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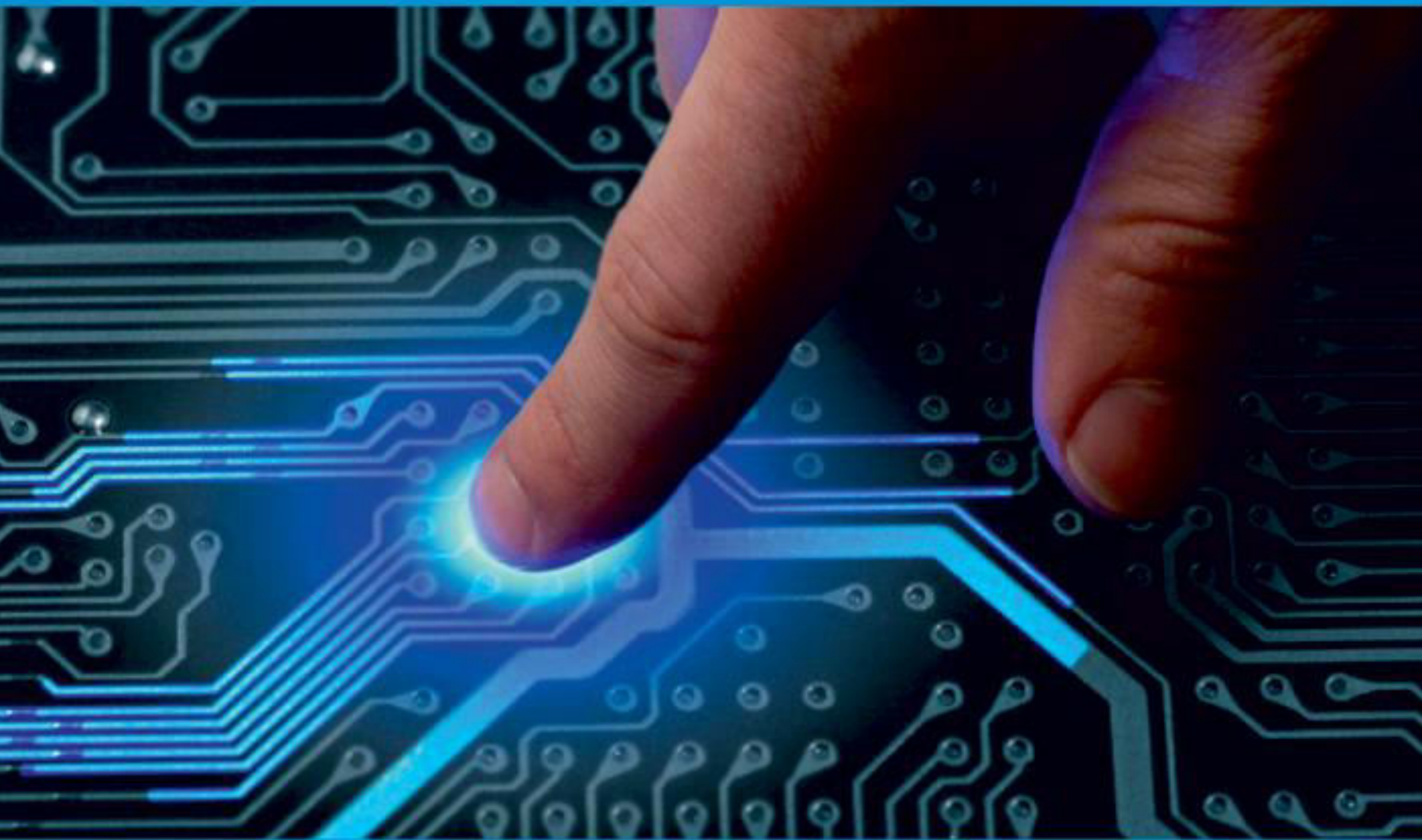

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Multi-Objective Energy Efficient Task Scheduling In Cloud Computing Using Harris Hawk Optimization

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ABSTRACT: Due to cloud computingrecent rise, it serves as the foundation for a vast array of applications. It enables clients to obtain a number of services that are predefined and to readily adapt to their business's needs. The rapid adoption of cloud computing across numerous industries has resulted in a number of problems, including resource management, distribution of load, power usage, and encryption. The multi-objective problem of task scheduling and energy consumption is taken into consideration for this work,the Harris Hawk Optimisation is used to effectively minimizeenergy consumption, migration Cost and improve utilization. The performance of the system is evaluatedby allocating the tasks from overused server to underused server and minimizing the energy consumed by the overloaded VMs and idle VMs in the physical machine. It is implemented using the CloudSim toolkit. The results analysis indicates that the proposed HHO performs better than the other algorithms.

