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A SURVEY OF VARIANTS OF ROUND ROBIN CPU SCHEDULING ALGORITHMS

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ABSTRACT

Quite a number of scheduling algorithms have been implemented in the past, including First Come First Served (FCFS), Shortest Job First (SJF), Priority and Round Robin (RR). However, RR seems better than others because of its impartiality during the usage of its quantum time. Despite this, there is a big challenge with respect to the quantum time to use. This is because when the quantum time is too large, it leads to FCFS, and if the quantum time is too short, it increases the number of switches from the processes. As a result of this, this paper provides a descriptive review of various algorithms that have been implemented in the past 10 years, for various quantum time in order to optimize the performance of CPU utilization. This attempt will open more research areas for researchers, serve as a reference source and articulate various algorithms that have been used in the previous years – and as such, the paper will serve as a guide for future work. This research work further suggests novel hybridization and ensemble of two or more techniques so as to improve CPU performance by decreasing the number of context switch, turnaround time, waiting time and response time and in overall increasing the throughput and CPU utilization.

Keywords— ***Round robin, descriptive review, quantum time, operating system***

INTRODUCTION

Operating system (OS) is a programme that serves as an interface between the users of computer and the hardware facilities. Other functions of OS include memory management, process management and storage management (Silberschatz, 2005). The user wants to communicate with the hardware in a multitasking way wherein different processes are entered into the system. Processes are tasks that need to be executed. CPU scheduling is used to allocate processes to the CPU for execution and the main reason is to obtain optimal performance by decreasing the waiting time, the turnaround time, the response time and the number of context switches. Researchers have adopted various approaches in the past years, the approaches adopted include Round Robin (RR), First Come First Serve (FCFS), Priority and Shortest Job First (SJF). Out of all the algorithms, RR seems to be outstanding due to its flexibility and impartiality in allotting processes to the CPU (Khaji, Abhijeet and Kakelli, 2020). RR is a scheduling algorithm that uses the same time quantum for all processes in the queue irrespective of their burst time. Burst time is the time required by a process to accomplish all its tasks. The following metrics are used to measure the performance of a CPU scheduling algorithms

(i) CPU utilization
(ii) Context Switch
(iii) Turnaround time
(iv) Response time
(v) Waiting time
(vi) Throughput

CPU scheduling algorithm is efficient if it has low waiting time, low response time, low turnaround time and low context switch (Olofintuyi, Omotehinwa, Oyekanmi & Olajubu, 2019). A very good approach to conceptualize areas of research is through literature review (Webster & Watson, 2002). Basically, literature review can be conducted with four different approaches, namely, meta-analysis narrative review, descriptive review and vote counting (King & He, 2005). Vote counting is a review whereby individual research finding is combined and an inference is concluded about their focal finding. It compares the positive result obtained from an experiment with a negative result from another experiment, not putting into consideration the size of the dataset used and the impact of the studies (King & He, 2005). The nascence of this research will rest on the descriptive method of review because it is suitable for current research work. The objective of this work is to provide a descriptive review of RR scheduling algorithms that have been used for the past ten years. Section II discusses the literature review, section III discusses the reviewer's comment and section IV conclusion.

LITERATURE REVIEW

Uferah, Munam, Abdul, Kamran, Qaisar and Muhammad (2020) develop a Novel Amended Dynamic Round Robin Scheduling Algorithm for Time-shared Systems. The study uses a dynamic quantum time for all the processes in the ready queue. All processes are sorted in ascending order according to their burst time such that the process with the least burst time is attended to first. The quantum time is set as the least burst time of processes in the queue, and afterwards, 20 is set as the threshold. The quantum time is then crosschecked to observe whether it is less than the set threshold. The results are compared with the following algorithms: RR, Priority Based Round Robin (PRR), Improved Round Robin (IRR), Optimum Multilevel Dynamic Round Robin (OMDRR). The proposed algorithm performs better than all algorithms compared to in-terms of Average Waiting Time (AWT), and Average Turnaround Time (ATT). The proposed algorithm gave 7.2% reduction in AWT compared to IRR and 10% reduction in ATT compared to IRR. The result obtained for Number of Context Switches (NCS) is relatively small because it was reduced only by 2% as other compared algorithm. Average response time was not used as a metric for evaluating the proposed algorithm which serves as a major setback

Alaa, Zoulikha and Hayat (2020) present an Improved Version of Round Robin Scheduling Algorithm Based on Analytic Model. The processes used here are first sorted into two groups: the light task and the heavy task. The sorting is determined by their burst time. The quantum time is determined by the burst time of the middle of each task to ascertain whether the arrival time of processes is zeros. But if the arrival time is not zero, the quantum time will be derived by dividing the burst time of the first process by two. The proposed algorithm gave a reasonable performance over RR, and Improved Round Robin with Varying time Quantum (IRRVQ) in term of AWT and ATT. Authors failed to benchmark their work with other algorithms using AWT and NCS

Khaji, Abhijeet and Kakelli (2020) develop a Hybrid Round Robin Scheduling Mechanism for Process Management. The methodology hybridized RR, FCFS and SJF, and the quantum time used in their methodology is derived by adding the mean and the least burst time together. The result is then divided by two. With this, the quantum time is obtained which is used to execute all the processes in the ready queue. Any process that is unable to complete its task is returned to the end of the queue. The results derived are only bench marked with the conventional RR using ART, ATT, NCS and AWT. The proposed algorithm gives 6% reduction compared to RR in terms of AWT, 5% reduction compared to RR in terms of ATT, 1.3% reduction in terms of ART and 2% reduction in NSC compared to RR. The results obtained from this work was only benchmarked with the conventional RR, it should have been benchmarked with at least five existing algorithms.

Chhaya and Kirti (2020) develop Fluctuating Time Quantum Round Robin (FTQRR) CPU Scheduling Algorithm. This technique adopts the approaches of conventional RR and FCFS. All processes are first arranged according to their increasing burst time. The burst time of the first process in the queue is used as the quantum time for the first process only. Immediately after execution, the second burst time is compared with the quantum time, where the burst time of the second process is more than the quantum time, it is then readjusted to the burst time of the second process. But if the burst time of the second process is less than the quantum time used for the first process, there will be no need to readjust the quantum time. This methodology is what is used for all the processes in the queue. The proposed algorithm is compared with (IRRVQ), Dynamic Time Quantum based Round Robin (DTQRR) and conventional RR, using the following evaluation parameters: AWT, ATT and NCS. The proposed algorithm gave 2% reduction in NCS compared to DTQRR, 7% reduction in ATT compared to DTQRR and 7.2% reduction in term of AWT. ART was not used to benchmark the proposed algorithm.

