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Enhance Resource Utilization in Cloud Computing

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ABSTRACT

Job satisfaction in cloud computing is closely related to processing costs and resource use.Task scheduling especially increases the cloud-based system's source utilization and processing costs. In order to provide optimal scheduling, numerous optimization methodologies are used to enhance task scheduling performance. It is providing resources to appropriate activities; when tasks are introduced with an eye towards their completion, it appears in the NP-hard crisis feature due to a large number of solution explorations and accepts the longest possible time for determining the best outcomes. In a cloud environment, results are produced at their best through resource maintenance processes. Task scheduling solves the problem where resources must be divided among numerous jobs to maximize resource utilization and shorten operating times. Scheduling approaches must be effective in order to achieve higher utilization, and they believe that the network's overall load should be balanced, disturbances should be managed, errors should be tolerated, and the execution time should be reduced.

Keywords: HEFT, Resource Utilization, PSO, ACO

INTRODUCTION

In order to enable a cost-effective, scalable, and flexible exploitation of heterogeneous resources, cloud computingis a subscription-based on-demand service that provides software, infrastructure, and platform-type services. It has been linked to Grid computing, distributed computing, and utility computing to provide effective virtualization and reflection with shrinking space.

The way cloudcomputing works is described as assigning jobs to a set ofresources made up of numerous computers connected by the internet and offering a wide range of services, including power, storage, and a variety of software services, depending on the task at hand [1]. Effective task- scheduling algorithms can manage these jobs to prevent resource overload, enhance resource utilization, shorten response times, and increase throughput.

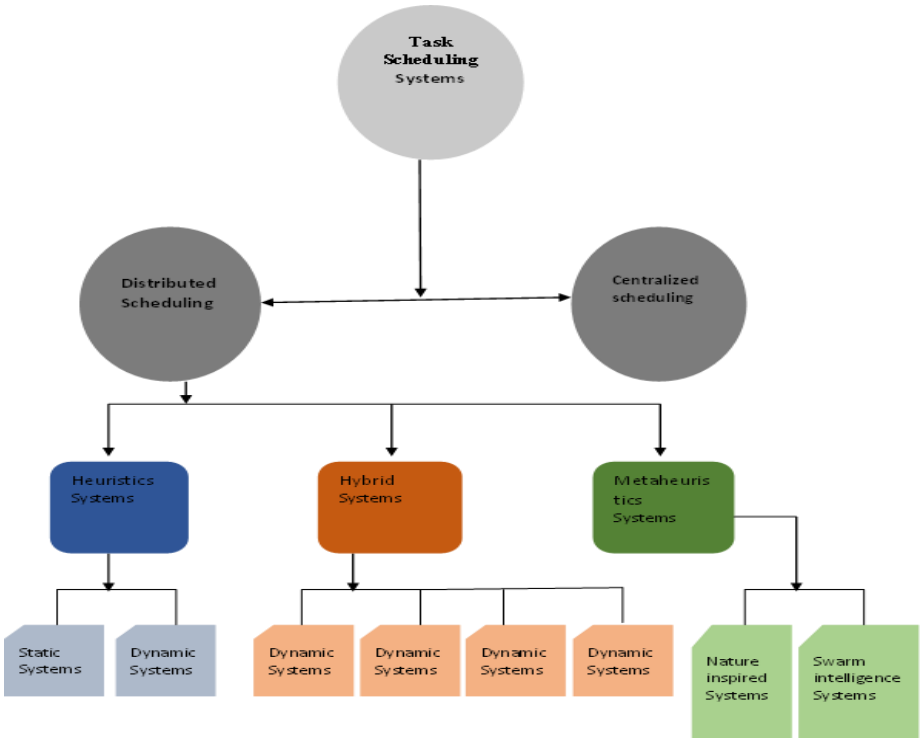

Fig 1: Task Scheduling Algorithms Taxonomy.

Task scheduling's goals are to maintain the system's consistency, improve speed, build a fault-tolerant system, and provide a future deviation in the system, such as protection while sacrificing customer time and resources for new activities categories of meta-heuristic scheduling: swarm and bio-inspired.

