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A Review Study on the CPU Scheduling Algorithms

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Abstract: In operating system, Scheduling plays a vital role in their designing. Different authors proposed various Scheduling algorithms and performance of their algorithms. In this paper, studying the review of those different scheduling algorithms are performed with different parameters, such as turnaround time, burst time, response time, waiting time, throughput, fairness and CPU utilization. In this paper, different reviews are collected and integrated various researches done in the field of CPU scheduling and its performance, so that this effort can be helpful for new researches to find out the future aspects in this field.

Keywords: Scheduling, Scheduler, Response time, Time quantum, burst time, context switch, AWT, ATAT, FCFS, SJF, STCF, Priority, RR, MLQ, MLFQ , GBTQ, EPSADTQ, PSMTQ, DWRR, Markov chain model, VHRRN, FUZZ, deadlock-waiting index, simulation, SL, GLS, State Probability, lottery scheduling, PPS-LS, SRS-LS, SJRR, mean-deviation, LRRTIME QUANTUM, integer programming, SRBRR, SARR, Deterministic, ARR, STS, TPBCS, CPU-intensive, I/O-intensive, Balanced factor, PSMTIME QUANTUM, AMRR, RRHRRN, ERR, NMLFQ, PSSDTQ, non-linear programming, integer programming, MDTQRR, NMLFQ, EDRR, SRBRR, ISRBRR, EDRR.

I. INTRODUCTION

Operating System (OS) is system software which acts as an interface between a user and the computer hardware. OS is also known as resource manager because its prime responsibility is to manage the resources of the computer system. Scheduling is a fundamental and most important OS Function which is essential to an operating system's design. Scheduling refers to set of rules, policies and mechanism that govern the order in which resource is allocated to the various processes and the work is to be done. The scheduling is a methodology of managing multiple queues of processes in order to minimize delay and to optimize performance of the system. A scheduler is an OS module that implements the scheduling policies. Its primary objective is to optimize the system performance according to the criteria set by the system designers. It selects from among the processes in memory that are ready to execute, and allocates the CPU to one of them.
Multiprogramming, Multiuser, Multitasking, Multi-processing, and Multithreading are some attractive features for OS designer to improve the performance. In a single-processor system, only one process can run at a time; any others must wait until the CPU is free and can be rescheduled. In the multiprocessing, is to have some process running at all times, to maximize CPU utilization. Almost all computer resources are scheduled before use. In multiuser and multi-programming environment also has multiple users queuing processes simultaneously to provide best performance to all users. So Controlling and managing CPU for all process requests.

Different scheduling algorithms have different properties, and the choice of a particular algorithm may favor one class of processes over another. Consider the properties of the various algorithms to choosing in a particular situation. Many criteria have been suggested for comparing scheduling algorithms judging to be best. CPU Scheduling deals with the problem of deciding which of the processes in the ready queue is to be allocated the CPU. It is the act of selecting the next process for the CPU to "service" once the current process leaves the CPU idle that decisions may take place among the processes. Many algorithms for making this selection from these seven classical kind of scheduling algorithms like First Come-First Served (FCFS), Shortest Job First (SJF), Shortest Time-to-Completion First (STCF), Round-Robin (RR), Priority, Multilevel Queue (MLQ), Multilevel Feedback-Queue(MLFQ).

II. LITRATURE REVIEW

The operating system plays a major role in managing processes arriving in the form of multiple queues. The arrival of a process is random along with their different categories and types. All these require scheduling algorithms to work over real time environment with special reference to task, control and efficiency. Many Researchers have introduced various CPU scheduling algorithms from time to time. Some researches that appropriate with our work are:

Jain et al. (2015) presented a Linear Data Model Based Study of Improved Round Robin CPU Scheduling algorithm with features of Shortest Job First scheduling with varying time quantum.

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Lulla et al. (2015) developed a new approach for round robin CPU scheduling algorithm which improves the performance of CPU using 'Dynamic Time Quantum'.

Banerjee et al. (2015): proposed a new algorithm called Optimized Performance Round Robin (OPRR) in which we focused on dynamic time quantum which give result as a very less context switching as well as average waiting time and average turnaround time and also reduces the overhead of the CPU by adjusting the time quantum according to the highest burst time of the processes in the ready queue.