Mayuree and Tanapat (2020) present Round Robin Scheduling Based on Remaining Time and Median (RR_RT&M) for Cloud Computing. Conditions are set to determine the quantum time. The first condition is to arrange the processes in increasing order of their burst time. Thereafter, if processes are only three in the waiting queue, the quantum time used will be maximum burst time of process in the waiting queue, else the median will be used. In the ready queue, another condition is checked whether the burst time of the process is less than the quantum time, then it is executed and sent to the finish list. But if the process is unable to finish its task, it is sent back to the waiting queue. The simulation results show that the proposed algorithm outperforms Smarter Round Robin (SRR) algorithms, Modified Median Round Robin Algorithm (MMRRA), RR and FCFS. The evaluation parameters include: execution time, makespan and waiting time. The results obtained reveals 16 – 72% improvement in makespan, 31-73% improvement in execution time and 73% improvement in waiting time. However, NCS, ART and ATT were not considered by the author for evaluation.

Amit and Amaresh (2020) develop a Modified Round Robin Method to Enhance the Performance in Cloud Computing. All processes are sorted according to their increasing burst time. The mean of burst time of all processes are used as the quantum time. Processes whose burst time is greater than the quantum time are group and rearranged, while the ones whose burst time is less, are equally rearranged. The proposed algorithm is only bench-marked with the conventional RR. The evaluation results reveal that the proposed algorithm gives 28.5% reduction in the waiting time and 49.25% reduction in average turnaround time.

The number of context switches are however not considered in their work.

Omotehinwa, Azeez and Olofintuyi (2019) propose a Simplified Improved Dynamic Round Robin CPU (SIDRR) Scheduling Algorithm. From the proposed algorithm, the quantum time used is the result of the product of all the processes that are present in the queue; then, the nth root of the product is found, and then used as the quantum time. The nth root is obtained by the number of processes in the queue. The proposed algorithm is evaluated with AWT, AVT and NCS. Also, the proposed algorithm is bench-marked with the following algorithms: New Improved Round Robin (NIRR), Dynamic Average Burst Round Robin (DABRR), Improved Round Robin with Varying time Quantum (IRRVQ), Revamp Mean Round Robin (RMRR) and Efficient Dynamic Round Robin (EDRR). The result shows an improved performance when compared with the existing algorithms. The proposed algorithm saves 49% compared to the aforementioned algorithm in terms of waiting time and 40% in terms of waiting time. ART was not used to evaluate the proposed algorithm.

Olofintuyi, Omotehinwa, Oyekanmi and Olajubu (2019) propose an Improved Time Varying Quantum Round Robin CPU Scheduling Algorithm (ITVRR). The study use 50th percentile of the burst time of all the processes as the quantum time. The results of the experiment reveals that the proposed model perform better than RR, FCFS and RMRR using context switch and average turnaround time. But RMRR outperforms the proposed model using waiting time. Pradeep and Sharma (2019) propose a Modified Round Robin Scheduling Algorithm Based on Priorities. Processes are assigned to the CPU according to their highest priorities and shortest burst time. The proposed method performs better than the existing algorithm using average turnaround time and waiting time. The proposed algorithm gave 5% reduction of ATT and AWT compared to other algorithm. Other evaluation metrics were not considered such as NCS and ART which would have improve their presentation.

Sohrawordi, Ehasn, Palash and Mahabub (2019) present a Modified Round Robin CPU Scheduling Algorithm with Dynamic Time Quantum. The researchers use the integer of the average burst time as the quantum number. After the experiment, the results show that the proposed model performs better than the conventional RR, RRVQ algorithms because it requires less waiting time and less turnaround time. The proposed algorithm gave 10.8% reduction in ATT and 12% reduction in AWT compared to RRVQ. But the proposed algorithm gave the same number of context switches with RRVQ. The author failed to benchmarked the proposed model using ART

Samih and Hirofumi (2019) present an Adjustable Round Robin Scheduling Algorithm in Interactive Systems. The study uses the expiration of the time slice, stating that if the new time quantum of process is equal to the burst time of process, it should run and leave the queue; else it should put the process at the tail of the queue. The results reveal that there is 26.36% reduction in waiting time and 55. 7% reduction in number of context switch as compared to the conventional RR. Authors failed to consider other evaluation parameters and it was not benchmarked with other algorithms expect the conventional RR.

Sonia, Lotfi and Abdellatif (2019) present an improved time quantum length estimation for Round Robin Scheduling Algorithm using neural network. The study make uses of RR based on neural network, and their work is application in a real time system. After simulation exercise in Matlab environment, a minimum average turnaround time is derived as compared to the general RR. One of the weaknesses of the paper is that other evaluation parameters were not considered in the work and the NCS is high compared to RR. Another setback is that the work was not compared to other existing algorithms apart from RR

Chunhong, Ping, Yuye and Jianqiang (2019) present an Efficient Round Robin Task Scheduling Algorithm based on a Dynamic Quantum Time. The researchers rearrange the processes in ascending order, and then compute the median of all the burst times. The quantum time is decided by the burst time of the next process near the median. The proposed algorithm gives a better performance compared with the conventional RR. The proposed algorithm also gives a lower overhead, better performance and lower complexity compared with some improved algorithms. The proposed algorithm gave an improvement of 37.5% context switch, 31.1% improvement of waiting time and 21.1% improvement of turnaround time. The major setback of the proposed algorithm is the response time as compared with other four algorithms.

Sonia, Lotfi and Abdellatif (2019) propose Priority-Based Round Robin (PBRR) CPU Scheduling Algorithm. The authors combine both RR algorithm and priority in order to achieve a better result. The proposed algorithm only improve the AWT and ATT. The setback of the algorithm include high context switch and high response time.

Rashmi (2019) presents Round Robin Scheduling Algorithm based on dynamic time quantum. The quantum time is derived by first arranging the burst time in ascending order and then compute the median of the burst time. The proposed model shows a better result than the conventional Round Robin in terms of context switch, waiting time and turnaround time. The setback of the algorithm include high context switch and high response time. The proposed algorithm was not benchmarked with other existing algorithm except RR algorithm.