KEYWORDS:Cloud Computing, Virtual machines, Harris Hawk Optimization, CloudSim

I. INTRODUCTION

The system used for delivering resources over the internet is called cloud computing. Users may utilise a variety of computer services, such as software applications, processing, and storage, without buying or maintaining their own physical system.In cloud computing, computing resources are typically provided by third-party service providers, who own and maintain large-scale data centres. These data centres are connected over a network and providing the computing services to users.

The technique of allocating jobs to readily available computing resources, such as servers, processors, or virtual machines, is known as task scheduling. It is a crucial part of contemporary computing systems because it enables users to effectively employ the computing resources at their disposal and reduce response time.In the task scheduling process, the requirements of the tasks—such as processing speed, memory, and storage—are determined and compared to the resources that are already available. Choosing the right resource for each task and making sure that resource is used effectively are the objectives.It could also entail setting tasks in order of importance or urgency. By doing this, you can make sure that important tasks are finished on time and that resources are distributed properly.

The Harris Hawk Optimization (HHO) algorithm is a nature-inspired optimization technique based on the hunting behaviour of Harris's hawks. This algorithm has been applied to a variety of optimization problems, including those in cloud computing.The HHO algorithm can be used to optimize task allocation in cloud computing by mimicking the hunting behavior of Harris's hawks to explore the search space of possible solutions.
The HHO algorithm has several advantages in cloud computing optimization. First, it is a population-based optimization algorithm, which means that it can explore multiple solutions simultaneously, leading to a faster and more efficient optimization process. Second, it is a flexible algorithm that can be easily adapted to different cloud computing systems.

The proposed work aims to enhance resource optimization and load balancing with respect to the Quality of Service, ranking of VMs, and resource allocation. It is created to deal with both the issues that have been identified . By including more SLA criteria, this work can be developed to further optimise cloud resources and boost the usability of cloud-based applications[1].

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II. RELATED WORK

The scheduling of tasks and the optimization of energy consumption in cloud computing are vital problems that can be solved using a variety of techniques, according to earlier related publications. This section provides a summary of the relevant works that are cited for the suggested literature survey system.

The MOABCQ method, which Artificial Bee Colony Algorithm (ABC) with a Q-learning algorithmfor task scheduling approach in cloud computing. The three various datasets were gathered from the Random, Google Cloud Jobs, and Synthetic workload[2].

Due to the diversity of computing cloud resources used in cloud data centres, the Ant Colony Optimisation (ACO) algorithmis made for heterogeneous cloud. It employs the. The suggested technique focuses on make span and cost. By maintaining load balance, this effort decreases both execution time and cost and effectively utilises the resources that are already available[3].Through the Adaptive Neuro-Fuzzy Inference System-Black Widow Optimisation technique, it is possible to quickly find the right VM for each task. In the ANFIS scheme, the optimum solution is found using the BWO algorithm. This suggested method can make use of the best server by scheduling the VMs there[4].

To balance the demand on the cloud, a dynamic load-balancing technology relies on clustering and classifying virtual machines using the Bayesian optimization method. To enhance load balance, user tasks are scheduled for VMs that are not fully loaded in the second stage of this work. In comparison to Max-Min and R.R algorithms, it has maintained less Make span by 65.54% and 68.26%, respectively[5]. Based on the ability to maintain correct load balancing, the Grey Wolf Optimisation algorithm has been adopted. In this approach, the algorithm searches for idle or active nodes[6].The Firefly (FF) algorithm is used in this technique to reduce the search space, while the IMPSO technique is used to find the increased answer. The algorithm chooses the global best with the smallest line separation[7].

Two genetic-based approaches are merged and described in this article. The performance of virtual machines (VMs) is first tested in a cloud computing environment after performance models are generated from their creation parameters. Second, using the GEP-estimated VMH loads, the evolutionary algorithm chooses the best VM-VMH pairing for load-balancing and VM migration[10].The migration of energy-efficient virtual machines utilising the best cryptography techniques has been introduced. The migrated data was encrypted for security reasons using a sanitization approach. The adaptive cat swarm optimisation (ACSO) method is created to solve optimisation issues. Different value indicators are used to analyse the effectiveness of the suggested methodology, and performance is differentiated using additional techniques[11].