An ideal object is chosen from a large number of existing objects using the optimization process (depending on a few specific conditions). It demonstrates how single- objective and multi-objective functions with a few constraints can be used to determine the object's maximum and minimum values. It is selection criteria for minimum and maximum values rather than a problem- solving approach [3].

A technique for making anything as totally ideal, practical, or competent as is likely is known as optimization. By analytically selecting input values within a specific range and evaluating the function, an optimization strategy minimizes or maximizes an objective function.

Many fields of functional mathematics are included in the specialized optimization review and methods for all deterrence. Finding "optimal attainable" values for the objective function within a set of constraints is the essence of optimization [4].

The optimization's major elements include several:
Objective element: It is a mixture of multiple phrases that describes the various traits or qualities of items and evaluates to provide the minimum or maximum values. Here, one or more objectives are used to solve an optimization problem where object compatibility is absent. One term or item may be different from another, and using weight factors can further make this possible [5].

Variables: A significant group of unknowns is referred to as a variable. The variables have been used to describe restrictions and objective utility. Devise Assuring precise serviceability and other necessities, variables cannot be chosen arbitrarily.

Constraints: The requirements that allow the unknowns to achieve the confidence values without involving others are known as constraints. Prior to now, the devise variables, constraints, and goals have been chosen and merged to form the goal function of the optimization problem.

The chaos BSA for task scheduling undergoes the following processes.

Step 1: A connection needs to be made between client tasks and birds.

Step 2: We set the starting points for the bird locations, the explorable dimensions, the number of iterations, and the constants. The chaotic equation is used to seed the initial bird population.

Step 3: The optimal solution exploration technique then uses the position data of each bird to calculate its fitness score. The present ideal solution is to choose the bird with the lowest fitness value.

Step 4: The minimum objective optimization function F_{mo} is represented as:

$$F_{mo} = minimum\{w_1 F_{fc} + w_2 F_{sc} + w_3 F_{tc}\}$$

Step 5: The birds' positions are adjusted.

Step 6: All possible repetitions of steps 3 and 4 are carried out.

Step 7: The solution will be updated with the position information of the final creator bird; this information will be used to determine the most efficient method of doing tasks in the cloud.

The EHOTS performs the following steps.

Step 1: Initially, the mapping between user tasks and elephants is to be done.

Step 2: The elephant position, searching dimension, elephant populations, number of repetitions, and constant`s values provide initial values.

Step 3: All the elephant`s fitness values are calculated according to the elephant`s position information in the optimal solution-searching process. The elephant with minimum fitness value is denoted as the current best solution.

Step 4: The entire elephants are updating their positions.

Step 5: Step 3 to step 4 is continued for all repetitions.

Step 6: The position information about the last leader elephant will be added to the solution, which is used for generating the best execution scheme of tasks in the cloud computing environment.

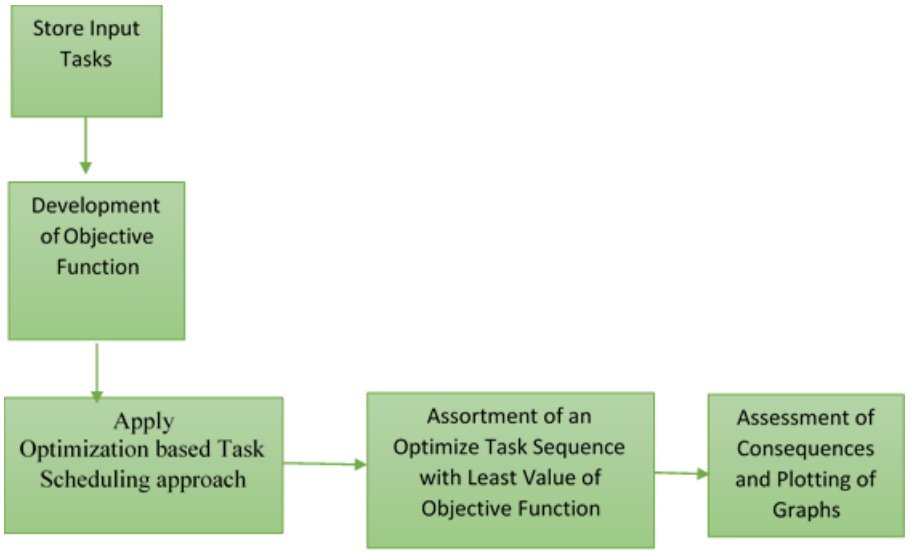

Fig II: **The Proposed Block Diagram**

The minimum objective optimization function F_{mo} for chaos BSA is represented as:

$$F_{me} = minimum\ \{w_1 F_{p1} + w_2 F_{p2}\} \quad (2)$$

Where, F_{p1}

is first attribute processing expense function,

$$F_{mo} = minimum\ \{w_1 F_{fc} + w_2 F_{sc} + w_3 F_{tc}\} \quad (1)$$

Where, F_{fc} is first objective function, F_{sc} is second objective function and F_{tc} is third objective function. Moreover, w_1, w_2, w_3 are respective weight factors.

Total optimization function for a set of goals in EHOTS approach, when the attribute functions FPE and FLE are combined with a small number of weight factor coefficients, F_{me} is clearly demonstrated.

F_{p2} is second attribute processing expense function and w_1, w_2 are respective weight factors. The minimum objective optimization functions is calculated for different task range of 500 to 1500 and compared with existing approach. The consequences are compared and summarized below in Table I.

Table I: The value of Optimization Function for 500 Tasks.

Number of Iterations	PSO	ALO	EHOTS	Chaos BSA
20	0.285	0.287	0.274	0.251
40	0.286	0.321	0.285	0.259
60	0.284	0.286	0.324	0.318
80	0.287	0.328	0.329	0.316
100	0.326	0.319	0.326	0.324

According to the data presented in Figure III and Table I, PSO achieves 14% better outcomes than ACO, whereas ALO provides 12% better outcomes than PSO. By comparison to ALO, the EHOTS produces 11% higher yields, and compared to PSO, it yields 12% higher yields.

For modest numbers of activities (500 tasks), the Chaos BSA produces 13% higher efficiency compared to EHOTS, 15% superior efficiency compared to ALO, and 19% superior efficiency compared to PSO based on overall cost.

