechanism.

MATERIALS AND METHODS

Proposed system: The proposed WSCE is divided into four major layers each and every layer perform different role in architecture. The layers are user module, coud environment, sensor centric layer and sensor filed. Here, the client module connects the user to cloud service provider and the cloud is maintain all the respective user data in a secure manner. Third layer is sensor centric layer in this layer registration of sensor nodes and collecting the information from sensor field finally forward the data to cloud storage and then the final layer if sensor field, here sensor nodes sense the information from a location and it is going to route the information based on CPEGASIS routing algorithm.

User module: The user module layer is doing a big role in the proposed architecture. This layer is act as an intermediate layer between user and cloud environment. It is a combination of three component like user interface, user management and user data repository. The user interface is a WSCE user interface lets specify some parameters such as data sensing phenomena, sensing time, frequency and secure data transformation. The client parses the request through web application because of accessing the resource from cloud. Next user registration is adding, removing and manage the users in the model. The user repository is stores the overall detailed cloud user information in the proposed system such as user details, account details instance details, payment details and billing information. In this user module when user start a Process (P) that consist of multiple number of events (e). The events namely secure creation, process management and finally process termination. The history (H) of particular user is measure based on following formula:

$$H(P_i) = (e_1, e_2, e_3, \ldots, e_n)$$

Cloud environment: Cloud environment is a next layer in the architecture this layer is act as a middleware between user module and sensor centric layer. This cloud layer performs so many functions in architecture such that instance maintenance, virtual Image life cycle management and billing management. The first one is instance management is a role of connecting user and sensors. In this layer is possible to create a virtual sensor instance in a cloud environment. Based on the user request the cloud service provider is analyze the query and forward the queries to cloud virtual sensors, then the virtual sensor extracting the information from the cloud storage. Second

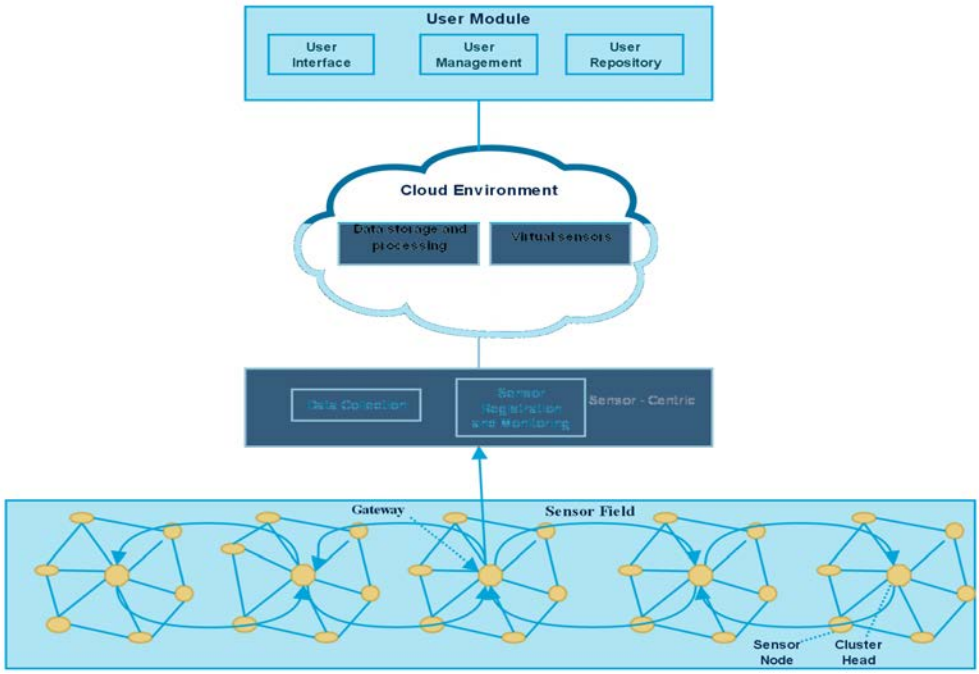

Fig. 1: Cloud sensor architecture

management here the processor of virtual sensor instance and storage creation in the cloud. In this virtual sensors receive the user query based on the query it is going to response to users through UI. Final component is billing management process in this usage of cloud service calculated and proceed the payment.

Sensor centric: The third layer is sensor centric layer in this layer in all physical sensor registration and that sensors connect to the cloud virtual sensors. Data collection is the next process in the sensor centric it collects the data from sensor gateway. Finally one is sensor maintenance process. When the owner wants to share service in a cloud, they are need to prior register in the sensor registration block. The cloud sensor verifies the component of the middleware is virtual image life cycle logical and physical sensor capability, location information (longitude, latitude, region IDs) and cluster ID (Fig. 1).

Once the registration process is completed then the wireless physical sensor connected with cloud it establish the connection and commit with trusted data communication. Next process is monitoring sensor nodes here sensor energy, power, life time of the sensor everything is monitoring. Finally data collection is collecting all the relevant information from sensor gate and transfer the information to sensor cloud.