III. PROPOSED WORK

The proposed solution is designed to enhance work schedule in a cloud computing environment for better system performance without compromising the Quality of Service. The datacentres in the cloud environment balance the usage of data and power. Tasks are scheduled and optimized using the Harris Hawk optimization.HHO has been applied to task scheduling to maximise performance and efficacy when allocating work to resources. The method generates a population of candidate solutions, where each candidate solution corresponds to a potential task schedule. Based on their fitness, which is a gauge of how effectively they satisfy the optimisation goals, these solutions are assessed. The HHO method simulates the hunting behaviour of Harris hawks to iteratively update the population of candidate solutions. The candidate solutions serve as a representation of the hawks in the algorithm, who converse and exchange knowledge to raise the calibre of the solutions.

Three main steps make up the algorithm:
Exploration: Using a random selection of solutions and tiny perturbations, the hawks hunt for new regions of the solution space in this phase.
Exploitation: In this stage, the hawks choose the best ideas and alter them to produce new ones in order to concentrate on the most promising ones.
In this stage, the hawks intensify their search in the area of the solutions in order to exploit the best solutions.

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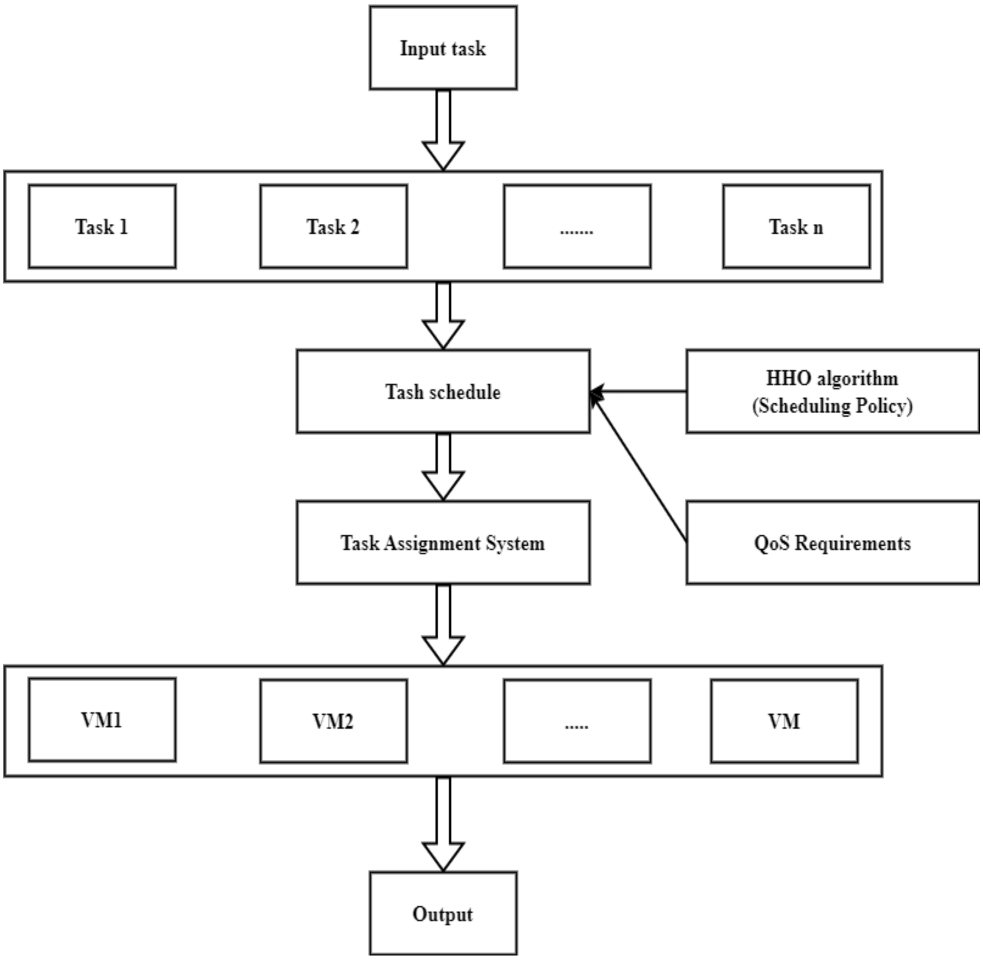

Fig.1: Architecture diagram for Task scheduling using Harris Hawk Optimization.

