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Enhancing the QoS and security of database system using Particle Swarm Optimization

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Abstract: *Both network security and quality of service (QoS) consume computational resource of IT system and thus may evidently affect the application services. Database systems are widely used in today's computer system, which are adopted for storing and accessing data in various application services. It is important to model the mutual influence between network security and QoS, which can be concurrently optimized in order to provide a better performance under the available computational resource. This paper represents the particle swarm optimization which enhances is designed to get the optimization performance. These obtained security policies not only meet the security requirement of the user, but also provide the global optimum solution easily and has good convergence speed.*

Keywords: *Database System, QOS, Network Security, Particle Swarm Optimization.*

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I. Introduction

Database system is used for storing as well as obtaining information in several application services. The latest applications are not necessary need to preserve a huge quantity of mutual data, but also maintain the information contemporary for the transactions. With standard repository program, it is made to method the lasting, secure information, and keep the reliability and reliability of data. Their efficiency objectives primarily concentrate on the large throughput and the lower price of system. Database as a Service (Dbase) cheaply allows the clients with restricted sources to outsource large-scale sources to the cloud. But, it becomes an extremely complicated issue that just how to perform SQL on outsourced sources while guarding the confidentiality of outsourced sources at the exact same time [2]. While using the common usage of databases methods, people are in contact with a growing number of bodily and mental dangers while your data residing in sources generally call for considerably hypersensitive facts, for example private privateness, financial institution facts along with private secrets. A growing number of real-time products and services with databases are needed, that could remarkably influence human eye program (QoS). Real-time databases technique is considered the foundation of small business facts details foundation, currently in use to be able to approach the particular real-time exchange details for your e-commerce technique from the organization, so as to recreate in conjunction with keep close track of the product efficiency related to sim approach using the research laboratory in order to storage space famous facts regarding facts giving software so on. For the reason that reciprocal affect amongst multi-level basic safety plus QoS, we have a rising curiosity to understand their particular specific partnership for collection systems. By way of example, using the raising using the real-time multi-level app expert services which contain hypersensitive facts, the idea is necessary to provide you with the satisfactory basic safety program regarding sustaining you'basic safety and QoS to fulfill a real- time period requirements.

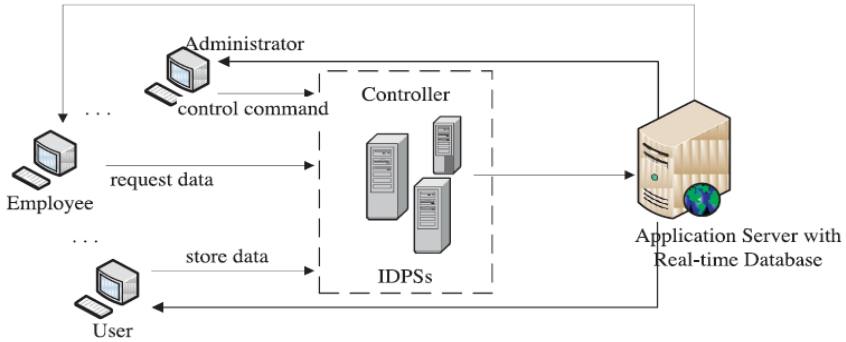

Fig 1: Enterprise application environment with real-time database.

II. Particle Swarm Optimization

Particle swarm optimization (PSO) is a stochastic optimization strategy, patterned on the cultural conduct of chicken flocks. PSO is a population-based research method wherever in actuality the persons, named contaminants, are arranged proper in to a swarm. Each chemical in the swarm presents prospect methods to resolve the optimization problem. In a PSO process, each chemical is "flown" through the multidimensional research room, modifying their place exploring room relating using its knowledge and that of neighboring particles. A chemical thus employs the top place undergone due to it and the top place of their neighbors to place it self toward an perfect solution. The consequence is that contaminants "fly" toward an perfect, while however exploring a wide place about the prevailing most useful solution. The efficiency of each chemical (i.e. the "closeness" of a chemical to the world wide minimum) is tested relating with a predefined conditioning Purpose which pertains to the problem being solved. PSO has some benefits around different related optimization methods such as for example for example GA, specifically the following:- 1) PSO now's better to apply and you will find less variables to adjust. 2) In PSO, every chemical recalls their prior economical along with a regional most useful; thus, it comes with a more effective storage capacity set alongside the GA. 3) PSO is more efficient in sustaining the range of the swarm (more similar to the excellent cultural connection in a community), because every one of the contaminants utilize the data associated with one of the most effective chemical to have the ability to increase themselves, although in GA, the worse answers are extracted and just the great people are preserved; thus, in GA the citizenry evolves about a the main best individuals.