Sensor field: Sensor field is a last layer in the proposed architecture, the role of sensor filed is form a cluster in sensor field all cluster head transmit data to gateway. Gateway is communicated with sensor centric layer. The major process of sensor filed is CPEGASIS routing algorithm in this algorithm is specially for wireless sensor networks. CPEGASIS algorithm is Cluster based Power Efficient Gathering in Sensor Information System it is a improvement of PEGASIS algorithm. The process of PEGASIS algorithm is a chain based hierarchy, all the nodes transfer the information to particular node in the chain that node is like a head or master node. Master node is transfer the information to user. In this proposed CPEGASIS algorithm is enhancement of PEGASIS

Algorithm: The working process of CPEGASIS is all the sensor node select the cluster head and nodes send the information to cluster head and cluster node transfer the information to gateway this the working process of sensor filed. The working process of CPEGASIS algorithm based on

Algorithm:

CPEGASIS. The k-means CPEGASIS for gathering information from multiple clusters.

Input:

S : Set of sensor nodes
C : Cluster head
N: Number of clusters in the sensor field
G: Gateway

Output:

G: All clusters share the information to particular gateway in a sensor field

Method:

Step 1 : S sends the information to C

Step 2: Cluster head receive the information from S in sensor field cluster head define as based on following function

$$N = C1, C2, C3 \ldots\ldots Cn.$$

Step 3 : G forward the user request to neighbors of right and left side cluster head

Step 4: Cluster head forward the same request to all cluster head

Step 5: Based on the user request cluster head collect the information to sensor nodes and forward the same information to neighbor cluster head

Step 6: Finally G receive the information from neighbor cluster head and forward the information to sensor centric layer.

Cluster formation in sensor field: The clustering technique it have more advantages in wireless sensor networks here the advantage is reduce number of nodes take a part of transmission energy consumption and scalability for maximum number of nodes. In this clustering process Cluster Head (CH) selection is a major thing the CH selection process based on the probability by winning competition of neighbor nodes this is also depending on number of active nodes in the overall network infrastructure. In our proposed algorithm the construction model of clustering is seven nodes participating in the cluster and one energetic node act as a cluster head when the current node is failure in the cluster next energetic node act as a centralize CH. WSCE we are using Centralized k-Means clustering, it is very efficient algorithm in wireless sensor networks (Sasikumar and Khara, 2012).

RESULTS AND DISCUSSION

The implementation of proposed Wireless sensor cloud Environment is developed using Ubuntu 14.04 operating system with back end server, each and every server they have region. The back end served programmed using java based on proposed working model. The sensor is TelosB mote sensors it is capture the relevant data in a sensor field; we programmed the entire sensor based on the working principle using Tiny OS 2.1.2.

Then this sensor centric design is connected with cloud environment, for cloud environment we use AWS (Amazon web services). In this AWS we choose compute and configure the environment that virtual instances connected with the sensor centric layer. The cloud we create virtual sensor that virtual sensors interact with physical sensors in a system. Here many physical wireless sensors connected with a single virtual wireless sensor, the user requested is going to cloud and then the cloud instance forward the request to virtual wireless sensor. Virtual sensors collecting the relevant information from the physical sensor.

Table 1: Number of rounds when 1, 25, 50 and 100% nodes die. 50×50 m network

Energy (J) node	Protocol	1%	25%	50%	100%
0.5	LEACH	813	962	1036	1208
	PEGASIS	1532	2053	2085	2155
	CPEGASIS	1650	2150	2203	2212
1.0	LEACH	1630	1945	2130	2376
	PEGASIS	3059	4132	4216	4421
	CPEGASIS	3251	4221	4432	4523

Table 2: Comparison of web and cloud data retrieval

Web data retrieval		Cloud dataretrieval	
Size (MB)	Time/sec	File size	Time/ sec
1	2	10 KB	1.5
10	20	1 MB	15.0
100	172	100 MB	124.0

We need to show our proposed CPEGASIS algorithm performance se we compare with our protocol to other existing protocol PEGASIS and LEACH. We take two ways for evaluating our performance in normal sensor data retrieval and cloud data retrieval. Table 1 shows the node death and energy level of nodes in LEACH, PEGASIS and CPEGASIS while we communicate the information based on cluster so here the performance level is very high comparatively existing protocols. Next integration of cloud storage with wireless sensor networks while we retrieve the data calculated based on size and time.

Table 2 shows the information about web and cloud data retrieval based on file size and time; we take a sample data for evaluating the working model. After evaluation finally we got efficient data processing in wireless cloud environment.

CONCLUSION

The proposed work introduces an experimental model of wireless sensor cloud environment. In this model we introduce a new protocol CPEGASIS it is an enhancement of PEGASIS, the proposed CPEGASIS algorithm is comparatively highly efficient with existing algorithms. The sensor networks are connected with the cloud environment so data storage and retrieval time was reduced in proposed model. Here, everything based on sensor data processing in cloud so data loss is very low because the entire sensor data store in cloud storage, User directly access the data based on request and cloud provide the data based on user query so proposed WSCE model is provide high performance in wireless sensor networks.

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