A Hybrid Genetic and Cuckoo Search Algorithm for Job Scheduling

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Abstract: **Job scheduling is a NP –hard problem in which we have to minimize the makespan time. Scheduling is the algorithm of assigning resources to the jobs in such a way that all jobs get required resource in fairly manner without affecting one another. In this paper we have proposed a hybrid algorithm for job scheduling using genetic and cuckoo search algorithm. This proposed algorithm combines the advantages of both genetic algorithm and cuckoo search algorithm. Genetic algorithm is an evolutionary algorithm that provides optimal solution for optimization problem but the dis advantage of the genetic algorithm is that it can be easily trapped in local optima to overcome this difficulty we are using cuckoo search algorithm.**

Index Terms: **job scheduling, cuckoo search algorithm, genetic algorithm, hybrid algorithm**

I. INTRODUCTION

Job scheduling problem has a combinatorial optimization problem. Job scheduling is the algorithm of assigning tasks to the machines in such a fairly manner that all task should get resource at time and complete their execution without affecting other tasks. The major problem in job scheduling is that many scheduling do not fit into a common description model. Hence for scheduling problems it is too difficult to define a common frame work. In this paper, we have proposed a Hybrid algorithm which combines the advantage of genetic and Cuckoo Search algorithm so as to solve the job scheduling problems. Job Scheduling can be used in scientific computing and high power computing for solving all the combinatorial optimizations problems. Our approach is based on heuristic principles which have the advantage of minimizing the make span. The proposal of a Hybrid algorithm which combines the advantage of genetic algorithm and Cuckoo Search. The performance comparison of the Hybrid algorithm and genetic algorithm is compared by makespan time.

II. RELATED WORK

All the algorithms to complete its execution. Assumptions and constraints are as follows:
Some of the assumptions for job scheduling are as follows:

Maryam Rabiee and Hedieh Sajedi [13] used a cuckoo search algorithm for job scheduling in grid computing. In this paper author compared the result of cuckoo optimization algorithm with genetic algorithm and PSO and result show that cuckoo optimization algorithm can complete tasks in minimum time as compare to other genetic algorithm and PSO. R.G. Babukartik and P. Dhavachelvan [5] proposed a hybrid algorithm for solving job scheduling problem using advantage of both genetic and cuckoo search algorithm. Result show that as the size of the problem increases task creation time and result retrieval time also increases. Jun-qing Li, Quan-ke Pan [16] proposed a hybrid algorithm using Tabu search and PSO for job shop scheduling problem. In the sequencing stage, Author use PSO to discover the best solution, and for the allocation of machine, author use tabu search algorithm to find the optimize solution near the given particle. Result show that this hybrid algorithm perform better than genetic algorithm. P. Mathiyalagan [15] proposed an enhanced hybrid algorithm using PSO and ACO algorithm for job scheduling. Author compared the performance of enhanced hybrid algorithm with hybrid algorithm using PSO and ACO. And it was found that performance of enhanced hybrid algorithm using PSO and ACO algorithm was better than hybrid algorithm using PSO and ACO algorithm. Khaled mesghouni, slim hammadi [17] proposed a genetic algorithm for job shop scheduling. In this paper author used parallel encoding for suitable representation of chromosome. Result show that parallel encoding is suitable for job shop scheduling problem.

III. PROBLEM DEFINITION

Job scheduling is a combinatorial problem. To solve a combinatorial problem we need to design an efficient algorithm. In this paper we have proposed an efficient hybrid algorithm that combines the advantage of both genetic and cuckoo search algorithm .This designed algorithm solve problem of job scheduling very effectively.
We have N number of jobs and M number of machines .Each machine has its own order of execution. Our main objective of proposed hybrid algorithm is to minimize the make span time. Make span time is the total time taken by

1. Job should be a finite set.
2. Machines should be a finite set.
3. Every job must contain a series of operation that

Should be performed by machine.
4. All jobs should be able to handle only one Operation at a time.

Some of the constraints for job scheduling are as follows:
1. No job should visit the same machine the twice.
2. No condition among various operation jobs.
3. Premption type of jobs are not allowed.
4. A single machine is able to handle only a single job At a time.

IV. PROPOSED SYSTEM

Our proposed algorithm combines the advantage of both genetic and cuckoo search algorithm. Disadvantage of genetic algorithm is that it can be easily trapped in local optima. Local optima means it provides different results for Same parameters on different runs. To overcome this difficulty of genetic algorithm we are using cuckoo search algorithm which is very fast and efficient algorithm. This is very fast, efficient and simple because it uses only a single parameter for searching.

