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Cloud Computing based Wireless Sensor Network in Data Transmission With Routing Analysis Protocol and Deep Learning Technique

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Abstract: Wireless sensor networks are required in an extensive variety of essential applications that collect and analyse data from the corporeal environment. A similar need for remote resource sharing exists in cloud computing, which uses a standards-based methodology. A very promising technology called Sensor Clouds is created by applying wireless sensor networks' shared sensor resources while utilising the cloud computing framework. This study offers an innovative cloud-based wireless sensor network in cloud data transmission and routing analysis utilizing deep learning technique. here the cloud based data has been transmission using wireless sensors in cloud module. Then the data routing is done for trained data where the training is carried out using fuzzy convolution based secure routing. An assessment of the empirical data has been done in perspective of validation accuracy, throughput, packet delivery ratio, end-end delay and QoS. The recommended approach accomplished validation accuracy of 95%, throughput of 93%, packet delivery ratio of 72%, end-end delay of 55% and QoS of 73%.

Keywords: *Wireless Sensor Networks, Cloud Computing, Cloud Data Transmission, Routing Analysis, Secure Routing*

1. Introduction

The capacity of wireless sensor networks (WSNs) to collect data as well as the data processing and storage capabilities of mobile cloud computing (MCC), WSN-MCC integration is garnering a lot of interest from both academics and business. By defining the fundamental problems with WSN-MCC integration and offering a framework for the processing of sensory data, we may concentrate on the transmission of the desired sensory data to the mobile users in a quick, dependable, and secure way [1]. With the help of cloud computing, businesses can expand their capacity quickly without having for investment in new infrastructure, in addition to it, reduce capacity instantly with effectively. The "Using the cloud for distribution and consumption paradigm For several IT-based applications, the customer simply sees the service and doesn't need to understand how it was implemented [2]," depending on a recent IBM research. "Cloud Computing is a methodology for giving access to a common pool of resources via a handy, on-demand network programmable computing resources," claims the US National Institute of Standards and Technology. The cloud provides access to a variety of services, applications, information, and infrastructure through pools of computing power, network, information, and storage resources. An on-demand utility-like prototype of allocations and consumption is possible with the rapid orchestration, provisioning, implementation and decommissioning, and scaling up and down of cloud components [3]. The five key elements of cloud computing are on-demand self-service, wide network access, resource pooling, quick elasticity, and measured service, according to NIST [4].

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2. Related Works

Environmental monitoring to medical applications like Alarm-Net and CodeBlue have all made extensive use of wireless sensor platforms [5]. Although the fundamental issue, remote monitoring utilising sensor networks, remains, These systems' architectures have been designed to created in a fairly ad hoc manner and is not adaptable to modify to various applications or circumstances. Many researchers have been looking into methods for syncing wireless sensor networks with the cloud during the past few years. Although genuine implementations have not been revealed, authors in [6] have developed Internet protocols to connect wireless sensor networks to the Internet. Less genuine implementation and testing of wireless sensor networks with the Clouds than theoretical aspects of system architecture dominated much of the prior work. Researchers in [7] have also proposed using Web services to connect sensor networks with external networks. However, the majority of their work was concentrated on the energy and bandwidth overheads associated with SOAP-based Web services. One of the earliest frameworks on integrating WSN to the Internet for sharing sensor data was SenseWeb [8]. Using the SenseWeb API, users could sign up and post their own sensor data. Work [9] outlined application scenarios, the tools required to build the cloud, and a proposed architecture for tangible cloud computing. The suggested framework is still in its infancy, and not much information is accessible. The integration of a sensor network with grid computing (GRID) was suggested by the author [10], although given the present application scenarios, GRID may not be suitable for the majority of uses.

3. System Model

New cloud-based wireless sensor network technology is discussed in this section. in cloud data transmission and routing analysis utilizing deep learning technique. here the cloud based data has been transmission using wireless sensors in cloud module. Then the data routing is done for trained data where the training is carried out using fuzzy convolution based secure routing. In figure 1, the suggested architecture is depicted.

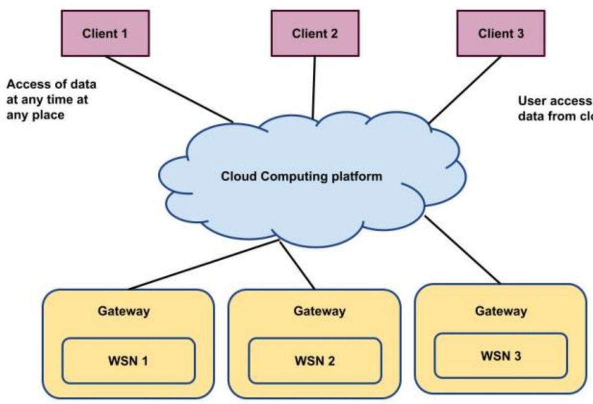

Fig.1 suggested cloud based wireless sensor network in data transmission and routing analysis

According to the proposed system, integration controllers (IC) and sensor nodes can communicate with one another via SOA. Sink nodes are information consumers and sensor nodes are information service providers; information is received through IC. The application server deploys the sensor nodes as described in the service description. It offers a service end point, a target namespace, and a transport name in addition to location data. These parts communicate via the xml format.