Aishanya and Deepak (2019) provide an analysis of Round Robin Scheduling Algorithms in CPU Scheduling. The study compare six variants of existing algorithms in order to see which one gives better prediction. The algorithms compared include the following: Optimised Round Robin algorithm

(ORR), Mean Difference Round Robin (MDRR), Dynamic Average Burst Round Robin (DABRR), Self-Adjustment Round Robin (SARR), Smart Optimised Round Robin (SORR) and Non-Linear Programming Mathematical Model (NLMRR). After the experimental results, only four out of the six algorithms are found to give a minimal context switch, minimal turnaround time and waiting time when compared with others.

Zaidi and Shukla (2018) present variable time quantum based round robin policy for cloud computing environment. The quantum time used in the proposed algorithm is derived by computing the square root of the median and the highest burst time. The proposed algorithm performs better than RR algorithm in term of AWT and ATT. The setback of the algorithm include increase in ART and the algorithm was not benchmarked with other existing algorithm except RR algorithm. The proposed algorithm can be hybridized and then benchmarked with other five existing algorithms

Eric, Afolayan and Abdullah (2018) propose Vehicle Traffic Control System Using Modified Smart Optimised Round Robin Scheduling Algorithm. The authors integrate priority into round robin algorithm in a Vehicle traffic control system. The proposed algorithm reduces the waiting time of vehicle by 11.61%. The major setback of this work is the ART.

Govind, Kumar and Devendra (2018) propose an Improved Round Robin CPU Scheduling Algorithm based on priority of process. The study used the traditional round robin but give priority to processes that are prioritised –for example, the shutting down of the system because of the exceeding temperature. The proposed algorithm generally reduces the average waiting time of processes with high priority. The setback of the algorithm include fixed time quantum, high context switch and high response time. The proposed algorithm was not compared with other existing algorithms except RR algorithm

Sarvesh, Gaurav, Komal and Aditi (2018) The study combined the traditional round robin with the traditional Shortest Job First. After their experiment, the results show that the combined algorithm gives a low turnaround time when compared with RR algorithm and SJF. The setback include high waiting time and high response time. The accuracy of the result can be improve by coordinated data structure.

LaxmiJeevani, Madhuri and Devi (2018) present an Improvised Round Robin Scheduling Algorithm and Comparison with Existing Round Robin CPU Scheduling Algorithm. The study used FCFS for the first process in queue, and thereafter consider the process with short burst time. After the experiment, there is reduction in the average waiting time and average turnaround time. The setback include high response time and high context switches. Also, the proposed algorithm was not compared with other existing algorithms except RR algorithm.

Neha and Ankita (2018) propose an Improved Round Robin CPU Scheduling Algorithm. The methodology used in the research follows the same conventional round robin pattern with a little difference. If the burst time of the process is small compared with the quantum time, the process then finishes its execution. However, if the burst time is more than the quantum time, the process is placed back at the end of the queue. With the varying burst time used for all the processes, the experimental results reveal that the proposed algorithm gives a low turnaround time and low waiting time. The proposed algorithm is only compared with the conventional RR.

Bhavin and Manoj (2018) present Dynamic Time Quantum Approach to Improve Round Robin Scheduling Algorithm in Cloud Environment. The quantum time used is derived by finding both the mean and the median of all the processes. The results obtained from both the mean and median are added up and divided by two. The experimental results show that the proposed algorithm gives a low waiting time only when compared with the traditional round robin and MRRA algorithm. While RR performs better than the proposed algorithm in terms of turnaround time and response time.

Ahmed, Hadeel and Khalid (2018) propose a Novel Method Based on Priority for Enhancement Round-Robin Scheduling Algorithm. Processes are all rearranged upon arrival in the ready queue. Processes are then prioritised based on their burst time. Processes with low burst time are given the highest priority. The turnaround time and waiting time derived by the proposed algorithm are less compared with RR. Author did not evaluate their work with average response time and number of context switches. Also, the results can be improve with an enhanced smart RR. Scheduler.

Kumar and Rohit (2017) present performance analysis of Modified Round Robin Algorithm. The study introduces two approaches in their methodology. First, Round Robin Algorithm is combined with the Shortest Job First and the process with the shortest burst time is used as quantum time after arranging all the processes in ascending order. In their second approach, RR is also combined with SJF and the average of all the burst time is used as the quantum time. With the two approaches proposed by the authors, the average waiting time and average turnaround time are reduced, compared with the conventional RR. The work is not compared with other existing algorithms.

Pragya, Shubhi, Nitin and Richa (2017) present a Novel CPU Scheduling Method and comparison with Round Robin Scheduling: As a hybrid approach, all processes are rearranged according to their burst time, and then sum up. The result is then multiplied with the highest burst time and divided by the number of processes in the queue. The square root of result derived is obtained as the quantum time for the CPU. The proposed algorithm is only compared with the conventional RR. The work is not compared with other existing algorithms.

Priyanka, Manmohan and Anil (2017) propose an Improved Round Robin Scheduling in Cloud Computing. The quantum used in the work is derived by rearranging the burst time according to their arrival in the queue, and then compute the mean of all the burst time of the processes. AWT and ATT is used as the evaluation metrics. The proposed algorithm is benchmarked with the conventional RR and the performance is better considering the two metrics aforementioned. Author failed to benchmark their work with other existing algorithms and number of context switch is not considered in the research work.

Keerthana (2017) presents Modified Round Robin Scheduling Algorithm by dynamic time quantum. The quantum time is derived by using FCFS and priority approach. The proposed algorithm is bench marked with the conventional RR. The results show that the proposed algorithm produces less AWT, ATT and relatively low NCS. The proposed algorithm is not bench marked with existing algorithms.

Sushruta, Soumya, Sunil and Brojo (2017) propose CPU Scheduling using an Optimised Round-Robin Scheduling Technique. The study combined SJF and RR for optimum performance. The proposed algorithm produces optimum result better than the conventional RR. However, the proposed algorithm was only bench marked with RR.

Dolly and Ankur (2017) present Best Time Quantum Round Robin CPU Scheduling Algorithm. The quantum time is derived by first rearranging all the processes with respect to their burst time, and then divide the median and mean of all the burst time by 2. The three parameters used to evaluate the proposed algorithm include AWT, ATT and NCS. The proposed algorithm gives a better result when compared with the conventional RR. The algorithm is not bench-marked with existing algorithms and the conventional RR perform better in terms of NCS and ART than the proposed algorithm.