III. Related Work

Xuancai Zhao et.al [1] an evaluation design is consequently shown to explain the good impact of system protection and QoS, and then the multi-objective genetic algorithm NSGA-II is changed to improve the multi-objective model. Utilising the intrinsic data from the prospective issue, a brand new crossover strategy is made to more boost the optimization performance. Alomari et al. [2] introduced productive reply period approximations regarding simultaneous constructs attributes because shell and also sign up for queues. All these approximations can be employed through experts and gratification technicians in order to swiftly review your overall performance connected with being competitive configurations. Your additions more than prior do the job tend to be twofold.Aliyu Rufai Yauri et al. [4] propose a method that helps the conclusion individual in querying and discovering the Quran ontology. The device comprises individual issue reformulation from the Quran ontology saved and annotated in the information base. An individual produces a problem in the normal language and the planned program reformulates the issue to fit this content present in the information bottom to be able to recover the appropriate answer. Andrés Gago-Alonso et al. [6] gifts a brand new algorithm for fingerprint indexing, which is founded on minutia triplets, and it's really resistant to lacking and spurious minutiae. In that feeling, a book illustration for fingerprints is planned by defining a pie collection centered on extensions of Delaunay triangulations. Mayanka Katyal1 et al. [5] discussed min-max algorithm by which selection of resources over the network is done. Saad M. Darwish et al. provide the structure of house M2M systems decomposed in to three subareas with regards to the radio company stages and possible applications.

IV. Research Gap

As discussed by Xuancai Zhao et.al [1] , an evaluation product is appropriately shown to spell it out the common effect of system protection and QoS, and a multi-objective genetic algorithm NSGA-II is adjusted to enhance the multi-objective model. By conducting the survey, it is found that the existing researchers have neglected many issues i.e. the use of multi objective optimization is ignored in the most of the existing literature and the Genetic algorithm suffers from poor convergence speed.

V. Methodology

5.1 Proposed Methodology

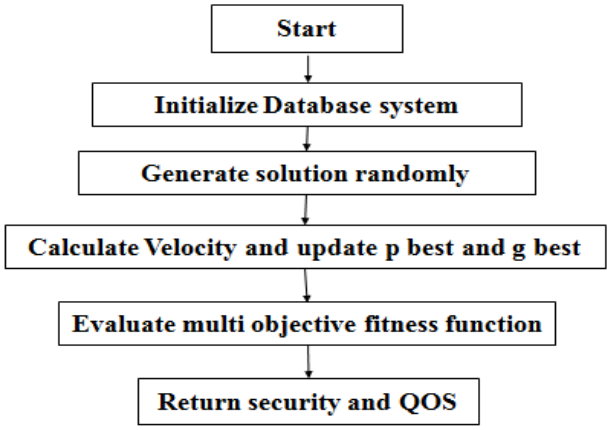

Fig 2: Flow chart of Proposed Methodology

5.2 Performance analysis

The proposed technique is designed and implemented in Matlab tool and weka tool. Weka contains tools for data pre processing, classification, regression, clustering and visualization. So the evaluation of the proposed technique is done on the basis of following parameters i.e. accuracy, TP rate, FP rate, F-Measure and kappa statistics based on no of trees 10, size of tree is 39-47 and no of leaves is 10. The comparison has been drawn between existing technique and proposed technique.

1. Accuracy:

It is defined as number of instance per classes that have been correctly identified. Correctly classified instances lead to the accuracy of results. It relates to those instances, which are being identified as correct or positive while making predictions.

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}$$

Table 1: Comparison on Accuracy

No of Trees	No of Leaves	Size of Tree	Accuracy(Existing)	Accuracy (Proposed)
1	21	41	95.1995	99.5200
2	22	43	95.4695	99.1299
3	22	43	95.2595	97.3897
4	22	43	95.6196	97.9598
5	21	41	95.5596	97.6898
6	23	45	95.8896	97.6898
7	22	43	95.7996	97.2997
8	21	41	95.7396	96.6097
9	20	39	95.5896	96.5596
10	21	41	95.7396	96.8197

