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A Periodical Study to Unveil Solving Job Shop Scheduling Problem from its Root Cause

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Abstract: Job Shop Scheduling Problem (JSSP) is an optimization problem in computer science and operations research in which ideal jobs assign to resources at particular times.
The fundamental objective of JSSP is to reduce makespan time; makespan in manufacturing is the time difference between the start and finish of a sequence of jobs or tasks. From the past decades various research analysis carried out in JSSP platform, still there is a gap in solving the minimize makespan time this contemplate the vision of literature review. The significant intention of this literature survey is to identify the real problem in achieving minimize makespan time.
This literature survey incorporates various benchmark problem investigated by different techniques. It is quite evident that the influence of optimization techniques plays a vital role in solving Job Shop Scheduling Problem (JSSP). Eventually, this precise investigation windup with solution providing in achieving minimize makespan time.
Keywords: Job Shop Scheduling Problem (JSSP), Manufacturing Industry, Optimization Techniques

I. INTRODUCTION

Manufacturing industry is facing various challenges: guaranteeing beneficial development, enhancing productivity and reducing costs while reacting rapidly to client requests [1].
After a challenge, the original schedule may wind up invalid because of the new conditions. At times, it is conceivable to effectively change the solution to absorb the challenges, however, in many cases, rescheduling is mandatory in order to minimize the impacts of this interruption and recover the original solution as soon as possible [2].
The Scheduling issue has a vital impact, generally, because of the rocking consumer demand for assortment, downsized item life cycles, regularly shifting markets with worldwide competition and quick development of the refined innovations [3]. Scheduling is the allocation of resources by applying the limiting factors of time and cost to execute a collection of tasks. Scheduling can be classified into single machine scheduling, Flow Shop scheduling and Job shop scheduling [4].
The job shop-scheduling problem (JSSP) has developed as a hugely precarious combinatorial optimization issue right from the 1950s [5]. Job shop, here alluded as job shop, is a production system that procedure n number of tasks on m number of machines. In this sort of framework, products are made to arrange and the volume can change from small to large quantities [6]. Job-shop scheduling, generally, constitutes a vibrant NP-complete challenge.
Various specialists have visualized a few JSP models as per the issue propositions [7]. The makespan represents the maximum completion duration of the jobs and the intention of the JSP is to find a schedule, which fundamentally minimizes the makespan, and a good schedule, thusly, requires the powerful minimization of the dormant time spent by the machines [8].
The major intention is to schedule the jobs between machines effectively.
To build a proficient solution, it is not permitted to process a similar job on various machines and each job must be handled on each machine precisely once. In recent years many algorithms have been proposed for solving this problem, namely neutral network algorithm (NNA), Genetic Algorithm, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, and so forth [9].
The execution examination of the optimization techniques are established on the computational insight standards for settling the job shop-scheduling issue to accomplish the optimized execution time, to reduce the makespan of the job sequence, accordingly enhancing the viability of the scheduling methodology [10].