Rao et al. (2015) proposed a new algorithm which is a logical extension of the popular Round Robin CPU scheduling algorithm suggests that a priority be assigned to each process based on balanced precedence factor using mean average as a time quantum conducting experiments to measure the effectiveness of this novel method that showed EPSADTQ is superior to RR and PSMTQ and its variants.

Padhy and Nayak (2014) presented a new CPU scheduling algorithm Revamped Round Robin(RRR) Scheduling Algorithm which made more efficient and perform better in comparison with the traditional RR scheduling algorithm in terms of reducing the number of context switches, average waiting time and average turnaround time.

Chavan and Tikekar (2013) derived a new CPU scheduling algorithm called an Optimum Multilevel Dynamic Round Robin Scheduling Algorithm, which calculates intelligent time slice and changes after every round of execution.

Abdulrahim et al. (2014) proposed algorithm compared with the other algorithms, produces minimal average waiting time (AWT), average turnaround time (ATAT), and number of context switches that adopt RR CPU scheduling.

Sukhija et al. (2014) proposed a new-fangled CPU scheduling algorithm called MIN-MAX which behaves as both preemptive and non-preemptive algorithm basis on the burst time to improve the CPU efficiency in multiprogramming OS and also trims down the starvation problem among processes and focused on the comparative study of the existing algorithms on basis of various scheduling parameters.

Panda et al. (2013) considered different time quantum for a group of processes and reduced context switches as well as enhancing the performance of RR algorithm, calculated time quantum using min-max dispersion measure and showed experimental analysis that Group Based Time Quantum (GBTQ) RR algorithm performance better than existing RR algorithm.

Suranauwarat (2007) used simulator in operating system to learn CPU scheduling algorithms in an easier and a more effective way.

Sindhu et al. (2010) proposed an algorithm which can handle all types of process with optimum scheduling criteria.

Li et al. (2009) analyzed existing fair scheduling algorithms are either inaccurate or inefficient and non-scalable for multiprocessors. This problem is becoming increasingly severe as the hardware industry continues to produce larger scale multi-core processors. This paper presents Distributed Weighted Round-Robin (DWRR), a new scheduling algorithm that solves this problem.

Hieh and Lam (2003) discussed smart schedulers for multimedia users.

Saleem and Javed (2000) developed a comprehensive tool which runs a simulation in real time, and generates data to be used for evaluation which is useful for the design and development of modern operating systems, for measuring the performance of different scheduling algorithms and for the understanding and training of students.

Shukla et al. (2009) incorporated only three processors along with three queues and the procedure of thread scheduling is examined in light of Markov chain model with simulation study to support the findings.

Raheja et al. (2013) proposed a new scheduling algorithm called Vague Oriented Highest Response Ratio Next (VHRRN) scheduling algorithm which computes the dynamic priority using vague logic in Fuzzy Systems (FUZZ).

Shukla and Jain (2007 a) have a discussion on the use of Markov chain model for multilevel queue scheduler in an operating system.

Shukla and Jain (2007 b) proposed a data model based Markov chain model to study the transition phenomenon, designed a scheduling scheme and compared through deadlock-waiting index measure with simulation study.

Shukla et al. (2010 a) proposed a Markov chain model for a general setup of Multi level queue scheduling and evaluate Performance.

Shukla et al. (2010 b) took Data model approach and Markov Chain based analysis of multilevel queue scheduling and assumed the scheduler to perform random movement on queue over the quantum of time.

Shukla et al. (2010 c) presented a new CPU scheduling scheme in the form of SL Scheduling which is found useful and effective to estimate the total processing time of all the processes present in ready queue waiting for their processing using a numerical study.

Shukla et al. (2010 d) designed a new scheduling scheme Group Lottery Scheduling (GLS) in multi-processor environment to predict ready queue processing time using two variants involved Type-I and Type-II allocation of jobs whose variabilities are compared.

Shukla et al. (2010 e) proposed a Data Model Approach in State Probability Analysis of Multi-Level Queue Scheduling and evaluated performance effectiveness.

Shukla et al. (2011) used probability models to get estimates of system parameters in multiprocessors environment to overcome the queue length using lottery scheduling.

Shukla and Ojha (2010) proposed a data model based Markov chain model to study the transition phenomenon and a general class of scheduling scheme is designed through a proposed deadlock index measure to evaluate by simulation study.

