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ENERGY EFFICIENT TASK SCHEDULING IN CLOUD COMPUTING ENVIRONMENT USING HYBRID GENETIC WHALE OPTIMIZATION ALGORITHM

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Abstarct:
Cloud computing system is an on demand availability of computing resources, information's and software over internet. There are three types of cloud computing models such as private, public and hybrid. The main advantages of these system is it's flexibility, low cost and more secured one. According to the control. Flexibility and management, the cloud can be divided into three models such as Infrastructure as a service, Platform as a service and Software as a service. Task scheduling is plays an major role that properly lines the incoming tasks and schedule it without delay, less power consumption and reduced cost. There are lot of task scheduling techniques and algorithms available. In this paper, an energy efficient Hybrid Genetic whale optimization algorithm is proposed by reducing make span and increasing resource to reduce the power consumption during the scheduling. This algorithm is simulated using cloud sim environment

I-INTRODUCTION

Cloud computing is a collection of bulk quantity of resources like Network bandwidth, Virtual Machine. Processing, allocation and execution of these resources are the main objectives of the scheduling process in cloud computing environment. This is called Task Computing Problem (TSP).It is a non determistic polynomial hard problem and it is responsible for recourses sharing, allocation of computing resources with more reliable, secured and efficient. The are many algorithms available to solve the polynomial problems such as PSO(Particle swam optimization),HGPSO(Hybrid genetic Particle swam optimization),WOA(Whale optimization algorithm), Imperialism competitive algorithm (ICA) and MWOA(Modified Whale optimization algorithm).In this paper we proposed Whale optimization algorithm along with Genetic algorithm to overcome the drawbacks of the existing HGPSO algorithm. In HGPSO algorithm, the queue manager stores the user task .Here, the existing tasks and new tasks are stored in a queue based on the demand. HGWOA process the new tasks kept in the queue. This algorithm allocates the suitable tasks to be executed without any delay and loss. The rest of this paper is organized as section-II presents related work, section -III presents proposed method in detail, section-IV presents results and discussion, section-V presents conclusion and future scope of the proposed work.

Keywords: Cloud computing, Task scheduling, GA (Genetic algorithm),WOA(Whale optimization algorithm),VM(Virtual Machine).

II-RELATED WORK

Task scheduling is an major thrust area in cloud computing system. Task scheduling and processing is an ongoing research of the researcher. Still now lot of research works is going on. There are lot of algorithms are available and also new algorithms are also implemented to check the system.

Xuan Chen, Long Cheng, Qingzhi Liu, Jinwei Liu and John Murphy proposed an algorithm called WOA that optimizes the task scheduling in cloud computing system.

Gui-Ying ,Dun-Qian Cao, proposed IWOA (Improved Whale Optimization Algorithm) to solve constraint optimization problems.

III-PROPOSED METHOD

Whale optimization algorithm

Whale optimization algorithm is a new technique which is used to solve many real time optimization and NP problems. There are three operators such that prey, encircling prey and bubble net foraging behavior of humpback whales. This algorithm initially starts with the set of random solutions. In each and every iteration, the search agent updates the position of the current search agent with respect to the randomly chosen search agent or the best solution obtained on that time. The population based WOA has an ability to solve global optimization problems rather than local optimization problems. This is the major advantage of this algorithm and it provides the solution for lot of constrained or unconstrained optimization problems for many practical real-time applications without any structural change in algorithm. Fig 1 shows the Whale optimization algorithm in task scheduling The WOA also have some drawbacks compared to the other algorithm in terms it's convergence speed and accuracy.

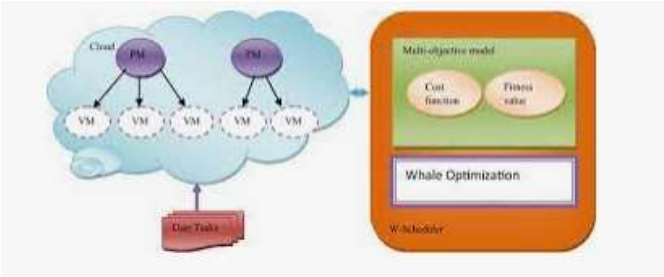


Fig 1 Whale optimization algorithm in task scheduling

Genetic Algorithm

Genetic Algorithm is an algorithm which is a biological based concept and it has the main principle of Initial population, Fitness function, Selection. Cross over and mutation. Fig 2 shows the flowchart of Genetic Algorithm.