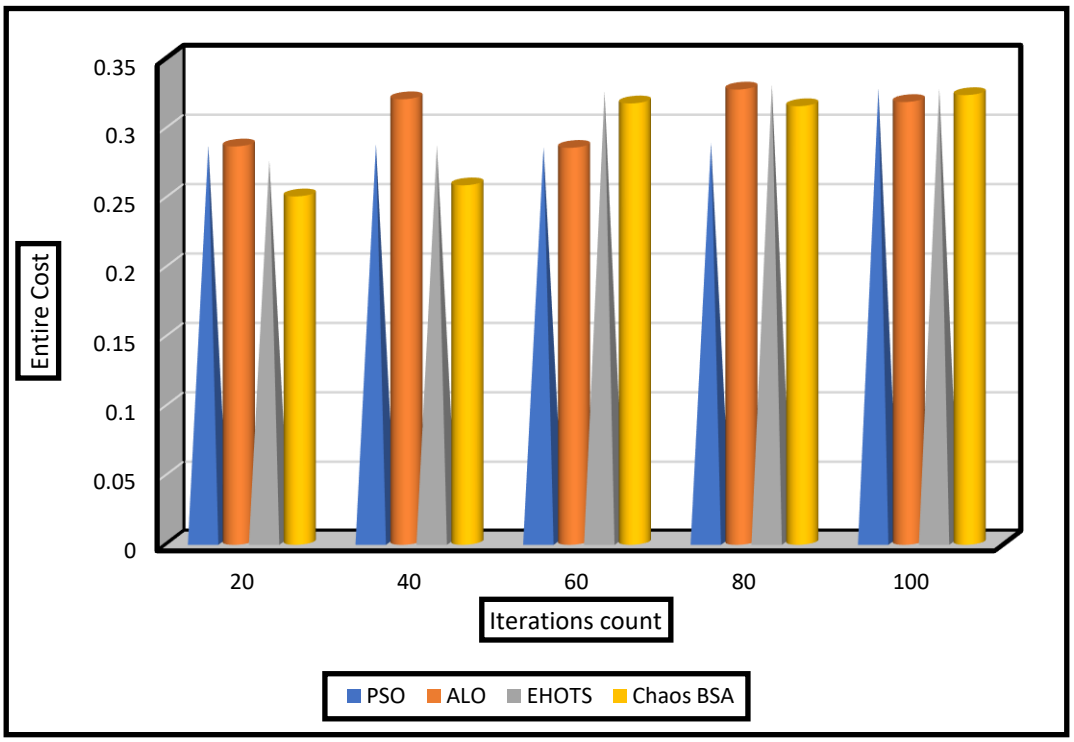

Fig III: **The value of optimization function for 500 Tasks.**

Table II: The value of Optimization Function for 1000 Tasks.

Number of Iterations	PSO	ALO	EHOTS	Chaos BSA
20	0.3326	0.2811	0.2798	0.2718
40	0.3313	0.3063	0.2536	0.2453
60	0.2926	0.2614	0.2467	0.2347
80	0.2912	0.2784	0.2614	0.2458
100	0.2897	0.3125	0.2798	0.2578

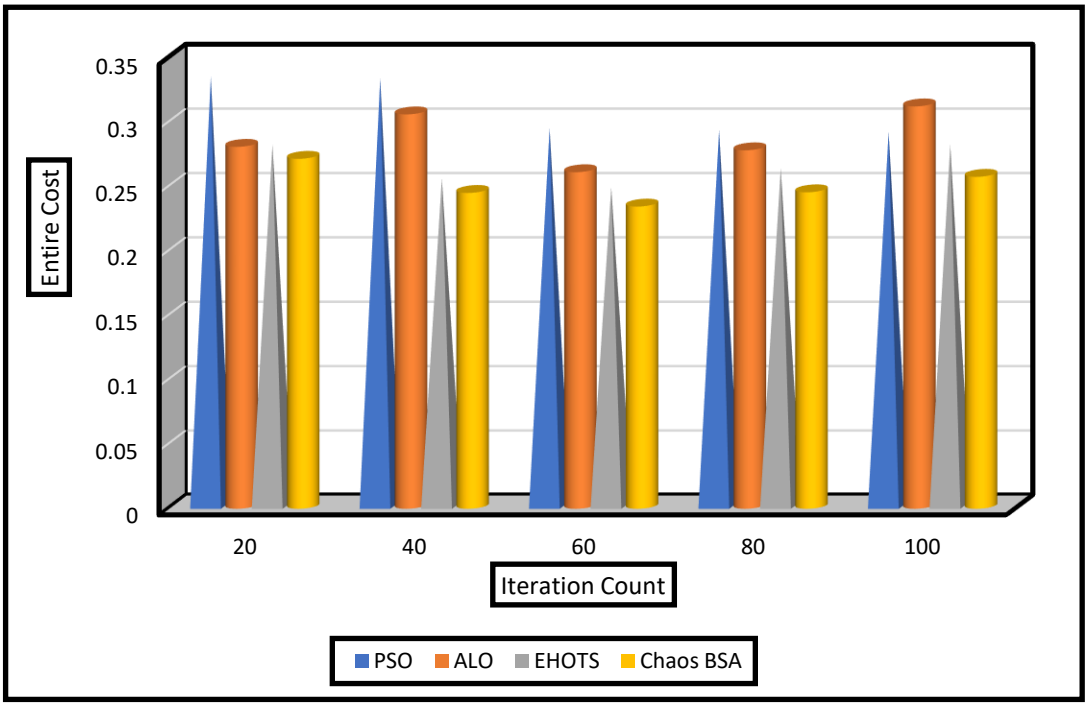

Fig IV: **The value of Optimization Function for 1000 Tasks.**

According to the findings (shown in Figure IV and TableIII), the PSO achieves outcomes that are 16% more favourable than those generated by the ACO, while the ALO provides outcomes that are 8% more favourable thanthose generated by the PSO. When compared to ALO, theEHOTS produces outputs that are 8% higher, and when compared to PSO, those outputs are 13% higher. In terms of the overall cost for a large number of tasks (1000 tasks), the Chaos BSA generates 11% superior efficiency incomparison to EHOTS, 16% superior efficiency in comparison to ALO, and 21% superior efficiency in comparison to PSO. All of these comparisons are made onthe basis of the number of iterations.