Shukla et al. (2009) used a model based study to compare

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several scheduling schemes of the class and defined an index measure in the mixture of FIFO and round robin algorithms.

Sisodia, and Garg(2011) are used a Markov chain model to compare several scheduling schemes which is a mixture of FIFO and round robin in terms of model based study approach using system simulation procedure.

Shukla and Jain (2012) presented an efficient method to predict about total time needed to process the entire ready queue if only few are processed in a specified time. Confidence internals are calculated based on PPS-LS and compared with SRS-LS. The PPS-LS found better over SRS-LS.

Babu et al. (2012 a) focused on design and development of new and novel scheduling algorithm for multi-programming operating system in the view of optimization. They developed a tool which gives output in the form of experimental results with respect to some standard and new scheduling algorithms.

Patel and Patel (2013) introduced a new CPU algorithm called SJRR CPU Scheduling Algorithm which acts as preemptive based on the arrival time which improved the average waiting time of Round Robin algorithm in real time uni-processor-multi programming operating system.

Siregar (2012) concerned with improving Round Robin performance to combine with Genetic algorithm that will be iterated for achieving best quantum that will produce minimal average waiting time.

Noon et al. (2011) proposed a new algorithm namely AN, a dynamic quantum with burst time of a set of processes in ready queue which improved performance of RR algorithm.

Trivedi and Sajja (2011) proposed a RR algorithm with Neuro Fuzzy can optimize a multitasking environment by increasing throughput and decreasing waiting time of a process.

Behera et al. (2012 a) proposed a new RR algorithm using a modified mean-deviation. This is addressed to real time system which can reduce context switch, average waiting time and average turnaround time.

Neshat et al. (2012) used Fonseca and Fleming’s Genetic Algorithm (FFGA) multiobjective optimization to yield an adaptive CPU scheduling that is compared to seven classical scheduling algorithms which are more optimized than other methods.

Raheja et al. (2012) proposed a new RR algorithm using Linguistic Synthesis to attain an optimum time quantum which includes Mamdani Fuzzy Inference System and produces LRRTIME QUANTUM Fuzzy Inference System that improved the performance of the system by cutting off an unimportant context switches and an unreasonable turnaround time.

Nayak et al. (2012) proposed a new variant of RR scheduling algorithm known as Improved Round Robin (IRR) Scheduling algorithm, using Dynamic Time Quantum that reduces context switching, average waiting time and average turnaround time.

Panda and Bhoi (2012) proposed an effective RR algorithm using Min-Max dispersion measure of remaining CPU burst time. This algorithm performs better than RR algorithm in terms of average turnaround time, average waiting time and number of context switches.

Dhakad et al. (2011) proposed a new algorithm in scheduling which priority-driven according to burst time. Results show that this algorithm can solve problem of fixed quantum and it support a development of self-adaptive system.

Mostafa et al. (2010) proposed for finding better quantum of round robin CPU scheduling algorithm in general computing systems using integer programming.

Yadav et al. (2011) proposed a new algorithm which is a combination of RR and SJF (Shortest Job First) algorithm. From experiments, results show that this combination is better than pure RR.

Helmy and Dekdouk (2007) introduced Burst Round Robin, a proportional-share scheduling algorithm as an attempt to combine the low scheduling overhead of round robin algorithms and favor shortest jobs.

Mohanty et al. (2009) proposed Shortest Remaining Burst Round Robin (SRBRR) Scheduling Algorithm by assigning the processor to processes with shortest remaining burst in round robin manner using the dynamic time quantum.

Yaashuwanth and Ramesh (2009) developed a new scheduling algorithm using Intelligent Time Slice for Round Robin scheduling tasks in real time operating systems.

Matarneh (2009) proposed Self-Adjustment Time Quantum in round robin is the new proposed algorithm called Self-Adjustment-Round-Robin (SARR) based on a new approach called dynamic-time-quantum.

Saxena and Agarwal (2012) extended the concept of Round Robin algorithm (RR) to incorporate user or system defined priority and different arrival times of process and suggested a novel approach that minimizes context switching overhead, average waiting time and turnaround time.

Maste et al. (2013) proposed a new variant of MLFQ algorithm, in which time slice is assigned to each queue such that it changes with each round of execution dynamically and used neural network to adjust this time slice to optimize turnaround time i.e used dynamic time quantum and neural network and static time slice for each queue over MLFQ.