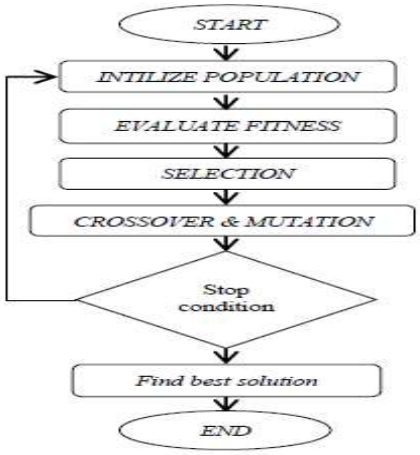


Fig 2 Genetic Algorithm

Proposed Hybrid genetic Whale optimization algorithm

Task scheduling is an important issue in cloud computing. In existing system, task scheduling focused only on certain parameters either execution time or make span. To overcome this issue ,the proposed paper uses Genetic algorithm along with Whale optimization algorithm. In this algorithm, the task scheduler calls the Genetic scheduling function during every scheduling cycle. The genetic algorithm (GA) is one of the evolutionary approaches used to solve complex problems quickly. The main drawback of the GA is its slow response for higher the number of tasks. To overcome these issues, The proposed algorithm overcomes the drawbacks of the others and provides solution for TSP. The proposed Hybrid genetic Whale optimization algorithm improves the local search by using the GA mutation operator and expected to work with variable size of the task. These features reduces the make span and increase the resources utilization. This scheduling function creates a set of tasks along with WOA algorithm and measures the performance of each task with user satisfaction along with the availability of the Virtual Machine.

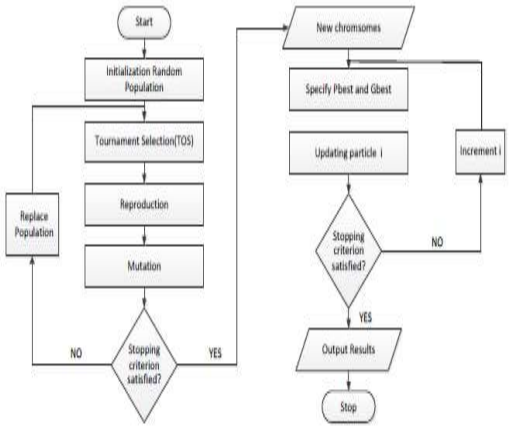


Fig 3 Hybrid genetic Whale optimization algorithm

The experimental results shows the efficiency and it is compared with GA and PSO (Particle swarm optimization).

Step 1: Determination of parameters and Initialization of random population and No.of iterations. The population provides the solution during the first iteration.

Step 2: Apply GA method. During the first step of GA, Tournament selection is used to select random (between 0 and 1)of the chromosomes for cross over operation .The other chromosomes are selected again when they returned to the population. During the second step, Single point crossover operator is applied to the selected chromosomes with 0.9 Probability to generate two off spring. The reproduction point is also selected with respect to the length of the chromosomes. During the third step, Mutation operation takes place to make the changes in the chromosomes .In the HGWOA Algorithm, the probability of the mutation is calculated using the formula (i.e,1/Number Of Tasks) which is used to improve the local search ability and fitness value of the chromosomes. In this process is continued ,when the termination criterion is reached.

Step 3: Process using WOA method.

$$(t+1)=\begin{cases} X*(t)- AD & p < 0.5 \\ \cos(2\pi t)+ X*(t) & p \geq 0.5 \end{cases}$$

Where,

X=No.of tasks
t=Time taken to execute the task
D=delay time

Random sequence p is a numeric value, D=Y*(t)-Y(t) and the distance of i th whale, b is a constant and a represents iteration and A=(CY*(t)-Y(t)) & B=2ar-a, C=2r and r denotes random vector. Y represents whale's population and A represents present search agent.

Algorithm : Pseudo codes of WOA
Set the whales population $Yi(i = 1,2,3,\ldots,n)$
Set a, A, and C
Compute the fitness of each search agent $Y* = the\ best\ search\ agent$
Procedure WOA $(Population, a, A, C, Max\ Iter, ..)$ $t = 1$
while $t \leq Max$ Iter **do**
for each search agent **do**
if $|A| \leq 1$ then
Update the position of the current search agent
else if $|A| \geq 1$ **then**
Take a random search agent Xr and
Bring up to date the position of the current search agent
end if
end for
Bring up to date a, A, and C
Bring up to date $Y*$ if there is a better solution $t = t + 1$
end while
return $Y*$
end procedure

Step 4: In this process is continued ,when the termination criterion is reached.