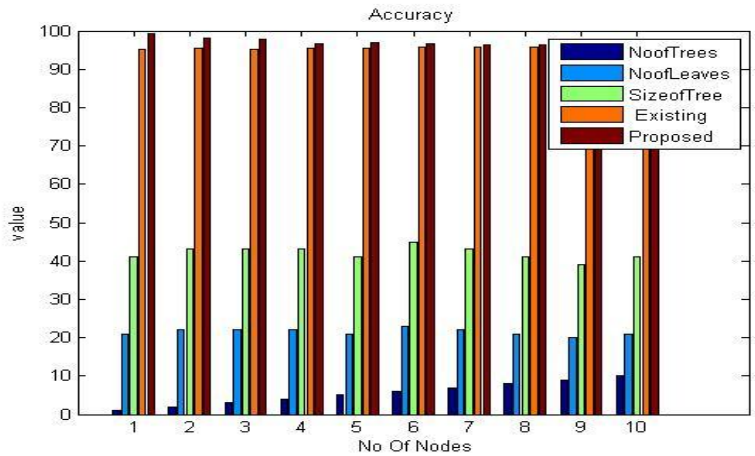

Fig 3: Represent Accuracy

2. **TP-Rate:**

TPR refers to True Positive Rate. It is also called Sensitivity or Recall in some fields. TPR is defined as measurement of positive cases that are correctly identified

$$\text{TP Rate} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

Table 2: Comparison on TP Rate

No of Trees	No of Leaves	Size of Tree	TP Rate(Existing)	TP Rate (Proposed)
1	21	41	0.952	0.997
2	22	43	0.955	0.997
3	22	43	0.953	0.994
4	22	43	0.956	0.997
5	21	41	0.956	0.992
6	23	45	0.959	0.992
7	22	43	0.958	0.991
8	21	41	0.957	0.991
9	20	39	0.956	0.992
10	21	41	0.957	0.9992

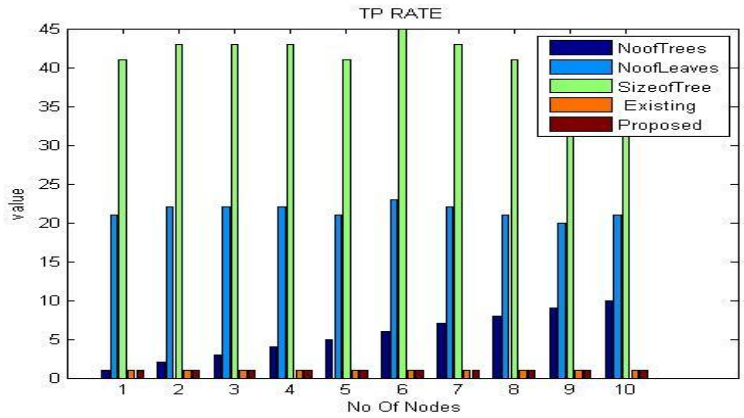

Fig4: Represent TP Rate

3. **FP Rate:**

FPR is called False Positive Rate. It is defined as ration of those instances or objects that are incorrectly identified as positive. It is also known as fall-out.

$$\text{FP Rate} = \frac{\text{FP}}{\text{FP} + \text{TN}}$$

Table no. 3: Performance Analysis of FP Rate

No of Trees	No of Leaves	Size of Tree	FP Rate (Existing)	FP Rate (Proposed)
1	21	41	0.252	0.033
2	22	43	0.221	0.043
3	22	43	0.254	0.147
4	22	43	0.228	0.112
5	21	41	0.226	0.112
6	23	45	0.201	0.112
7	22	43	0.210	0.135
8	21	41	0.200	0.182
9	20	39	0.217	0.259
10	21	41	0.208	0.174

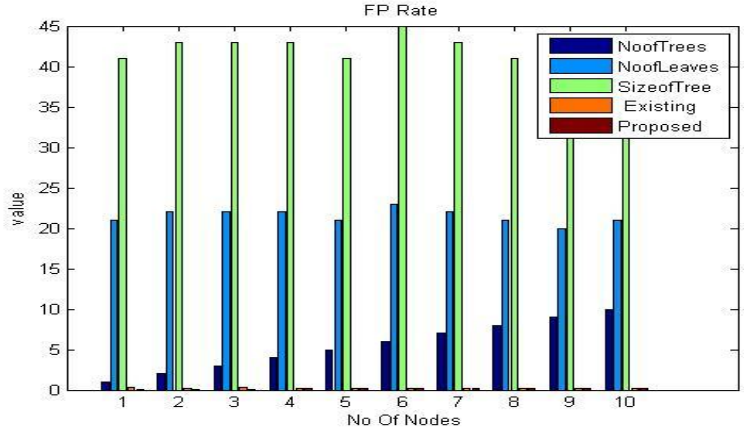

Fig 5: Represent FP Rate

4. F-Measure:

F-Measure is also called F1 score. It contains both precision and recall. It is generally use to check the accuracy and reliability. It computes the mean of precision and recall. Basically, it uses as best and 0 as worst when both precision and recall are used.