Oyetunji and Oluleye, (2009) discussed three basic CPU scheduling algorithms and evaluated on four CPU scheduling objectives or goals (average waiting time, average turnaround time, average CPU utilization and average throughput) to determine which algorithm is most suitable for which objective with experimental results.

Kamalapur, S. and Deshpande, N. (2006) presented and evaluated a method for process scheduling and discussed the use of genetic algorithms to provide efficient process scheduling to evaluate the performance and efficiency of the proposed algorithm in comparison with other deterministic algorithms by simulation.

Dhakad and Sharma (2012) suggested the new algorithm called “Adaptive Round Robin (ARR) Scheduling a Novel

Approach Based on Shortest Burst Time Using Smart Time Slice(STS)" which is a Priority Driven Scheduling Algorithm to increase the performance and stability of the time sharing systems and support building of a self-adaptation operating system.

Behera et al. (2011) suggested two processor based CPU scheduling (TPBCS) algorithm, where one processor is exclusively for CPU-intensive processes and the other process is exclusively for I/O-intensive processes that dispatched the processes to appropriate processor according to their percentage of CPU or I/O requirement to perform better result experimental analysis.

Kundargi and Bandekar (2013) improvised the Round-Robin algorithm and there by proposed a new NK algorithm which computes the time quantum, by selecting the burst time depending on the set of available processes dynamically.

Varma (2012) proposed a novel scheduling algorithm is used which uses mean average as a time quantum and used the Balanced factor of precedence rather than factor of precedence to find the order of execution of processes to prove PSMTIME QUANTUM is better than RR with experimental analysis that reduced the number of context switches, average waiting time and average turnaround time.

Yadav and Upadhayay (2012) suggested a novel approach which will improve the performance of MLFQ (Multilevel feedback queue) CPU scheduling algorithm.

Mishra and Khan (2012) designed and tested the Improved Round Robin (IRR) with describing a simulator program that reduced the waiting time and turnaround time drastically.

Rajput and Gupta (2012) developed a new approach for round robin CPU scheduling algorithm which improves the performance of CPU in real time operating system and proposed Priority based Round-Robin CPU Scheduling algorithm integrating of round-robin and priority scheduling algorithm in which reducing starvation in RR and implementing the concept of aging by assigning new priorities to the processes and presented the comparative analysis of proposed algorithm with existing RR scheduling algorithm.

Goel and Garg (2012) presented a state diagram that depicted the comparative study of various scheduling algorithms for a single CPU and shown which algorithm is best for the particular situation that is easier to understand what is going on inside the system and why a different set of processes for the allocation of the CPU at different time.

Dawood(2012) proposed the new approach to calculate the TQ, known as Ascending Quantum and Minimum-Maximum Round Robin (AQMMRR) which performs better than RR with experimental result.

Hasan (2014) suggested visual interfaces for CPU scheduling algorithms were designed by using Visual Basic6 language and used to learn users about this algorithms and how they worked.

Raheja et al. (2014 a) proposed a 2-layered architecture of multilevel queue scheduler based on vague set theory (VMLQ) that scheduler handles the impreciseness of data as well as improving the starvation problem of lower priority tasks which optimizes the performance metrics and improves the response time of system through simulation using MATLAB.

Raheja et al.(2014 b) proposed a new 2-stage vague logic based scheduler that handled the uncertainty of tasks in vague inference system (VIS) and used a vague oriented priority scheduling (VOPS) algorithm for selection of next process to optimize the performance matrices with simulation using MATLAB.

Hiranwal et al. (2011) improved the performance of RRT and proposed the new algorithm called "Adaptive Round Robin Scheduling using Shortest Burst Approach Based on Smart Time Slice" which is a Priority Driven Scheduling algorithm based on burst time of processes to increase the performance and stability of the operating system with Empirical results.

Behera et al. (2012 b) an improved fuzzy technique has been proposed to overcome the drawbacks of other scheduling algorithms for better CPU utilization, throughput and to minimize waiting time and turnaround time.

Suranauwarat (2012) developed an interactive Java-based simulator that uses graphical animation to convey the concepts of various CPU scheduling algorithms and discussed the development history, features, and future plans.

Back et al. (2007) proposed a hierarchical deficit round-robin scheduling algorithm for a high level of fair service which improves performance.