Rashid, Mehedi, Zakari, Alam and Abdul (2017) present an Improved Performance of Round Robin CPU Scheduling Algorithm Using Non-preemptive SJF. The study introduced two sets of queue: Request and ready queue. All the processes in the ready queue use the conventional RR – and if there are processes that is unable to finish its execution, such process is returned to the request queue. When all the processes have been attended to in the first batch, the remaining processes that is returned to the request queue use non-preemptive SJF. The proposed algorithm gives a less number of context switch, low waiting time and low turnaround time, when compared with RR and SJRR. The algorithm is bench-marked with RR, DQRR and dynamic SJRR. Hybridization of techniques will enhance the results if applied to their methodology.

Samir, Shahenda and Manar (2017) The study hybridises the concept of SJF and RR putting into consideration the weakness of the two approaches. The proposed algorithm is bench-marked with the traditional SJF, traditional priority and RR. The proposed model performs better than all the three aforementioned algorithms. The proposed algorithm also strikes the balance between throughput and starvation. Dynamic quantum time will improve the accuracy of the result obtained.

Kamal, Afaf and Nermeen (2017) present achieving stability in the Round Robin algorithm. The methodology used here reveals that processes are rearranged in ascending order with respect to their burst time. The quantum time is derived by finding the three quarter of the mean of all the burst time. The proposed algorithm outperforms the conventional RR using average turnaround time and average waiting time as the evaluation metric. The setback of the work include high response time and high number of context switches. Also, the author did not benchmark the proposed algorithm with other existing algorithms except conventional RR.

Nischaykumar and Pramod (2016) propose an Improvising Round Robin Process Scheduling through Dynamic Time Quantum Estimation. The operating system is made to adjust the time quantum by considering the second maximum of all the burst time of processes in the queue. To accomplish this task, a register is created to store the value of the second maximum for an updated quantum time. The proposed algorithm is equally bench-marked with the conventional RR using context switch, average waiting time and average turnaround time. The result of the proposed model is relatively better than RR. The major setback in the work presented is that author did not benchmark the proposed algorithm with other existing algorithms except conventional RR.

Sachin, Piyush, Pradyumn and Prashan (2016) propose a Revamped Mean Round Robin (RMRR) CPU Scheduling Algorithm. The study proposed two sets of queue: Pre-ready queue and ready queue. The time quantum is derived by computing the mean of all the burst time in the ready queue. The work is compared with different existing algorithms which include: RR, SJF and FCFS. The proposed algorithm performs better than the existing algorithms considering number of context switch, average waiting time and average turnaround time as the performance metric. The setback of the algorithm include high waiting time and high turnaround time compared to SJF and FCFS. The accuracy of the results obtained can be improved by efficient data structure

Shreyank (2016) presents statistical approach to determine most efficient value for time quantum in Round Robin Scheduling. The statistical approach is used to derive the quantum number. The product of mean, standard variation and number of processes in the queue is computed, and the square root of the result is used as the quantum time. The proposed algorithm is bench-marked with Shortest Remaining Burst Round Robin (SRBRR) algorithm and the conventional RR algorithm. The proposed algorithm outperforms both algorithms using average turnaround time and average waiting time. The major setback of the proposed algorithm include high NCS and ART. The accuracy of the results obtained can be enhanced by hybridization of techniques.

Rao and Srinivasu (2016) present an Efficient Round Robin CPU Scheduling Algorithm using Dynamic Time Slice. This approach uses two methods to calculate the quantum time: first, the median of all the burst time is computed and then multiplied with the highest burst time. Secondly, the mean of the burst time is also computed and then multiplied to the lowest burst time. Both results are added together, and then the square root is computed as the quantum time. The result derived is bench marked with conventional RR and other two algorithms. The proposed algorithm outperforms all the other algorithms using context switch, waiting time and turnaround time as a metric of evaluation. The major weakness in the proposed algorithm is that it produces high response time as compared to the other algorithms

Saini, Panjeta and Sima (2016) propose an Enhanced Efficient Dynamic Round Robin CPU Scheduling Algorithm. The study used two approaches to derive the quantum time. First, all the processes are rearranged in increasing order of their burst time, after which the mean and median are computed. If the mean is greater than the median, then the quantum time used will be derived by multiplying the mean and the extreme burst time added to both the product of the middle burst time and the least burst time. However where the median is greater than the mean, the quantum time is derived by multiplying the middle of the burst time and the most extreme burst time, added to the product of mean of the burst time and the least burst time. The proposed algorithm is bench-marked with the conventional RR and other two existing algorithms, which are SRBRR, ISRBRR, using number of switches, average waiting time and average turnaround time as the evaluation metric. The experimental results reveal that the proposed algorithm outperforms the three algorithms aforementioned. The major weakness in the proposed algorithm is that it produces high response time as compared to the other algorithms

Wasim and Sahana (2016) develop an Improved Round Robin Scheduling Algorithm with Best Possible Time Quantum, and Analysis and Comparison with The RR Algorithm. The quantum time used in their methodology is derived by first rearranging the processes in the ascending order. The product of the median and the highest burst time is computed and the square of the result is used as the quantum time. The results are only bench-marked with the conventional RR. The proposed algorithm performs better than the conventional RR using number of context switches, average waiting time and average turnaround time. Author did not evaluate the proposed algorithm with response time. Variable quantum time and efficient data structure would improve the accuracy of the results

Pandaba, Prafulla and Ray (2016) The researchers use two sets of register to determine the quantum time used in their methodology. The first register, called SR, is used to store the sum of all the burst time of processes in the ready queue. While the second register, called AR, is used to store the average of all the burst time processes in the ready queue. The result that derived from the AR is then used as the quantum time for each process. The implementation of the research work is done in Matlab environment. The work was only bench marked with the conventional RR, and uses just two evaluation metric. The turnaround time and waiting time of the proposed algorithm is better than the conventional RR.