IV EXPERIMENTAL RESULT AND EVALUATION

Experiment is conducted using HGWOA algorithm with number of tasks and its resource utilization, Make span are calculated , the results are analyzed with GA and PSO algorithm.

Environment setup

Cloud Sim is a tool kit which is used to model the computing environment. It is also easy to simulate and configure with flexible parameters. The parameters used in HGWOA algorithm along with it's values are tabulated in TABLE 1.

TABLE 1 .HGWOA Parameters

Number of VM	10-20
Tasks count	80
RAM (MB)	4096
Bandwidth (mpbs)	1000-1500
MIPS	300-600
No.of Processors	10

TABLE 2 .HGWOA Algorithm Parameters

Max No. of Iteration	100
Crossover operator	Single point
Crossover probability	90%
Mutation operator	Random
Mutation Probability	1/No. of. Tasks
Execution time	10 Sec s

The proposed system has tested and the results are given in table compared with GA and PSO algorithms. There are two types of analysis has been made by reducing make span and increasing resource utilization shown in Table 3 and 4.

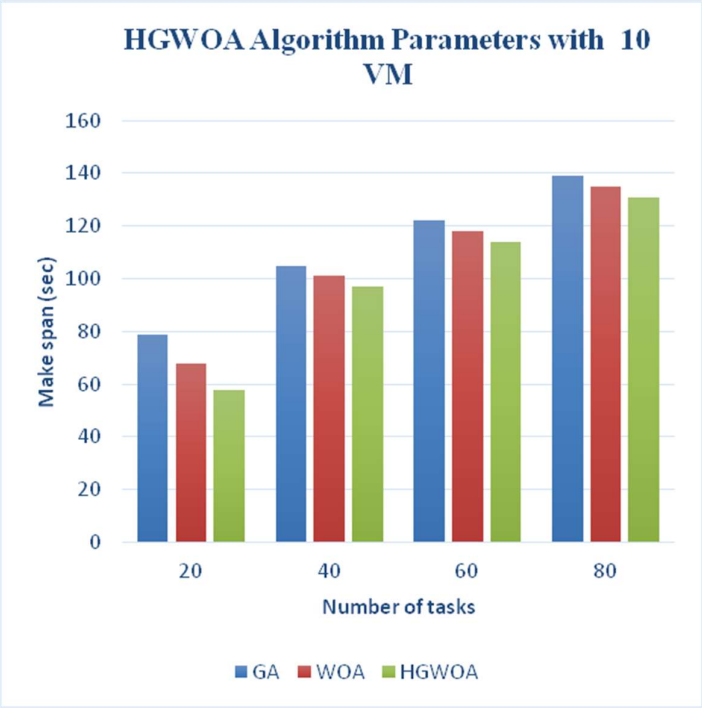
TABLE 3 .HGWOA Algorithm Parameters with 10 VM

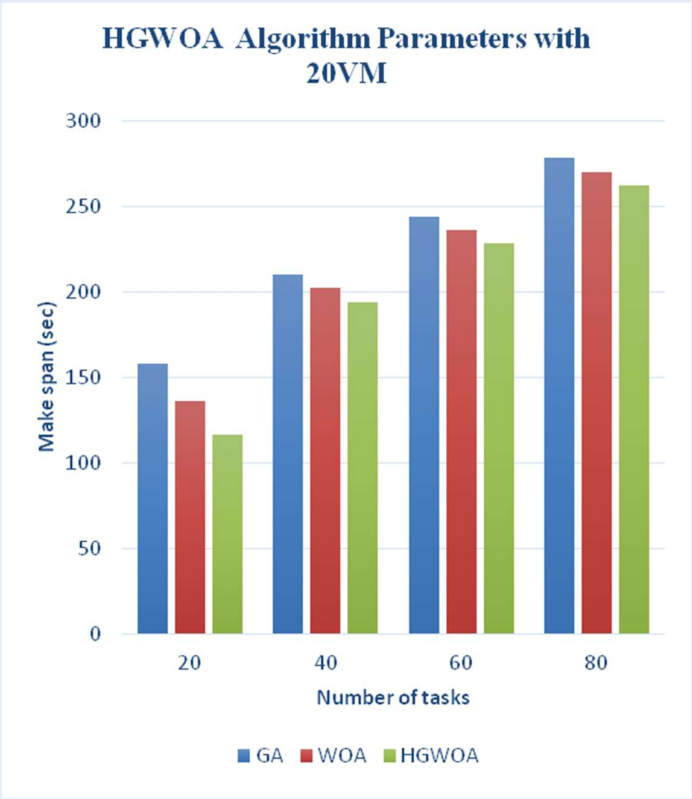
Algorithm	Number of Virtual Machines	No. of tasks	Make span	Resource Utilization
GA			79	0.32
WOA		20	68	0.36
HGWOA			58	0.37
GA		40	105	0.44
WOA			101	0.45