Banerjee et al. (2012) presented a new algorithm Average Max Round Robin (AMRR) scheduling algorithm to adjust the time Quantum dynamically for better performance than simple Round Robin scheduling algorithm.

Hiranwal and Roy (2011) presented a new algorithm which is discussed in detail, tested and verified called "Adaptive Round Robin Scheduling using Shortest Burst Approach Based on Smart Time Slice" depends on execution time/burst time and the smart time slice (STS) based on the experiments and calculations radically solves the fixed time quantum problem and increased the performance and stability of the operating system.

Behera et al. (2012 c) proposed a new Round Robin with Highest Response Ratio Next (RRHRRN) scheduling algorithm which uses Highest Response Ratio (HRR) criteria for selecting processes from Ready Queue with experimental result performs better in terms of reducing the number of context switches, average waiting time and average turnaround time.

Zhu et al. (2008) presented three new scheduling algorithms for FIFO input queue (IQ) switches of network on chip, which are called RR-path on round-robin scheduling algorithm.

Thakor and Shah (2011) proposed an efficient Scheduling Algorithm called D_EDF to overcome the limitations of dynamic algorithm during overloaded conditions and simulated and tested for independent, preemptive, periodic tasks on tightly coupled real-time multiprocessor system under global scheduling and measured the performance in terms of Success Ratio and Effective CPU Utilization from experiments and result analysis.

Bibi et al. (2010) proposed a new scheduling algorithm Combinatory scheduling algorithm that combines the function of some basic scheduling algorithm that evaluated scheduling objectives and its better performance.

Foster (2010) discussed the symbiosis between central processor scheduling and memory management and four processor scheduling algorithms along with Rate Monotonic Scheduling and its applicability to both single processor and multitasking implementations.

Barman (2013) introduced a new scheduling algorithm to adjust time quantum dynamically depending upon arrival time and burst time of the processes based on the experiments and calculations.

Babu et al. (2012 b) introduced a new CPU algorithm called a Novel CPU Scheduling Algorithm which acts as both preemptive and non-preemptive based on the arrival time which helps to improve the CPU efficiency in real time uni-processor-multi programming operating system and the results of the existing algorithms are compared with the proposed algorithm.

Sharma et al. (2012) proposed a new algorithm for soft real time operating system that gave better response time, good waiting time, turnaround time than existing algorithm completed all processes within deadline, very low context switching and less range of time quantum.

Acharya et al. (2006) carried on how recently processed requests can be taken up for deciding the priorities (or) order for scheduling the CPU Processing and found very favorable results as per their simulation study.

Behera et al. (2011) proposed a new Fair-Share scheduling with weighted time slice and analyzed which calculates time quantum in each round and based on a novel approach which made the time quantum repeatedly adjustable according to the burst time of the currently running processes with Experimental analysis and reduced the average waiting time, average turnaround time and number of context switches.

Babu et al. (2012 c) focused on a new algorithm called Efficient Round Robin (ERR) algorithm for multi-programmed operating system and developed a tool which gives output in the form of experimental results with respect to some standard scheduling algorithms like FCFS, SJF, Priority, Round Robin etc.

Selvaraj et al. (2014) reviewed the basic scheduling algorithms and shown which algorithm is best for a particular situation and modified a particular scheduling algorithm to improve the performance in scheduling the processes.

Khankasikam (2013) investigated the new proposed algorithm which is based on a new approach called dynamic time quantum which is considered as a challenge for round robin scheduling algorithm with the experimental result demonstrate to increase the capability and stability of the operating system.

Arora et al. (2013) proposed CPU scheduling algorithm with improved performance using the technique ‘Pipelining’ for increasing the speed up factor to improve its performance by 40-50%.

Patel and Solanki (2012) involved the design and development of new CPU scheduling algorithm “the Hybrid Scheduling Algorithm using genetic approach” incorporating with a software tool which produced a comprehensive simulation of a number of CPU scheduling algorithms for performance metrics, efficient scheduling algorithm and efficient for sequencing problems in genetic.

Rao and Shet (2010) performed the comparison of different preemptive scheduling algorithms, the simulation of new multi level feedback queue (NMLFQ) is written in C++. NMLFQ simulates the CPU scheduler by using four queues and two different kinds of jobs regular and batch that the proposed scheduler not only has a good response time but also keeps the system with ideal throughput.