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II. LITERATURE REVIEW

Sl.No	Author Name	Title	Objective	Technique	Result
1. [11]	I. Sabuncuoglu and M. Bayiz (1999)	Job shop scheduling with beam search	To develop a beam search based scheduling algorithm for the job shop problem.	Beam Search	When contrasted with different algorithms, the speed and the performance of a beam search based algorithm are manipulated by changing search parameters and assessment functions.
2. [12]	S. Binato et al. (2002)	A GRASP For Job Shop Scheduling	The objective of the JSP is to find a schedule that minimizes the maximum completion time, or makespan, of the jobs.	Greedy Randomized Adaptive Search Procedure (GRASP)	A new algorithm for finding estimated solutions to the job shop scheduling problem. The algorithm was assessed on 66 standard test problems and was appeared to create optimal or near-optimal solutions on all occasions.
3. [13]	Byung Joo Park et al. (2003)	A hybrid genetic algorithm for the job shop scheduling problems	To develop an efficient scheduling method based on genetic algorithm to address JSSP.	Parallel Genetic Algorithm (PGA)	A proficient GA-based scheduling technique was developed to address JSSP in that research. The superior performance of the proposed GA was gotten by the successful incorporation of the chromosome representation, the generating technique of initial population, genetic operators and selection technique, which are intended to enhanced transmit the temporal relationships in the chromosome.
4. [14]	Jose Fernando Goncalves et al. (2005)	A hybrid genetic algorithm for the job shop scheduling problem	To solve job shop scheduling problem using a hybrid genetic algorithm	Hybrid Genetic Algorithm (HGA)	The computational outcomes demonstrate that the algorithm created optimal or near-optimal solutions on all instances tested. In general, the algorithm produced solutions with an average relative deviation of 0.39% to the best-known solution.
5. [15]	D.Y. Sha and Cheng-Yu Hsu (2006)	A hybrid particle swarm optimization for job shop scheduling problem	To modified the particle position representation, particle movement, and particle velocity to improved suit PSO for the JSP.	Hybrid Particle Swarm Optimization (HPSO)	They introduced a Hybrid Particle Swarm Optimization (HPSO) for job shop scheduling problems in that paper. They altered the representation of particle position, particle movement, and particle velocity to superior suit it for JSP. The computational outcomes demonstrate that HPSO can get preferred solutions than other techniques.
6. [16]	Jin-hui Yang et al. (2008)	Clonal Selection Based Memetic Algorithm for Job Shop Scheduling Problems	A clonal selection based memetic algorithm is proposed for solving job shop scheduling problems. The clonal selection and the local search mechanism are intended to improve exploration and exploitation.	Memetic Algorithm (MA)	In the proposed algorithm, a total scheme of clonal memetic algorithm for JSSP was planned and a simulated annealing local search algorithm was joined with the point of searching for local optimum of each individual. Numerical analyses demonstrate the efficiency of the proposed algorithm.
7. [17]	Hong-Wei Ge et al. (2008)	An Effective PSO and AIS-Based Hybrid Intelligent Algorithm for Job-Shop Scheduling	A promising HIA that joins the enhanced PSO and AIS is proposed to solve job-shop problems with minimization of the makespan.	Hybrid Intelligent Algorithm (HIA)	The proposed hybrid algorithm viably abuses the capacities of dispersed and parallel computing of swarm intelligence approaches. Computational outcomes are contrasted and those gotten utilizing other existing methodologies, and the proposed approach yields important enhancement in solution quality.
8. [18]	S. M. Kamrul Hasan et al. (2009)	Memetic algorithms for solving job-shop scheduling problems	To develop a gap reduction and restricted swapping (MA(GR-RS)) for solving JSSPs.	Memetic Algorithm Gap Reduction and Restricted Swapping (MA(GR-RS))	Memetic algorithm MA(GR-RS) obviously outperforms all the algorithms considered in that paper. Even though their algorithm is performing great, they feel that the algorithm requires more work to guarantee consistent performance for a wide range of practical JSSPs.
9. [19]	Gary G. Yen and Brian Ivers (2009)	Job shop scheduling optimization through multiple independent particle swarms	To develop an effective and efficient approach to exploit meta-heuristic in particle swarm optimization (PSO) for the job shop scheduling problem (JSP), a	Particle Swarm Optimization (PSO)	Through the division of the search space by the machines, the proposed algorithm demonstrated significant guarantee when searching the space of non-delay schedules. One point deserving of specifying was the

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			class of NP-hard optimization problems.		generally low number of capacity assessments expected to discover optimal schedules with the utilization of the proposed design.
10. [20]	Cesar Rego and Renato Duarte (2009)	A filter-and-fan approach to the job shop scheduling problem	General study has been devoted to developing proficient algorithms to find optimal or near-optimal solutions.	Filter-and-Fan (F&F)	Computational testing on a standard set of benchmark issues exhibits that a straightforward implementation of the filter-and-fan technique embedded in the proposed algorithm produced exceptionally great outcomes both for solution quality and computation time.
11. [21]	Liang Gao et al. (2011)	An efficient memetic algorithm for solving the job shop scheduling problem	An efficient MA with a novel local search is proposed to solve the JSP.	Memetic algorithm (MA)	The computational outcomes acquired in tests show the effectiveness of the proposed memetic algorithm, which was altogether better than the other detailed techniques.
12. [22]	Ren Qing-dao-er-ji and Yuping Wang (2012)	A new hybrid genetic algorithm for job shop scheduling problem	To solve the job shop scheduling problem more efficiently.	Hybrid Genetic Algorithm (HGA1)	To solve the JSSP more successfully, a mixed selection operator based on the fitness value and the concentration was intended in order to increase the diversity of the population. The experimental outcomes demonstrate that the proposed algorithm was powerful and performs superior than the compared algorithms.
13. [23]	Adil Baykasoglu et al. (2014)	Testing the performance of teaching–learning based optimization (TLBO) algorithm on combinatorial problems: Flow shop and job shop scheduling cases	To investigate the performance of TLBO algorithm on combinatorial optimization problems first time in the literature.	Teaching–Learning Based Optimization (TLBO) algorithm	In this way, it was viewed as that the execution of TLBO algorithm on these issues can give a thought regarding its conceivable execution for solving other combinatorial optimization problems. An extensive experimental work was carried out in that research in order to demonstrate that TLBO algorithm in its exceptionally essential frame has some potential when contrasted with a portion of the best heuristic algorithms developed for these scheduling problems.
14. [24]	Habibeh Nazif (2015)	Solving Job Shop Scheduling Problem Using An Ant Colony Algorithm	To solve the JSSP more efficiently, an ant colony algorithm is developed with the makespan criterion.	Ant Colony Algorithm (ACA)	The performance quality of a solution constructed by an artificial ant was enhanced by a job-index-based local search method fused with a threshold probability for choosing a job to insert into the other positions of the sequence. The experimental outcomes demonstrate that the proposed algorithm was competitive when contrasted with the best known solutions in the literature.
15. [25]	Hamed Piroozfard et al. (2017)	An improved biogeography-based optimization for achieving optimal job shop scheduling solutions	To develop an enhanced biogeography-based optimization approach, in order to minimize makespan in the job shop scheduling problems.	Improved Biogeography-Based Optimization	The proposed approach could discover 72.73% of the optimal schedules for the problem instances, and in the remaining instances, it accomplished better schedules generally in comparison to those of the other algorithms.