Anju, Neenu and Nandakumar (2016) propose a Dynamic Time Slice Round Robin Scheduling Algorithm with unknown burst time. The methodology used here shows that a dynamic time quantum is used in attending to all the processes in the queue. All the processes are attended to, based on FCFS on the arrival queue. Immediately after that, the initial quantum time is multiplied by 2 for the second cycle of processes that are unable to complete their tasks. The result of their findings show that there is about 15% in the turnaround time, 15% reduction in the waiting time and about 10% reduction in the context switch when compared with the traditional RR and an optimized RR. The major weakness in the proposed algorithm is that it produces high response time as compared to the other algorithms

Kanagala, Korupala and Sindhe (2015) present an Improved Dynamic Round Robin CPU Scheduling Algorithm using SJF technique. The authors use the combination of SJF and RR. All processes are rearranged in ascending order of their burst time. The burst time of the first process in the ready queue is used as the time quantum. Sub-sequent processes are also considered if their burst time is equal to or less than the time quantum. Any process that is unable to finish its task is returned to the end of the queue. For the second cycle of processes, the researchers employ SJF. The proposed algorithm gives a better result than the conventional RR algorithm because it produces low turnaround time, low waiting time and low number of context switches. The research results was not benchmarked with other existing algorithms except conventional RR

Lipika (2015) develops an Efficient Round Robin Scheduling Algorithm with Dynamic Time Slice. The quantum time used in this methodology is derived by finding the summation of all the burst time divided by the number of processes in the ready queue. The algorithm is only bench marked with Optimised RR (ORR) and Dynamic Quantum with Re-Adjusted Round Robin Scheduling Algorithm (DQRRR) using waiting time and turnaround time. The proposed algorithm gives better results when compared with the other two algorithms. The response time and the context switch derived from the result was not better than the existing algorithms.

Arpita and Gaurav (2015) present Analysis of an Adaptive Round Robin Algorithm and Proposed Round Robin Remaining Time Algorithm. Processes are first rearranged according to their increasing burst time. The quantum time used is derived by:

$$\frac{\sum P_i}{2n} \quad (1)$$

If any process on execution is unable to finish its task, it is sent to the tail of the ready queue, otherwise the CPU is assigned to another process in the ready queue. Results reveal that the proposed algorithm produces a better result when compared with Standard Round Robin and Adaptive Round Robin using AWT and ATT. The weaknesses of the proposed algorithms include high context switch and high response time. For a better performance of the proposed algorithm, an effective data structure is suggested

Amar, Sandipta and Sanjay (2015) develop an Optimised Round Robin CPU Scheduling Algorithm with Dynamic Time Quantum. The quantum time is derived by summation of all burst times in the ready queue divided by the number of processes in the ready queue. After execution of the first phase of processes, processes that are unable to finish their tasks are evacuated from the ready queue because their burst time is higher than the quantum time. In the second phase, the mean of the burst time of processes in the second phase is used as the quantum time for the second phase only. The same methodology is used until there is only one process in a phase, and the burst time of such process automatically is used as the quantum time. The proposed algorithm outperforms the following algorithms: RR, RP-5, IRRVQ, SARR, MRR, DQRRR, using NCS, AWT and ATT. The proposed algorithm saves 41% AWT and 31% ATT compared to other algorithms. While the author did not considered the NCS and ART.

Siva, Srinivasu, Srinivasu and Ramakoteswara (2015) develop an Enhanced Precedence Scheduling Algorithm with Dynamic Time Quantum (EPSADTQ). The study used Balanced Factor of Precedence (BFP) to determine the order of execution. Processes with shorter number of burst time gets a lower priority. Average burst time of all processes in the ready queue is used as the quantum time. The proposed algorithm gives a better result when compared with other variants of RR in term of AWT, ATT and NCS. Average response time was not use to evaluate the proposed algorithm.

Debabrata, Shouvik and Mousom (2015) present an efficient approach to calculate Dynamic Time Quantum in Round Robin Algorithm for Efficient Load Balancing. The time quantum for their methodology is derived by the summation of the highest burst time, lowest burst time and median of all processes. The result obtained is divided by 3. The proposed algorithm gives a better result when compared with other existing algorithms in cloud computing. The results of the research can be enhanced by hybridizing different techniques

Manish and Faizur (2014) develop an Improved Round Robin CPU Scheduling Algorithm with varying time quantum. Processes are first rearranged in ascending order of their burst time in the ready queue. The burst time of the first process to be executed is used as the quantum time for all the processes in the first cycle. After the first cycle, processes are rearranged again according to the ascending number of their burst time, and the burst time of the first process to be executed in the second phase is used as the quantum time for the second cycle. This method is adopted until all the processes finishes their tasks irrespective of the number of cycle. After simulation results, the proposed algorithm gives a lower AWT and ATT than the conventional RR. Number of context switches was not considered and the proposed algorithm was not bench marked with existing algorithms.

Abdulrazaq, Saleh and Junaidu (2014) The study used two sets of queue: arrival queue and request queue. The first process that arrives from the arrival queue is transferred to the ready queue and the burst time of the process is used as the quantum time for the process only. During execution, all processes that arrives in the arrival queue are transferred into the ready queue. Upon completion of the first process, all other processes are rearranged according to their increasing burst time. The ceiling average of all the burst time is computed and used as the quantum time for all the processes. Any process that is unable to finish its task before their burst time elapses, the remaining burst time is checked if it is less than or equal to the quantum time. If the condition holds, the process is allowed to continue with its execution, but if the remaining burst time is greater than the quantum time, such process is sent back to the arrival queue. These activities continue until all processes finish their tasks. Results obtained are compared with five different algorithms which include: LJF+CBT, FCFS, SJF, IRR and RR, using the following evaluation parameters: ATT, AWT, NCS and ART. The proposed algorithm gives a better result than RR and IRR with respect to ATT, AWT and NCS. The only weakness in the work is that the ART of the proposed algorithm is high.

Debashree, Sanjeev and Debashree (2014) develop an Improved Round Robin (IRR) Scheduling using Dynamic Time Quantum. Processes is first rearranged according to the shortest burst time in the ready queue. The optimal time quantum for their methodology is then derived by adding the median of all processes and the process with the highest burst time. The answer derived is then divided by 2. The answer is then used as the optimal time quantum for all processes. The same step is considered for the quantum time on each cycle of execution until all processes finish their tasks. Experimental results showed that the proposed IRR algorithm gives a low number of context switch, low AWT and low ATT when compared with the traditional round robin. The proposed algorithm was not bench marked with other algorithms.