Table III: **The value of Optimization Function for 1000 Tasks.**

Number of Iterations	PSO	ALO	EHOTS	Chaos BSA
20	0.293	0.275	0.264	0.241
40	0.291	0.272	0.263	0.238
60	0.283	0.274	0.261	0.237
80	0.284	0.261	0.257	0.228
100	0.276	0.253	0.258	0.215

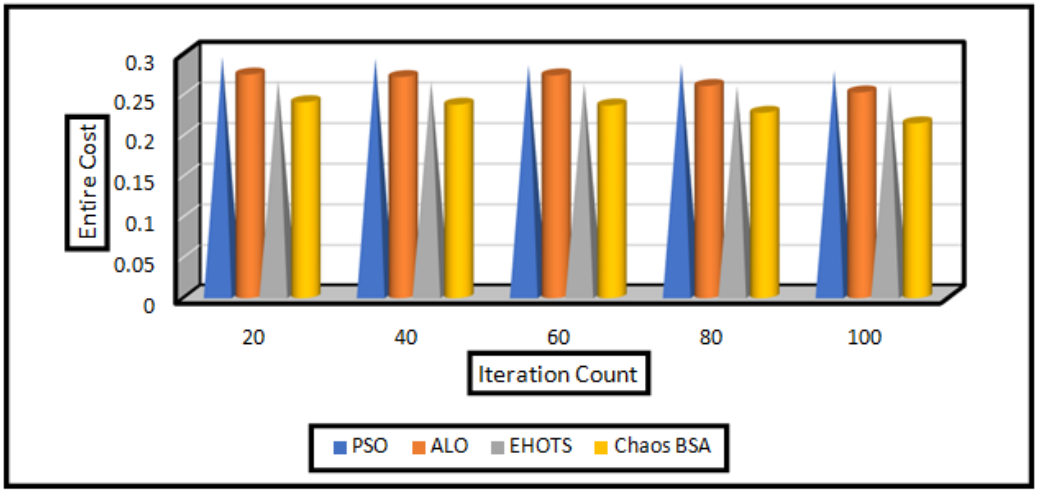

Fig V: The value of Optimization Function for 1000 Tasks.

Figure V and Table III show that compared to PSO, ALO yields 14% better results. When compared to ALO, the EHOTS produces 11% better results, and when compared to PSO, the EHOTS produces 14% better results. For high numbers of jobs (1500 tasks), the Chaos BSA generates 15% better efficiency than EHOTS, 15% better efficiency than ALO, and 24% better efficiency than PSO in terms of overall cost.

CONCLUSION

When using cloud computing, the scheduling of jobs has a significant impact on the amount of computer power and other resources that are used. Many studies have used these criteria to find the most effective way to partition the work that needs to be done. The work scheduling feature of a cloud-based system can make the use of its resources and the overall cost of the process look noticeably better. Several scholars have collaborated to develop and put into practise a variety of optimization algorithms with the goal of improving cloud-based job scheduling. In this work, we generate the most optimal scheduling of users' tasks by employing a combination of two methods: the Elephant Herding Optimization based Task Scheduling (EHOTS) method and the Chaos Bird Swarm Algorithm (Chaos BSA) method. Our objective is to maximise the utilisation of cloud resources while minimising the amount of money spent on processing. The simulation is carried out with the help of the tool MATLAB 2019a, and the findings indicate that Chaos BSA performs better than EHOTS, ALO, and PSO in terms of the overall cost. This is the case regardless of the number of tasks or iterations involved.

It is possible that in the not too distant future, researchers may be able to organise work according to audio and visual data. It's possible that one day we'll be able to improve the Strength of Chaos BSA and EHOTS by incorporating concepts like entropy and multidimensional chaotic maps. There is room for development in the capability of the task to be scheduled.

Conflict of Interests:
The authors declare that there is no conflict of interests regarding the publication of this paper.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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