Sirohi et al. (2014) suggested an improved CPU Scheduling algorithm for big effect on resources utilization and overall performance of the system.

Kishore and Saxena (2014) studied various existing and newly designed and developed CPU scheduling algorithms (PSSDTQ) to optimize system performance according to the criteria demanded in the market.

Noon et al. (2011) proposed a new algorithm based on a new approach called dynamic-time-quantum to adjust the time quantum according to the burst time of the set of waiting processes in the ready queue with simulations and experiments to solve the fixed time quantum problem and increases the performance of Round Robin.

Thanushkodi and Deeba (2011) proposed Particle Swarm Optimization (PSO) algorithm considering different number of processes and compared the performance results with the conventional techniques such as longest processing time, shortest processing time.

Guadana et al. (2013) tackled different scheduling disciplines and provided examples in each algorithm in order to know which algorithm to appropriate for various CPU goals.

Tyagi et al. (2012) developed an enhanced approach for existing Priority Scheduling algorithm and helped greatly in minimizing the Response time that reduced the waiting time for lowest priority processes and made a comparative study of the existing technique to illustrate significant difference in performance parameters.

Singh et al. (2014) reviewed various fundamental CPU scheduling algorithms for a single CPU and showed which algorithm is best for the particular situation.

Kumar and Nirvikar (2013) explained a new approach for CPU scheduling algorithms which can be used to improve the performance of CPU in real time operating system which is based on the integration of round-robin, SJF scheduling algorithm with calculating priority and time quantum in reducing starvation also presented the comparative analysis from existing round robin scheduling algorithm.

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Singh and Rana (2014) proposed a new approach for round robin scheduling algorithm which helps to improve the efficiency of CPU.
Chinmay and Sachdeva (2014) analyzed the high efficient CPU scheduler on design of the high quality scheduling algorithms which suits the scheduling goals and presented a state diagram depicting the comparative study of various scheduling algorithms for a single CPU that showing which algorithm best for the particular situation.
Adekunle et al. (2014) focused on the scheduling algorithms used for scheduling processes in a multiprogramming system and discussed each algorithm and made a comparison on the basis of eight parameters and other papers that showed no scheduling algorithm ideal satisfying the conditions and concluded that further studies which improve current scheduling algorithms need to be done.
Saeidi and Baktash (2012) developed a non-linear programming mathematical model to determine the optimum value of the time quantum, in order to minimize the average waiting time of the processes implemented and solved by Lingo 8.0 software on four selected problems from the literature.
Mostafa et al. (2010) proposed a method using integer programming to solve equations that decide a value that is neither too large nor too small such that every process has reasonable response time and the throughput of the system is not decreased due to un-necessarily context switches.
Iraji (2015) proposed methods to reduce Average waiting time, average response time, Switch Counts process, through the design of a time sharing non-exclusive scheduling algorithm based on the round Robin and determined accurate time quantum and achieved better and more accurate results in weight harmonic- dynamic weight and Subtraction Method.

Miglani et al. (2014) dealt with a comparative study of performance measures of CPU scheduling policies and considered the CPU burst time fuzzy in nature which is helpful for the designer in selecting the right scheduling algorithm at high abstraction levels which saves him from error prone priority assignments at the final stage of system design.
Tomco et al. (2014) showed MDTQRR, most effective new techniques, minimizing the number of context switch and Harm, most effective in AVG (Waiting and Turnaround) Time to calculate dynamic Time Quantum (TQ).