A. *Methodology of the ProposedWork:*

The key objective of the suggested work is to offer a task-scheduling process for the cloud computing. The VM is moved from one physical server to another physical server as part of the procedure based on overloaded and under loaded VMs for task scheduling. In this research, we create a multi-objective fitness function that combines energy, cost, completion time, execution time, schedule length, and memory usage. We can increase the resource utilisation of cloud resources by minimising those mentioned parameters

Fitness Function F= Min(R_t +C_t + P_o +M)

Where R_t-Response time

P_o-Power consumption

E_t-Execution time

M-Memory utilization

The following steps are involved in task scheduling using Harris Hawk Optimisation (HHO):

Problem definition: The definition of the task scheduling problem is the first stage. Identifying the tasks that need to be scheduled, the resources that will carry them out, and the optimisation goals are all part of this process.

Initialise the population: The following step is to begin by creating a population of potential solutions, where each solution is a potential task schedule. The solutions are created at random and assessed according to their fitness, which is a metric for how effectively they satisfy the optimisation goals.

Implement the HHO algorithm: The population of potential solutions is iteratively updated using the HHO method. The following steps make up the algorithm:

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a. Exploration: During this phase, the hawks randomly choose solutions and make little adjustments to them in order to discover new regions of the solution space.

b. Exploitation: In this step, the hawks select the finest ideas and alter them to produce new ones in order to concentrate on the most promising ones.

c. Intensification: In this step, the hawks intensify their search in the area of the best solutions in order to exploit the best solutions.

The solutions are assessed based on their fitness following each iteration of the HHO algorithm. The ideal task schedule is chosen as the finest option.

Application of the schedule: Implementing the ideal task schedule is the last stage. This entails tagging the resources with the tasks.

IV. Results & Discussion

This section describes the setting in which the planned work is carried out to assess the system's performance when contrasting task scheduling with alternative approaches in a cloud computing environment. In this project, a simulation was created using the simulator CloudSim 3.0.3 that can model, simulate, and experiment with virtualized cloud-based data. It can also simulate virtual resources. Using an Intel(R) Core(TM) i3-7020U CPU running at 2.30 GHz on Windows 10 with 4GB of RAM and a 64-bit processor, CloudSim is run on the Net beans platform with GoCj datasets, random datasets, NASA Ames iPSC / 860 and the HPC2N datasets.

1. Response Time

Response time is the interval between the ready state and the initial CPU acquisition. However, the entire period of time the process needs to be in the ready state is the waiting time.

Response Time By Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	50.163	37.166	65.678
UB2	50.324	36.828	65.511
UB3	50.482	36.282	65.018

Fig. 2 Response time

2. Data Center Loading Time

Datacenter loading time refers to the time it takes to provision and deploy virtualresources such as virtual machines (VMs) or containers in a cloud-based data center.

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.514	0.015	1.002
DC2	0.651	0.03	1.527
DC3	0.702	0.039	1.549

Fig. 3: Datacenter loading time

3.ExecutionCost

The overall cost of running a user's application is known as the execution cost. The execution cost in this arrangement design can be calculated as the cost of VMs.

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Data Center	VM Cost	Data Transfer Cost	Total
DC2	24.003	4.883	28.885
DC1	24.003	4.868	28.87
DC3	24.003	4.882	28.885

Fig. 4:Execution cost

V. CONCLUSION AND FUTURE WORK

In this work, Harris Hawk optimisation is used in this work to address the multi-objective problem in the cloud environment by overcoming multiple objectives like migration cost, execution time, schedule length, resource utilisation, and power consumption are taken into consideration. Depending on the arrival of tasks and the number of available VMs in their physical machines, whether they are overloaded or under loaded, the tasks from the users are distributed among each VM. The proposed work outperforms all other algorithms when the performance of the proposed system is compared and evaluated with those of other methods.

The future scope of this paper can be increased by utilising updated and modified algorithms for quickly and easily addressing multi-objective issues producing efficient results.

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