Using wsdl, The sensor products are available in the xml registry. In order to find and launch the sensor application/client, SOAP messages are utilised. Through IC, the client messages are forwarded, which handles user identification and push interaction pattern delivery of necessary parameters. There are numerous circumstances that could cause this. When the process parameters reach a predetermined threshold, for example, an audio event, i.e. a message conveyed to the client, is triggered. Cloud services enable communication between the IC and the internet. The construction of scalable systems with the ability to add capacity at any time and on the fly is made possible by cloud technology. IAMU is directly communicated with by consumers for access control and authentication. Kerberos is replaced with Edge Node (EN). Actually, it is built on Kerberos with a few minor tweaks. Additionally, Diffie-Hellman public key is used.

$$x(a \mid b) = \frac{\exp(Z_a \cdot b)}{\sum_{d=1}^{D} \exp(Z_d \cdot b)} \quad (1)$$

$$Z_{abb} = \sum_{i=1}^{d} Z_{aixi} = f_b \quad (2)$$

$$x(a \mid b) = \frac{\exp(f_b)}{\sum_{d=1}^{D} \exp(f_d)} = \text{softmax}(f)_b \quad (3)$$

To address the multi-classification challenge, softmax regression expands upon logistic regression. The training sample set for logistic regression is made up of e labelled samples, where feature m(i) y+1 is inserted and e dimension of the feature vector m is y + 1, m 0=1. (4)

$$h_\alpha(m) = \frac{1}{1+\exp(-\alpha^T m)} \quad (4)$$

$$S(\varphi) = \frac{1}{x}\left[\sum_{i=1}^{x} n^{(i)} \log h_\varphi(\mathrm{m}^{(i)}) + (1 - n^{(i)}) \log \left(1 - h_\varphi(m^{(i)})\right)\right] \quad (5)$$

7) In a convolutional network, there are two factors that go into the convolution process: the input and the kernel function (the convolution kernel). A feature map is the unit output of the convolutional process. When a two-dimensional image Z is used as the input and a two-dimensional convolution kernel, P, is used, the result is eq. (6)

$$S(i,j) = (Z * P)(i,j) = \sum_a \sum_b Z(a,b) P(i-a, j-b) \quad (6)$$

The fuzzy rules have input and output variables, plus these crucial inputs are controlled by the theory of fuzzy sets, which has characteristics related to each linguistic concept. Using the translated language terminology, fuzzy sets are utilised to transform the information into an assortment referred to as Fuzzy Rules. The fuzzy inference process and the fuzzy decision manager control the fuzzy rule base, which more efficiently stores the rules.

4. Performance Analysis

The experimental simulation platform in this study is Matlab 7.0. The platform offers expert text processing, symbolic computing, implementation control, and visual modelling and simulation Its outstanding numerical calculating abilities are only one of its strengths. Additionally, performance can be assessed by network algorithm simulation and experimental simulation.

The KDD Cup 99 dataset has been modified to become the NSL-KDD dataset. This dataset has fewer records in the training and testing sets because irrelevant records have been removed. Consequently, NSL-KDD dataset was selected for this study. Numerous studies have examined the NSL-KDD using various machine learning techniques. Investigation and analysis of ML-based techniques to intrusion detection go into great detail. This study aims to develop a binary classification-based intrusion detection system..

Table-1 Comparison of proposed and existing methods

Parameters	SOAP	GRID	CC_WSN_DT_RA
Validation Accuracy	88	92	95
Throughput	88	91	93
PDR	63	66	72
End-To End delay	72	63	55
QoS	65	68	73