Parashar and Chugh (2014) introduced a new CPU Scheduling Algorithm called time quantum based RR CPU Scheduling Algorithm which acts as preemptive based on the arrival time and helped to improve the average waiting time of Round Robin algorithm in real time uni-processor-multi programming operating system and compared the results of the existing Round Robin algorithm with the proposed algorithm.
Shrivastava (2014) developed CPU scheduling algorithms and understood their impact in practice can be difficult and time consuming due to the need to modify and test operating system kernel code and measure the resulting performance on a consistent workload of real applications.
Sonagara et al. (2014) focused on RR scheduling techniques and compared with different dynamic time quantum techniques and showed that average min-max scheduling best scheduling technique compare to simple RR, min-max RR and efficient RR.
Patel and Solanki (2012) involved the design and development of new CPU scheduling algorithm "the Hybrid Scheduling Algorithm" with software tool which produces a comprehensive simulation of a number of CPU scheduling algorithms and results in the form of scheduling performance metrics.
Singh and Kataria (2014) introduced a new CPU algorithm called CPU scheduling Algorithm which acts as both preemptive and non-preemptive based on the arrival time to improve the CPU efficiency in real time uniprocessor, multiprogramming operating system giving fair execution time by focusing on average waiting time of a process and compared the results of the existing algorithms with the proposed algorithm.
Banerjee et al. (2012) adjusted the time quantum dynamically in AMMRR scheduling algorithm to perform better than Round Robin scheduling algorithm.
Somani and Chhatwani (2013) dealt with various scheduling algorithms like First-Come-First-Serve (FCFS) scheduling algorithm, Shortest Job First (SJF) scheduling algorithm, Priority scheduling algorithm, Round Robin (R-R) scheduling algorithm, Multilevel Queue scheduling algorithm and Multilevel Feedback Queue scheduling algorithm.
Rao and Shet (2014 a) articulated the task states of New Multi Level Feedback Queue [NMLFQ] Scheduler and depicted the contingent of task transitions with triggers which leads to a change of state. In real time scenario, the literal time line of real time process, with time instants and intervals are elucidated.
Regner and Lacy (2005) introduced the concepts and fundamentals of the structure and functionality of operating systems and analyzed different scheduling algorithms in a simulated system implementation of three different scheduling algorithms: shortest process first, round robin, and priority sequence and comparing them.
Ajit Singh developed a new approach for round robin scheduling which helps to improve the CPU efficiency in real time and time sharing operating system.
Rao and Shet (2014 b) discussed distinguishing problems with existing Multi Level Feedback Queue (MLFQ) scheduling algorithm to develop a New Multi Level Feedback Queue (NMLFQ) illustrated along with synchronization through semaphore with the relationships of job sets, record of tasks and queues, so debated the scheduler involving respective steps along with pseudo-code describing object oriented code with comments to justify the algorithm.
Raman and Mittal (2014) discussed selection of time quantum and proposed a new CPU scheduling algorithm for timeshared systems called as EDRR (Efficient Dynamic Round Robin) algorithm to make a change in

round robin CPU scheduling algorithm to improve the performance of CPU and less chance of starvation and improved analysis of number of context switches, the average waiting time and the average turnaround time of processes in round robin CPU scheduling algorithm, SRBRR (Shortest Remaining Burst Round Robin), ISRBRR (Improved Shortest Remaining Burst Round Robin) and new proposed EDRR CPU scheduling algorithm.

Shyam and Nandal (2014) designed a new Round Robin Scheduling "Improved Mean Round Robin with Shortest Job First Scheduling" giving better result compare to Round Robin (RR), Improvent Round Robin (IRR), Enhanced Round Robin (ERR), Self Adjectment Round Robin (SARR), FCFS and some other scheduling algorithm. Chahar and Raheja (2013) discussed basic multilevel queue and multilevel feedback queue scheduling techniques and thereafter a review of techniques proposed by different authors are discussed.

Qureshi (2014) performed the review of different scheduling algorithms with different parameters, such as running time, burst time and waiting times etc. The reviews algorithms are first come first serve, Shortest Job First, Round Robin, and Priority scheduling algorithm.

Zhao and Stankovic (1989) studied the performance analysis of FCFS and improved FCFS scheduling algorithms for dynamic real-time in which tasks arrive as a random process and each task has a laxity specifying the maximum time a task can wait for the service.

Some other useful contributions are for different CPU scheduling by Silberschatz and Galvin (2010), Stalling (2004), Tanenbaum and Woodhull (2000) and Dhamdhere (2009).

III.CONCLUSION

System designers have many complex decisions that they are required to make before finalizing their designs. The selections of the appropriate processor scheduling algorithms allow them to tailor the design to perform at the highest level of performance, reducing overall idle time. Design specifications will drive decision such as responsiveness, preemption, and reliability. These combinations can benefit both single processor and multiprocessor systems if selected in the proper combination. Based on the results obtained they will be proposed. In the future work, more tests should be done based on the burst time of processes that follow different patterns of statistical distributions. We cannot do any kind of prediction about the algorithm it actually can be tested on operating system in real time or in real situations. In this paper, a review of techniques proposed by different authors are discussed which is helpful to design Operating System and new researches in Scheduling.

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