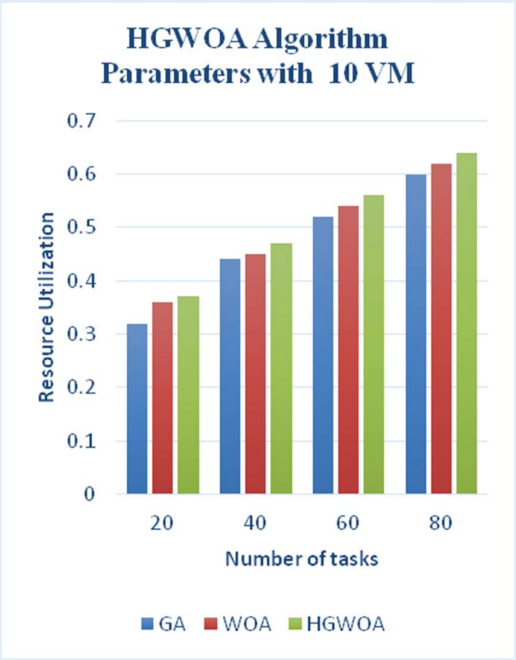
HGWOA	10		97	0.47
GA		60	122	0.52
WOA			118	0.54
HGWOA			114	0.56
GA		80	139	0.60
WOA			135	0.62
HGWOA			131	0.64

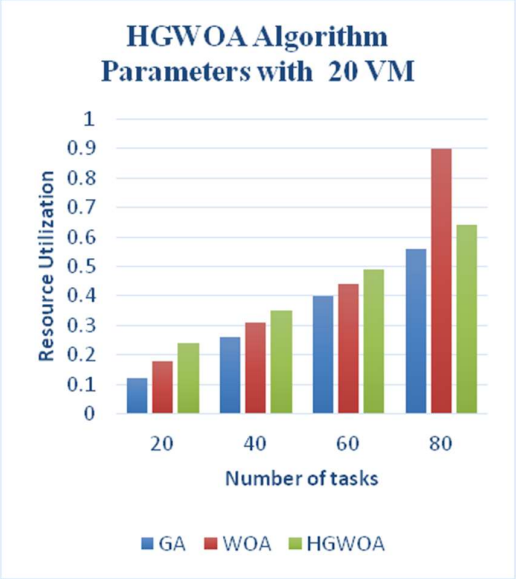
TABLE 4 .HGWOA Algorithm Parameters with 20VM

Algorithm	**Number of Virtual Machines**	**No. of tasks**	**Make span**	**Resource Utilization**
GA	20	20	158	0.12
WOA			136	0.18
HGWOA			116	0.24
GA		40	210	0.26
WOA			202	0.31
HGWOA			194	0.35
GA		60	244	0.40
WOA			236	0.44
HGWOA			228	0.49
GA		80	278	0.56
WOA			270	0.90
HGWOA			262	0.64


HGWOA Algorithm Parameters with 10 VM
160
140
120
100
80
60
40
20
0
Make span (sec)
20
40
60
80
Number of tasks
GA
WOA
HGWOA


HGWOA Algorithm Parameters with 20VM
300
250
200
150
100
50
0
Make span (sec)
20
40
60
80
Number of tasks
GA
WOA
HGWOA





V.CONCLUSION AND FUTURE SCOPE

In this paper, a hybrid Genetic Algorithm along with Whale Optimization Algorithm for task scheduling in cloud computing system with higher number of tasks and VMs are presented to increase the resource allocation by decreasing Make span of the application. The proposed HFWOA makes use of the GA and WOA algorithms in order to maximize the resource allocation and minimize make span. The simulation results of HGWOA algorithms are compared with GA and WOA algorithm and the results are tabulated, comparatively the proposed method gives better result compared with the GA and WOA algorithms. In future, the proposed algorithm will be tested by increasing the number of tasks and number of virtual machines.

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