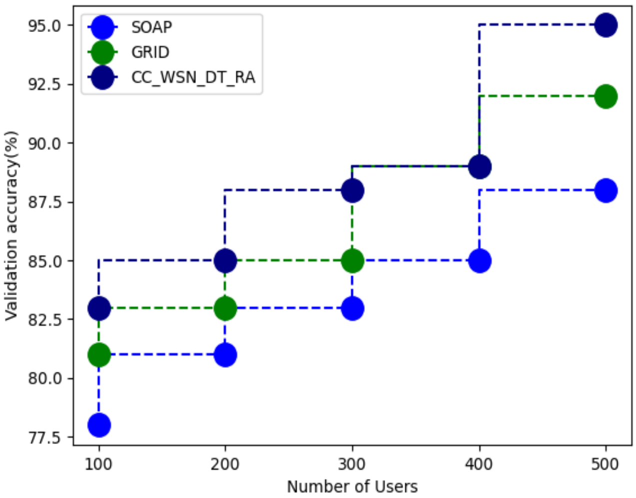

Fig. 2 Comparison of validation accuracy

The preceeding table-1 and figure-2 demonstrates comparison of validation accuracy among the suggested and the current method. Here the proposed technique attained 83% of validation accuracy for 100 users, 85% of validation accuracy for 200 users, 88% of validation accuracy for 300 users, 89% of validation accuracy for 400 users, 95% of validation accuracy for 500 users; while existing SOAP attained 78% of validation accuracy for 100 users, 81% of validation accuracy for 200 users, 83% of validation accuracy for 300 users, 85% of validation accuracy for 400 users, 88% of validation accuracy for 500 users; GRID attained 81% of validation accuracy for 100 users, 83% of validation accuracy for 200 users, 85% of validation accuracy for 300 users, 89% of validation accuracy for 400 users, 92% of validation accuracy for 500 users.

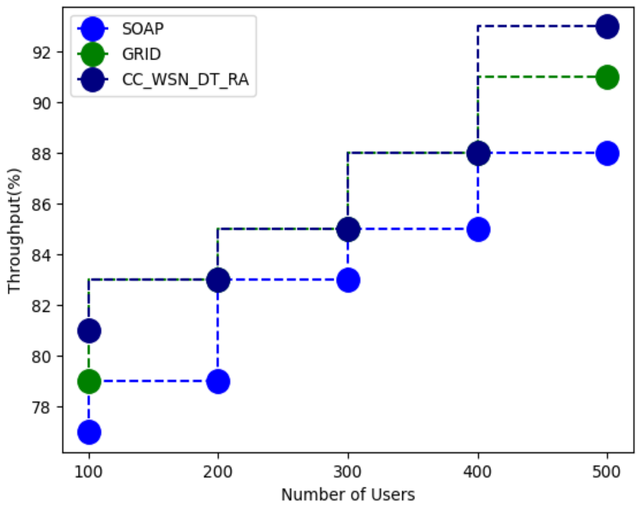

Fig. 3 Comparison of throughput

From above table-1 and figure-3 shows comparison of throughput based on number of users between proposed and existing technique. the proposed technique attained 81% of Throughput for 100 users, 83% of Throughput for 200 users, 85% of Throughput for 300 users, 88% of Throughput for 400 users, 93% of Throughput for 500 users; while existing SOAP attained 77% of Throughput for 100 users, 79% of Throughput for 200 users, 83% of Throughput for 300 users, 85% of Throughput for 400 users, 88% of Throughput for 500 users; GRID attained 79% of Throughput for 100 users, 83% of Throughput for 200 users, 85% of Throughput for 300 users, 88% of Throughput for 400 users, 91% of Throughput for 500 users.

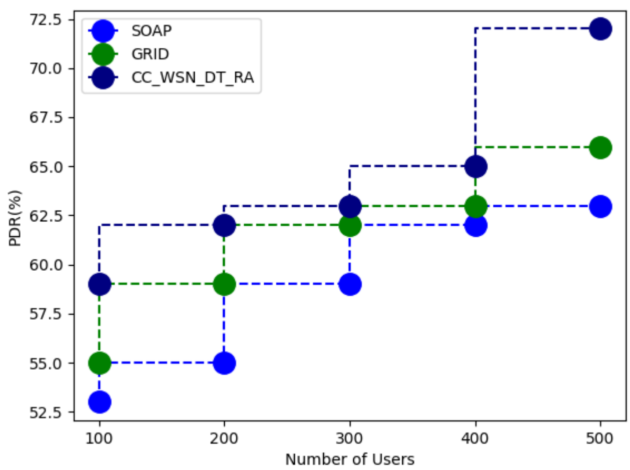

Fig. 4 Comparison of PDR

The table-1 and figure-4 depicts comparison of packet delivery ratio between proposed and existing technique. the proposed technique attained 59% of packet delivery ratio for 100 users, 62% of packet delivery ratio for 200 users, 63% of packet delivery ratio for 300 users, 65% of packet delivery ratio for 400 users, 72% of packet delivery ratio for 500 users; while existing SOAP attained 53% of packet delivery ratio for 100 users, 55% of packet delivery ratio for 200 users, 59% of packet delivery ratio for 300 users, 62% of packet delivery ratio for 400 users, 63% of packet delivery ratio for 500 users; GRID attained 55% of packet delivery ratio for 100 users, 59% of packet delivery ratio for 200 users, 62% of packet delivery ratio for 300 users, 63% of packet delivery ratio for 400 users, 66% of validation accuracy for 500 users.