Scheduling algorithm for job scheduling are as follows:
1. Initialization of parameters.
2. Enter the number of tasks and resources
3. Plans the tasks using hybrid algorithm(genetic + cuckoo)
4. Initialize current generation
5. While(maximum no of generations)
6. Apply local search using cuckoo search algorithm. Go to step 7
7. Initialize the population of n host birds nest;
8. While (no of domains)
9. Get a cuckoo randomly i and replace its solution by performing Mantegna algorithm;
10. Calculate fitness value Fi.
11. v Choose another nest among all nests randomly say it j;
12. Evaluate its quality value called as Fj.
13. Compare fitness value of both cuckoos.
14. if fitness value of cuckoo i is greater than fitness value of cuckoo j.
15. Replace cuckoo j by the new solution;
16. Some proportion of nest having low fitness value will be abandoned and some new nest will be.
17. Keep the fittest solution.
18. Forward the current best solution to the future generation.
19. End while. (end of cuckoo search)
20. Go to step 6
21. Apply selection operator for selecting fittest solution every time.
22. Apply crossover operator to produce new child
23. Apply mutation operator is used to maintain genetic diversity.
24. End while (end of Genetic algorithm)
25. Calculate completion time of tasks
26. All task allocated if yes go to stage 6 else go to step 3
27. Stop (end of scheduling algorithm)

Description of Algorithms:

a) Hybrid algorithm-

This proposed hybrid algorithm combines advantage of both genetic and cuckoo search algorithm. Hybrid algorithm starts with number of jobs and number of machines. Scheduling is done with the help of hybrid algorithm.

b) Genetic algorithm-

Genetic algorithm is a metaheuristic algorithm which is used for optimization. Genetic algorithm starts with number of solutions .Firstly genetic algorithm uses selection operator to select fittest individual from a set of population. Genetic algorithm selects a number of individuals until a desired condition met. After applying selection operator genetic algorithm uses crossover operator to produce anew offspring. After applying crossover operator genetic algorithm apply mutation operator. Mutation operator is used to maintain genetic diversity. Genetic algorithm provides better result as compare to existing algorithms but problem with genetic algorithm is that it can be easily trapped in local optima.

c) Cuckoo search algorithm-

Cuckoo search algorithm is simple, fast and efficient algorithm. Cuckoo search algorithm uses only a single parameter for search. We are using cuckoo search algorithm to remove difficulty of genetic algorithm. Cuckoo search algorithm provides global result and it does not trapped in local optima.