Mayank and Amit (2014) propose Time Quantum-based CPU Scheduling Algorithm. All processes are rearranged according to their increasing burst time in the ready queue. Thereafter, the burst time of the first process is subtracted from the burst time of the second process, while the burst time of the second process is likewise subtracted from the burst time of the third process. This method continues until the last process in the queue is encountered. The result from each is then added together to form the quantum time for all the processes. The proposed algorithm is bench marked with the following algorithms: Shortest Job Round Robin Algorithm, Enhanced Round Robin Algorithm, Adaptive Round Robin Scheduling Algorithm and the conventional RR. The proposed algorithm gives a lower AWT, ATT and NSC when compared with the aforementioned algorithms but the authors did not consider ART

Radhe and Sunil (2014) develop an Improved Mean Round Robin with Shortest Job First Scheduling. The quantum time used in their methodology is derived by the product of the highest burst time and the mean of all the processes. The square root of the result is then used as the quantum time. The proposed algorithm is bench marked with four algorithms. They include IRR algorithm, SARR algorithm and ERR algorithms. The proposed algorithm is also compared with the conventional RR algorithm. The results show that their work outperforms all the aforementioned algorithms. Author also did not put into consideration the average response time. Nayana and Sheetal (2013) present CPU Scheduling Algorithm using Dynamic Time Quantum for Batch Systems. The quantum time used is dynamic because the burst time of the first process in the ready queue is used as the quantum time. But if one or more processes arrive the queue at the same time, the average of the processes is then used as the quantum time. The results give a better performance in term of AWT, ATT and NCS than the conventional RR. Author did not benchmark the result with other exiting algorithms except the conventional RR.

Suman and Supriya (2013) present Modified Round Robin Scheduling Algorithm Using Variable Time Slice. Their methodology supports that the processes with shortest burst time be attended to first. Processes are rearranged in ascending number of their burst time, and the average number of all the burst time is used for the quantum time. After completion of the first cycle using SJF, the average of the burst time of all processes is again computed, and still the SJF approach is used to attend to all the processes. This activity continues until all processes complete their tasks. The algorithm was not bench marked with any other algorithm, but is only compared with the conventional RR. The proposed algorithm gives a better result in terms of AWT, ATT and NCS than the RR.

Chavan and Tikekar (2013) propose an Improved Optimum Multilevel Dynamic Round Robin Scheduling Algorithm. The study combines priority and shortest job scheduling for their methodology. An intelligent time quantum is used for all process, whereby processes with low burst time are given priority. The proposed algorithm is bench marked with RR and the results obtained is relatively better then RR in term of AWT, ATT and NCS. Authors did not benchmark the other variants of RR and also did not evaluate the proposed algorithm with average response time.

Ali (2012) designs an Improving Efficiency of Round Robin Scheduling Using Ascending Quantum and Minimum-Maximum Burst Time. The study rearranges the processes according to the ascending order of their shortest burst time. The quantum time used is calculated by adding the minimum and maximum burst time, then multiplied by 80 percentage. The algorithm proposed performs better than Shortest Remaining Burst Round Robin (SRBRR), Min-Max Round Robin (MMRR) and conventional RR in terms of AWT, ATT and NCS. The proposed algorithm was not evaluated with ART.

Sanjaya and Sourav (2012) present an Effective Round Robin Algorithm using Min-Max Dispersion Measure. The quantum used in their methodology is derived by taking the differences of the maximum and minimum of CPU burst time. The results show a better performance than the conventional RR in terms of AWT, ATT and NCS. The proposed algorithm was not bench marked with other existing algorithms.

Abbas, Ali and Seifedine (2011) introduced two sets of registers in their methodology. The burst time of the first process in the ready queue is used as the time quantum for the first process only. Thereafter, the average burst time of all other processes are computed as the quantum time. The uniqueness about their method is that the quantum time is recomputed after each process has been executed. Whenever a process has been computed, the burst time is subtracted from the sum of all the burst times and the average is recomputed; and as a result of this, the SR and AR are updated periodically. Average response time was not use to evaluate the proposed algorithm and the proposed algorithm was not bench mark with other existing algorithm except for conventional RR.

Saroj and Roy (2011) in the study, Smart Time Slice was used as the quantum time for all processes. First, all processes are rearranged according to their increasing burst time in the ready queue. Whenever the number of processes in the queue is odd, then the mid of the burst time of processes is used as the quantum time. However, where the number of processes are even, then the average of all processes are computed as the quantum time for execution. The proposed algorithm performs better than the conventional RR in term of NCS, AWT and ATT. The proposed algorithm is not bench marked with other existing algorithms.

DISCUSSION

In this paper, some of the various techniques used for the formation of round robin scheduling algorithm for the past 10 years have been reviewed with descriptive method. This paper has provided researchers insight into the various methodologies used so far in the area of round robin scheduling algorithms for operating system and cloud computing. It has also opened up areas that can be explored for more research because no optimal algorithms by the authors are not bench-marked with recently proposed algorithm; most of them are bench marked with only the conventional RR. Thus, it is suggested that any proposed algorithm in the area of round robin should be bench marked with at least five existing algorithms and the conventional RR.

Also, considering that no algorithm is optimal, researchers can still propose more algorithm to better the performance of the operating system. The extensive review presented in this study, showed that researchers are making attempt to improve the round robin scheduling algorithms. The goal of this survey is to ensure that efforts are directed to area that have not been fully explored. It can be observed that the approach for time quantum determination adopted by Pandaba, Prafola and Ray (2016) is the same as the one adopt-by Abbas, Ali and Sefindin (2011). quantum time has been agreed on. From the review, much works have been done on the variants of scheduling RR which the designers of a real time system or operating system can adopt in order to reduce the waiting time, turnaround time and the number of context switches of processes in the queue. It has also been noted that few of the

The implication is that the effort is repeated and wasted as a result of non-extensive review that could give a clear presentation of most of the time quantum determination approaches. It can also be observed that many of the study revealed relied heavily on the use of measure of central tendency particularly the arithmetic mean (Table 1). This approach has been proven to be unreliable (Omotehinwa, Azeeze and Oyekanmi, 2019) as the mean of asymmetrically distributed burst time of processes with an outliers will tend towards the outliers. It is worthy of note that the study by Sonia, Lofit and Abdullatif, 2019 deviated completely from the common approaches by deploying neural network in the determination of the quantum time. The study is the only one in this category. Researchers in this area can further explore quantum time determination through the use of neural network