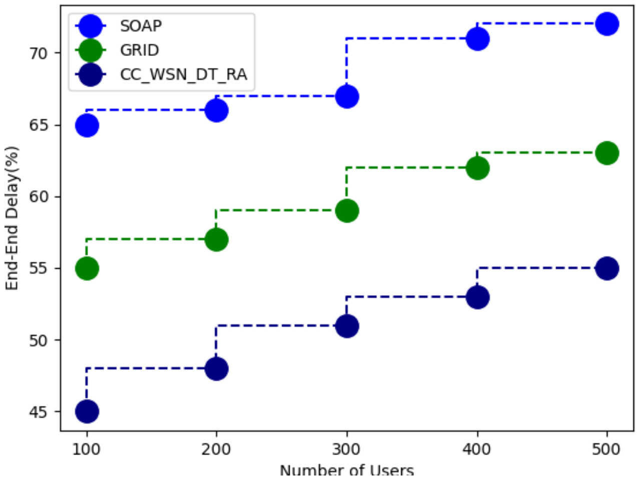

Fig. 5 Comparison of end-end delay

the suggested method accomplished 45% of packet delivery ratio for 100 users, 48% of packet delivery ratio for 200 users, 51% of packet delivery ratio for 300 users, 53% of packet delivery ratio for 400 users, 55% of packet delivery ratio for 500 users; while existing SOAP attained 65% of packet delivery ratio for 100 users, 66% of packet delivery ratio for 200 users, 67% of packet delivery ratio for 300 users, 71% of packet delivery ratio for 400 users, 72% of packet delivery ratio for 500 users; GRID attained 55% of packet delivery ratio for 100 users, 57% of packet delivery ratio for 200 users, 59% of packet delivery ratio for 300 users, 62% of packet delivery ratio for 400 users, 63% of validation accuracy for 500 users as shown in above table 4 and figure-5.

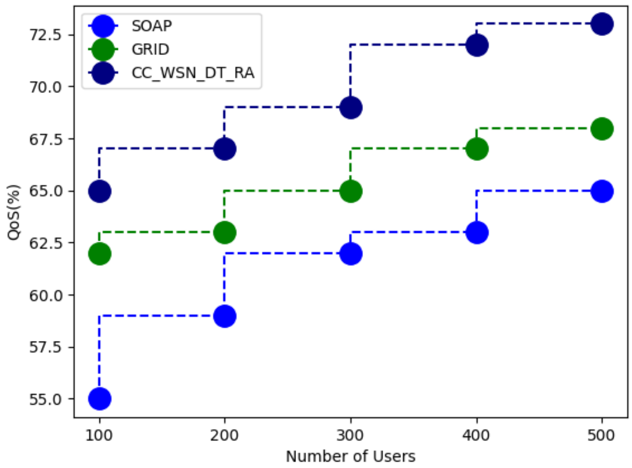

Fig. 6 Comparison of QoS

From above table-1 and figure-6 shows comparison of QoS based on number of users between proposed and existing technique. the proposed technique attained 65% of QoS for 100 users, 67% of QoS for 200 users, 69% of QoS for 300 users, 72% of QoS for 400 users, 73% of QoS for 500 users; while existing SOAP attained 55% of QoS for 100 users, 59% of QoS for 200 users, 62% of QoS for 300 users, 63% of QoS for 400 users, 65% of QoS for 500 users; GRID attained 62% of QoS for 100 users, 63% of QoS for 200 users, 65% of QoS for 300 users, 67% of QoS for 400 users, 68% of QoS for 500 users.

5. Conclusion

This study offers an innovative method which is dependent upon cloud wireless sensor network in cloud data transmission and routing analysis using deep learning technique. data routing is done for trained data where the training is carried out using fuzzy convolution based secure routing. Applications that transfer data from sensor networks to the cloud for processing or even other customer-focused services must be able to provide data reliably. An evaluation of the research data has been done with regards of validation accuracy, throughput, packet delivery ratio, end-end delay and QoS. The recommended approach achieved validation accuracy of 95%, throughput of 93%, packet delivery ratio of 72%, end-end delay of 55% and QoS of 73%. We are expanding the Pymote framework to include propagation, energy use, mobility, and other models as future development. For better performance evaluation, the enhanced framework will also offer interactive graphing and logging features.

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