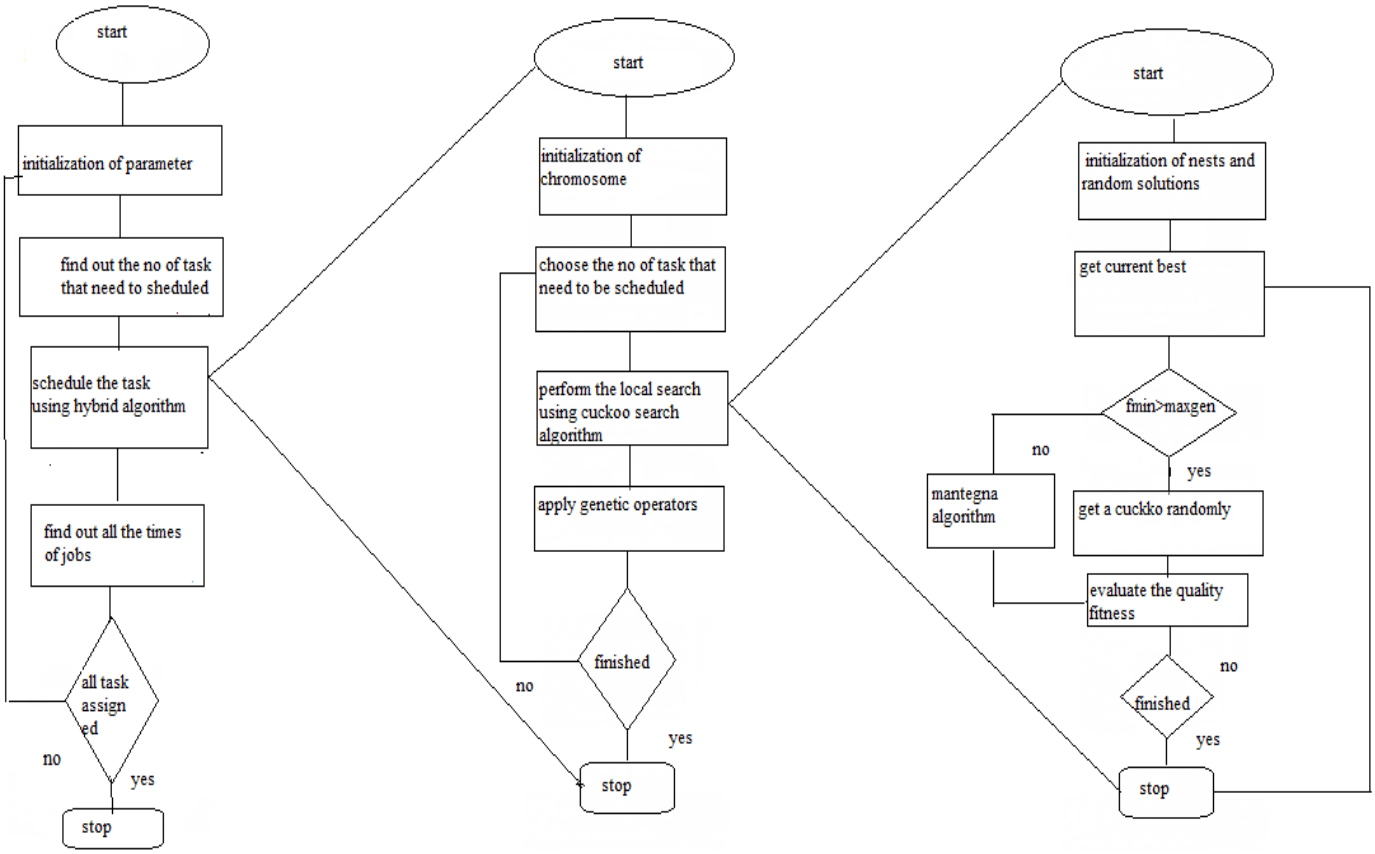

Fig (1): Flow chart of proposed system

IV. EXPERIMENT AND RESULT

We have taken different number of jobs and machines where number of jobs is greater than number of machines. Result analysis show that performance of proposed algorithm is better than genetic algorithm.
Following table shows the performance of hybrid algorithm

No of machines	No of jobs	Time taken by genetic algorithm	Time taken by hybrid algorithm
3	6	5.3191	0.3954
6	16	1.4609	0.5137
5	17	1.7534	0.5586

Input parameters for above table are taken as:
Number of machines= [3, 6, 5]
Number of jobs = [6, 16, 17]
Maximum no of generations=5
No of domains = 15

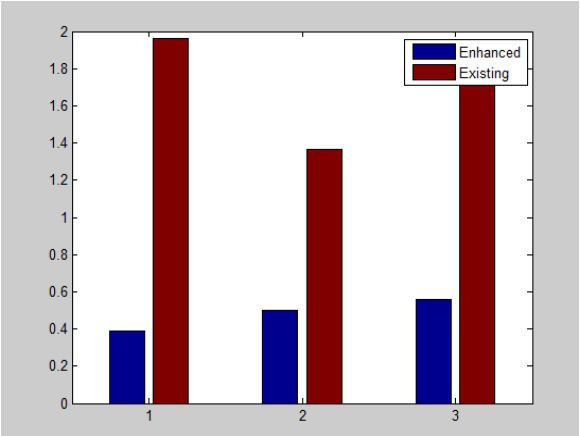

Fig (2).performance of proposed and genetic algorithm

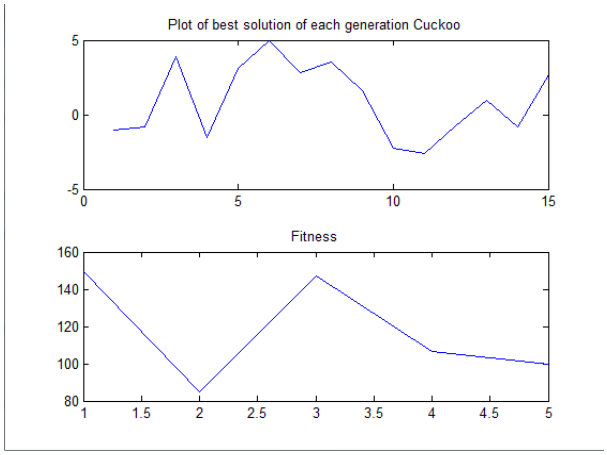

Fig (3): best solution for each generation of cuckoo search

V. CONCLUSION

In this paper we have developed a hybrid algorithm that combines the advantage of both algorithm genetic and cuckoo search algorithm. Disadvantage of genetic algorithm is that it can be easily trapped in local optima to remove this difficulty we are using cuckoo search algorithm along with genetic algorithm. Performance of hybrid algorithm should be better than genetic algorithm. In future we are planning to add more parameters to proposed algorithm to make more robust and flexible.

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