S/N	Authors	Years of publication	Topic	Time Quantum Used
1	Mayuree and Tanapat	2020	Round Robin Scheduling Based on Remaining Time and Median (RR_RT&M) for Cloud Computing	TQ = Maximum remaining time of process and Median
2	Amit and Amaresh	2020	A Modified Round Robin Method to Enhance the Performance in Cloud Computing	TQ = Arithmetic mean
3	Omotehinwa, Azeez and Olofintuyi.	2019	Simplified Improved Dynamic Round Robin CPU (SIDRR) Scheduling Algorithm.	TQ = Geometric mean
4	Samih and Hirofumi	2019	An Adjustable Round Robin Scheduling Algorithm in Interactive Systems	TQ = BT, If (abs(BT - TQ) <= (TSH× TQ)) Where TSH stands for predefined threshold
5	Chunhong, Ping, Yuye and Jianqiang	2019	An Efficient Round Robin Task Scheduling Algorithm Based on a Dynamic Quantum Time	TQ = Burst time closest to median
6	Amar, Sandipta and Sanjay	2015	An Optimised Round Robin CPU Scheduling Algorithm with Dynamic Time Quantum	TQ = Arithmetic mean
7	Eric, Afolayan and Abdullah	2018	Vehicle Traffic Control System Using Modified Smart Optimised Round Robin Scheduling Algorithm	TQ= Priority
8	Sonia, Lotfi and Abdellatif	2019	Improved Time Quantum Length Estimation for Round Robin Scheduling Algorithm Using Neural Network	TQ = Neural Network
9	Alaa, Zoulikha and Hayat	2020	Improved Version of Round Robin Scheduling Algorithm Based on Analytic Model	TQ = Median of burst time

10	Olofintuyi, Omotehinwa, Oyekanmi and Olajubu	2019	An Improved Time Varying Quantum Round Robin CPU Scheduling Algorithm	TQ = 50^{th} percentile of burst time
11	Sonia, Lotfi and Abdellatif	2019	Priority Based Round Robin (PBRR) CPU Scheduling Algorithm	TQ = Priority based
12	Ahmed, Hadeel and Khalid	2018	A Novel Method Based on Priority for Enhancement Round-Robin Scheduling Algorithm	TQ = Prioritized based on their burst time. Processes with low burst time are given priority.
13	Aishanya and Deepak	2019	Analysis of Round Robin Scheduling Algorithms in CPU Scheduling	The authors compare six variants of existing algorithms to see which one gives better prediction. The algorithms compared include: Optimised Round Robin Algorithm (ORR), Mean Difference Round Robin (MDRR), Dynamic Average Burst Round Robin (DABRR), Self-Adjustment Round Robin (SARR), Smart Optimised Round Robin (SORR) and non-linear programming mathematical model (NLMRR).
14	Sohrawordi, Ehasn, Palash and Mahabub.	2019	A Modified Round Robin CPU Scheduling Algorithm with Dynamic Time Quantum	TQ= Integer part of the result of arithmetic mean
15	Rashid, Mehedi, Zakari, Alam and Abdul	2017	Improved Performance of Round Robin CPU Scheduling Algorithm Using Non-preemptive SJF	TQ = All the processes in the ready queue use the conventional RR, and where there are processes that is unable to finish its execution, such process is return to the request queue. When all the processes have been attended to in the first batch, the remaining processes that is returned to the request queue use non-preemptive SJF.
16	Samir, Shahenda and Manar	2017	A Novel Hybrid of Shortest Job First and Round Robin with Dynamic Variable Quantum Time Task Scheduling Technique	TQ = Hybridizes the concept SJF and RR, putting into consideration the weakness of the two approaches.
17	Sachin, Piyush, Pradyumn and Prashan	2016	A Revamped Mean Round Robin (RMRR) CPU Scheduling Algorithm	TQ = Arithmetic Mean

18	Rao and Srinivasu	2016	An Efficient Round Robin CPU Scheduling Algorithm using Dynamic Time Slice	TQ = SQT{(Median * Highest burst time) + (Mean* Lowest burst time)}
19	Saini, Panjeta and Sima	2016	Enhanced Efficient Dynamic Round Robin CPU Scheduling Algorithm	TQ = Mean and median are computed. If the mean is greater than the median, the quantum time will be derived by multiplying the mean and the extreme burst time, and then added to the product of the middle burst time and the least burst time. But if the median is greater than the mean, the quantum time is derived by multiplying the middle of the burst time and the most extreme burst time, and added to the product of mean of the burst time and the least burst time.
20	Wasim and Sahana	2016	Improved Round Robin Scheduling Algorithm with Best Possible Time Quantum and Comparison and Analysis With RR Algorithm	TQ = SQRT{ Median * Highest burst time}
21	Siva, Srinivasu, Srinivasu and Ramakoteswara	2015	Enhanced Precedence Scheduling Algorithm with Dynamic Time Quantum (EPSADTQ)	TQ = Arithmetic mean
22	Ali	2012	Improving Efficiency of Round Robin Scheduling Using Ascending Quantum and Minimum-Maximum Burst Time	$TQ = \{LBT + HBT\} * 0.8$
23	Chhaya and Kirti	2020	Fluctuating Time Quantum Round Robin CPU Scheduling Algorithm	TQ = Burst time of the first process
24	Khaji, Abhijeet and Kakelli	2020	A Hybrid Round Robin Scheduling Mechanism for Process Management	TQ = Arithmetic mean + smallest burst time/2

25	Govind, Kumar and Devendra	2018	An Improved Round Robin CPU Scheduling Algorithm Based on Priority of Process	TQ = Priority
26	Kumar and Rohit	2017	Performance Analysis of Modified Round Robin Algorithm	TQ = Shortest Burst Time and arithmetic mean
27	Shreyank	2016	Statistical Approach to Determine Most Efficient Value for Time Quantum in Round Robin Scheduling	$TQ = \sqrt{Mean * SD * Count(p)}$
28	Pandaba, Prafulla and Ray	2016	Modified Round Robin Algorithm for Resource Allocation in Cloud Computing	TQ = Mean of burst time
29	Kanagala, Korupala and Sindhe	2015	An Improved Dynamic Round Robin CPU Scheduling Algorithm Using SJF Technique	TQ = Smallest burst time and SJF
30	Uferah, Munam, Abdul, Kamran, Qaisar and Muhammad	2020	A Novel Amended Dynamic Round Robin Scheduling Algorithm for Time-shared Systems	TQ = Burst time not greater than 20
31	Pradeep and Sharma	2019	Modified Round Robin Scheduling Algorithm Based on Priorities	TQ = $P_{\frac{n+1}{2}}$ $\frac{1}{2}\left[P_{\frac{n}{2}} + P_{1+\frac{n}{2}}\right]$ If n is odd and even