$$\mathrm{F-Measure} = 2 * \frac{\mathrm{P} * \mathrm{R}}{\mathrm{P} + \mathrm{R}}$$

Table no. 4: Performance Analysis of F-Measure

No of Trees	No of Leaves	Size of Tree	F-Measure(Existing)	F-Measure (Proposed)
1	21	41	0.949	0.997
2	22	43	0.953	0.995
3	22	43	0.949	0.985
4	22	43	0.954	0.988
5	21	41	0.953	0.987
6	23	45	0.957	0.987
7	22	43	0.956	0.984
8	21	41	0.956	0.980
9	20	39	0.954	0.974
10	21	41	0.955	0.982

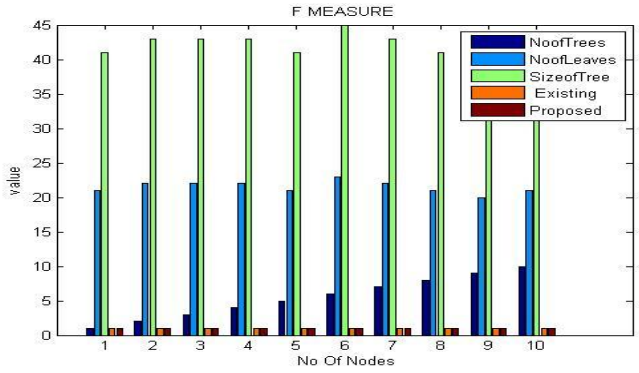

Fig 6: Represent F-Measure

5. Kappa Statics:

Kappa statistics is the measure that determines inter rater agreement for qualitative items. Cohen's kappa measures the agreement between two raters who each classify *N* items into *C* mutually exclusive categories.

$$kappa\_statistics < -1 + cor(Actual, Predicted)$$
$$kappa\_statistics < -round(kappa\_statistics/2,2)$$
$$kappa\_statistics$$

Table no. 5: Performance Analysis of Kappa Statics

No of Trees	No of Leaves	Size of Tree	Kappa Statics(Existing)	Kappa Statics (Proposed)
1	21	41	0.7832	0.9804
2	22	43	0.8006	0.9645
3	22	43	0.7851	0.8894
4	22	43	0.8048	0.9138
5	21	41	0.8029	0.9042
6	23	45	0.8024	0.9042
7	22	43	0.8153	0.8872
8	21	41	0.8151	0.8554
9	20	39	0.8058	0.8536
10	21	41	0.8133	0.8644

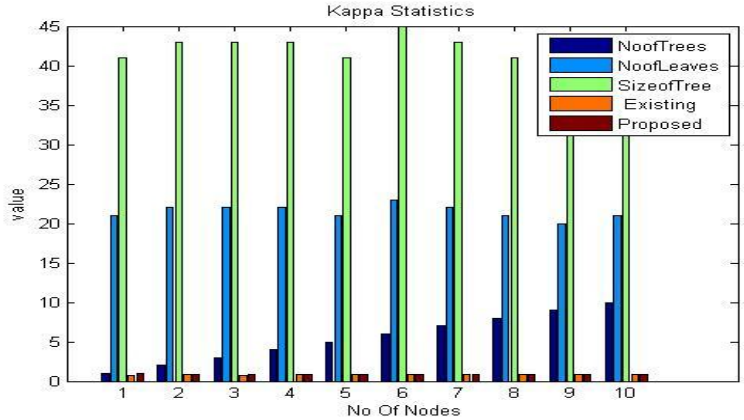

Fig 7: Represent Kappa Statistics

VI. Conclusion

This paper represnts the real-time database system is designed, which is aimed at optimizing QoS and security by dynamically changing the security configurations according to the requests from users. So their is a need to improve the global optimum solution and convergence speed. In this we proposed multi-objective particle swarm optimization for enhancing the QoS and security of database system. It has been designed and implemented the proposed technique in Matlab tool weka tool. So the comparison has been carried out between the proposed technique and existing technique is done on the basis of following parameters i.e. accuracy, TP-rate, F-Measure, FP-rate and kappa Statistics with number of trees is 10, size of tree is 39-47 and no of leaves is 10. By applying the proposed technique it gives the global optimum solution easily and improved the convergence speed. The futur scope of this work is additional parameters can be evolved for future work for more comfortable and pleasing results.

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