III.ROBLEM DESCRIPTION

The significant obstacle faced in scheduling problem is the job shop, in which multiple jobs are process on several machines. Each job consists of a sequence of tasks, which must execute in a given order, and each task must be process on a definite machine. For instance, the job could be the manufacture of a single consumer item, such as an automobile. The problem is to schedule the tasks on the machines to minimize the length of the schedule the time it takes from when the jobs first started until all the jobs are completed.

There are several constraints for the job shop problem:

1) No task for a job can be start until the previous task for that job is completed.
2) A machine can only work on one task at a time.
3) A task, once started, must run to completion.

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IV. CONCLUSION

From the aforementioned analysis, it is quite evident that there is a gap in achieving optimal makespan time from previous implemented techniques. These gap should be sort out by overcome the obstacles challenged in previous aforementioned techniques. This literature review contemplates and paves the way to solve JSSP in optimal manner. This investigation reveals the performance of individual techniques in JSSP platform for various benchmark problems. These literatures survey set a clear vision to lay the foundation of research work choose/build the technique to solve JSSP. This survey aid the upcoming researcher in this platform to aware about fundamental information in solving JSSP.

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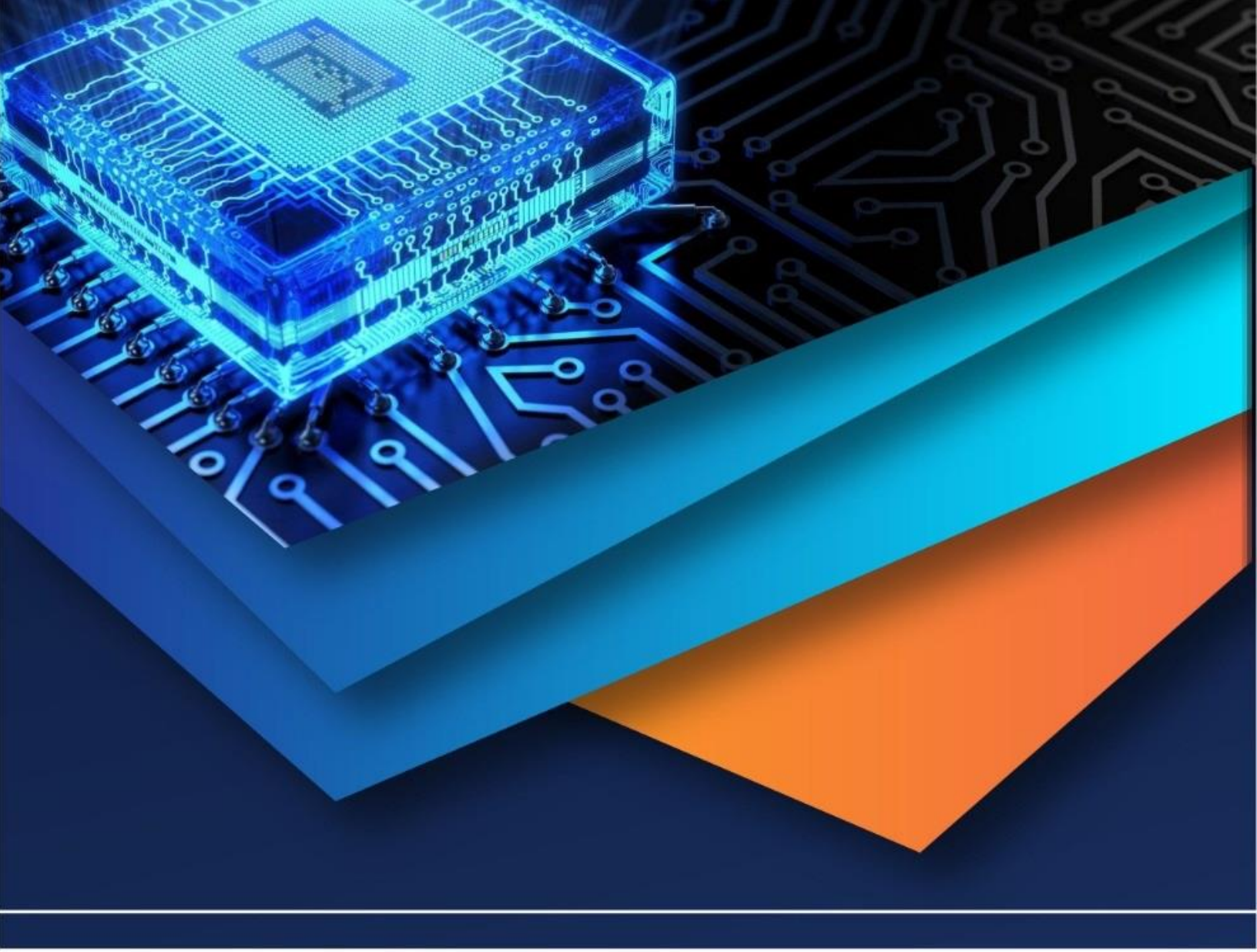

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