32	Rashmi	2019	Round Robin Scheduling Algorithm Based on Dynamic Time Quantum	TQ = Median
33	Zaidi and Shukla	2018	Variable time Quantum Based Round Robin Policy for Cloud Computing Environment	TQ= SQRT (Median + Highest burst time)
34	Sarvesh, Gaurav, Komal and Aditi	2018	An Approach to Reduce Turnaround Time and Waiting Time by the Selection of Round Robin and Shortest Job First Algorithm	TQ= Traditional round robin with the traditional shortest job first.
35	LaxmiJeevani, Madhuri and Devi	2018	Improvised Round Robin Scheduling Algorithm and Comparison with Existing Round Robin CPU Scheduling Algorithm	TQ = FCFS for the first process in the queue, and thereafter consider the process with short burst time.
36	Neha and Ankita	2018	An Improved Round Robin CPU Scheduling Algorithm	TQ = Burst time of first process
37	Bhavin and Manoj	2018	Dynamic Time Quantum Approach to Improve Round Robin Scheduling Algorithm in Cloud Environment	$TQ = \frac{Mean + Median}{2}$
38	Pragya, Shubhi, Nitin and Richa	2017	A Novel CPU Scheduling Method and Comparison with Round Robin Scheduling: a Hybrid Approach	TQ = SQRT{Sum(p) * Highest burst time}/ Count (p)
39	Priyanka, Manmohan and Anil	2017	Improved Round Robin Scheduling in Cloud Computing	TQ = Arithmetic mean
40	Nischaykumar and Pramod	2016	Improvising Round Robin Process Scheduling through Dynamic Time Quantum Estimation	TQ = Second maximum of all the burst time of processes in the queue.

41	Lipika	2015	Efficient Round Robin Scheduling Algorithm with Dynamic Time Slice	TQ = Mean of burst time
42	Arpita and Gaurav	2015	Analysis of Adaptive Round Robin Algorithm and Proposed Round Robin Remaining Time Algorithm	$TQ = \sum \frac{pi}{2n}$
43	Manish and Faizur	2014	An Improved Round Robin CPU Scheduling Algorithm with Varying Time Quantum	TQ = Burst time of the first process in each cycle of execution
44	Debabrata, Shouvik and Mousom	2015	An Efficient Approach to Calculate Dynamic Time Quantum in Round Robin Algorithm for Efficient Load Balancing	$TQ = \frac{HBT + LBT + Median}{3}$
45	Keerthana	2017	Modified Round Robin Scheduling Algorithm by Dynamic Time Quantum	TQ = FCFS + Priority
46	Sushruta, Soumya, Sunil and Brojo	2017	CPU Scheduling using an Optimized Round-Robin Scheduling Technique	TQ = SJF and RR
47	Abdulrazaq, Saleh and Junaidu	2014	A New Improved Round Robin (NIRR) CPU Scheduling Algorithm	TQ = The ceiling average of all the burst time is computed and used as the quantum time for all the processes.
48	Abbas, Ali and Seifedine	2011	A New Round Robin Based Scheduling Algorithm for Operating Systems: Dynamic Quantum Using the Mean Average	TQ = Mean of burst time
49	Pallab, Probal and Shweta	2012	Comparative Performance Analysis of Average Max Round Robin Scheduling Algorithm (AMRR) using Dynamic Time Quantum with Round Robin Scheduling Algorithm using Static Time Quantum	$TQ = \frac{Mean + HBT}{2}$.

50	Sanjaya and Sourav	2012	An Effective Round Robin Algorithm using Min-Max Dispersion Measure	$TQ = HBT - LBT$
51	Radhe and Sunil	2014	Improved Mean Round Robin with Shortest Job First Scheduling	TQ = SQRT{Mean* Highest burst time}
52	Dolly and Ankur	2017	Best Time Quantum Round Robin CPU Scheduling Algorithm	$TQ = \frac{Mean + Median}{2}$
53	Kamal, Afaf and Nermeen	2017	Achieving Stability in the Round Robin Algorithm	TQ = 3/4 (Mean of burst time)
54	Nischaykumar and Pramod	2016	Improvising Round Robin Process Scheduling through Dynamic Time Quantum Estimation	TQ = Second maximum of all the burst time of processes in the queue.
55	Debashree, Sanjeev and Debashree	2014	Improved Round Robin Scheduling using Dynamic Time Quantum	$TQ = \frac{Median + HBT}{2}$
56	Amar, Sandipta and Sanjay	2015	An Optimised Round Robin CPU Scheduling Algorithm with Dynamic Time Quantum	TQ = Arithmetic mean
57	Saurabh, Diwakar and Ratnesh	2015	Linear Data Model Based Study of Improved Round Robin CPU Scheduling Algorithm	TQ = The burst time of the first process to be executed is used as the quantum time for all processes.
58	Abdulrazaq, Salisu, Ahmad and Saleh	2014	An Additional Improvement in Round Robin (AAIRR) CPU Scheduling Algorithm	TQ = 1-time quantum for process execution.

59	Mayan and Amit	2014	Time Quantum based CPU Scheduling Algorithm	TQ = Burst time of the first process is subtracted from the burst time of the second process, while the burst time of the second process is also subtracted from the burst time of the third process. This method continues until the last process in the queue is encountered.
60	Nayana and Sheetal	2013	CPU Scheduling Algorithm Using Dynamic Time Quantum for Batch Systems	TQ = Mean
61	Chavan and Tikekar	2013	An Improved Optimum Multilevel Dynamic Round Robin Scheduling Algorithm	TQ = An intelligent time quantum is used for all process where processes with low burst time are given priority.
62	Suman and Supriya	2013	Modified Round Robin Scheduling Algorithm Using Variable Time Slice	TQ = Mean
63	Abbas, Ali and Seifedine	2011	A New Round Robin Based Scheduling Algorithm for Operating Systems: Dynamic Quantum Using the Mean Average	TQ = Mean of burst time
62	Saroj and Roy	2011	Adaptive Round Robin Scheduling using Shortest Burst Approach Based on Smart Time Slice	TQ = Whenever the number of processes in the queue is odd, the mid of the burst time is used as the quantum time. However, where the number of processes are even, the average of all processes are computed as the quantum time for execution.

CONCLUSION

In this study, some of the variants of RR were reviewed. The attempt made by different researchers in ensuring a fear allocation of processes to CPU was discussed. This paper also clearly identified the method of time quantum determination by each of the study reviewed. This will serve as a jumping-off point for quality research in the area of resource scheduling. In conclusion, novel hybridization and ensemble of two or more techniques can be adopted so as to improve CPU performance by decreasing the number of context switch, turnaround time, waiting time and response time and in overall increasing the throughput and CPU utilization. It is also important for the academia to collaborate with the industry for real life experimentation and possibly commercial deployment of some of these algorithms.This will help to create standard for further improvement.

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