An Efficient Multi-Level Scheduler Structure for Optimizing the Performance in Green Cloud Computing

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Abstract: Energy consumption is a main problem in green cloud computing. Various optimization algorithms have been used in previous approaches to reduce the energy consumption of data centres. But due to increases of work load and ideal time, the performance of existing approaches is still consuming high rate of energy for execution. This research work divides the job execution process in two different models. First model defines the job queues on a cloud server and another define the inner structure of the job queues. Because all the time cloud servers work with heavy load and multiple queues are handled by schedulers to minimize the response time so, to reduce the queue ideal time this approach introduces weighted round robin for outer module of execution. It handles all the queues and executes them with multi-threading process. Another approach used to handle the inner structure of execution and process the tasks with the help of adaptive technique. Here all possible situations are handled with the help of hybrid algorithm. It reduces the maximum energy consumption and provides better results for submitted tasks on cloud server. The performance of this hybrid algorithm is compared with other existing approaches and in all the cases the performance is better in terms of energy and execution time consumption.
Keywords: Cloud Computing, Job Scheduler, FCSC, Energy Consumption, EexecutionTime

I.   Introduction

In the origin of Computing revolutionized post-industrial society, Green Computing was portrayed and perceived as a new technology but it was also widely accepted as an evolution in various technology areas such as data centre networking, data centre-hosted-services, request performance-measurement etc. This was also known as green technology. By the end of 1970s, the world saw revolution and in the beginning of 1990s green computing came into limelight. Then businesses started using environment friendly ways to do business. Since, there has been fast growth in the high energy consumption rate. As given the evolutionary nature of Green Computing, it could mean different things and thus it is wise to pay attention to definition of Green Computing.

1.1 Green Cloud Computing

"Green Computing is a model for enabling convenient, environment sustainability in IT sector that can be rapidly provisioned and released with minimal management effort or green provider interaction". Green computing has been widely accepted from individual to official employee of government. "Green-computing has been enabled by the availability of broadband networks and low-priced end-user devices, along with commodity-computing nodes that can be simply interconnected and controlled, as well as virtualization to make available the advent of isolating processes that share computers by reducing CO_2 emission rate".
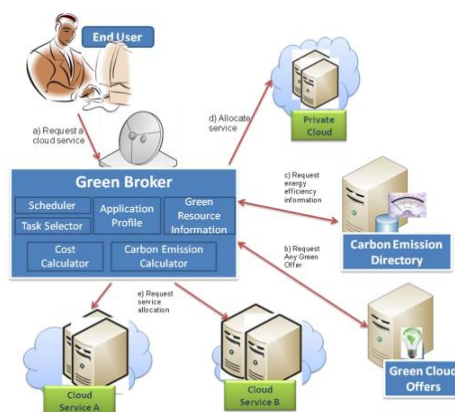

FIGURE:1 Green Cloud Architecture

II.   Literature Review

In previous work, Task scheduling must be correct due to several authorized issues. The confirmation mandate sorted in queue as well.The efficiency of an algorithm was evaluated by the amount of time necessary to execute it. The execution time of an algorithm is stated as a time complexity function relating the input. If a 20 problem had a polynomial time algorithm, the problem was tractable, feasible, efficient or fast enough to be executed on a computational machine.

Dazhao Cheng et.al, (2015), they proposed, a Resource and Deadline-aware Hadoop job Scheduler that takes coming resource availability into consideration when minimizing job deadline misses. They formulate the job scheduling problem as an online optimization problem and solve it using an efficient receding horizon control algorithm. To aid the control, they design a self-learning model to estimate job completion times and use a simple but effective model to predict future resource availability.[1]

Abhishek Gupta et.al, (2015) intended to present the performance comparison analysis of various pre-existing job scheduling algorithms considering various parameters. This paper discussed about cloud computing and its constructs in section (i). In section (ii) job scheduling concept in cloud computing had been elaborated. In section (iii) existing algorithms for job scheduling are discussed, and were compared in a tabulated form with respect to various parameters and lastly section (iv) concludes the paper giving brief summary of the work.[2]

Daochao Huang et.al, (2015) reviewed job scheduling proportional fairness and utility function, the multi-resource job scheduling algorithm which fulfils capacity constraints of virtual machines is conducted. Comparative analysis illustrates scheme improved average job completion time by preferentially grouping jobs that has different resource requirements.[3]

LipsaTripathyet.al(2014) Cloud computing is an increasing knowledge. It way huge quantity of data so preparation apparatus workings as a very important role in the cloud computing. Thus my procedure is projected to diminish the switch time, get superior the supply operation & also pick up the lavender maître d' production & throughput. This method or process is based on preparation the job in the cloud & to decide the disadvantage in the breathing protocols. Best effort has been made to direct the scheduling of jobs for solving disadvantage of breathing protocols & also manage the capability & throughput of the wine waiter.[4]

RajveerKauret.al(2014) While commerce with cloud computing, a numeral of matter are face up to like weighty load or transfer while computation. Job scheduling is single answer to these matter. It is the process of mapping job to available resources. In section (1) converse about cloud computing & scheduling. In part (2) give details about job scheduling in cloud computing. In part (3) accessible algorithms for job scheduling are discussed, part (4) existing algorithms are compared & lastly in part (5) conclusion& future work are discussed.[5]

Chihyun Jung et.al (2014) suggest an superior scheduling come up to bottom on a rolling prospect scheduling idea appropriate to the combinatorial environment of the preparation difficulty, the difficulty of the difficulty increase exponentially, when the numeral of work & tools augment. However, the calculation time authorized for the scheduler is incomplete in rehearsal, since the unpredictability in mainly Fobs require schedulers to modernize the schedule in small period. The rotting method repeats numerous preparation iterations, as it steadily expand the figure of runs on equipment, facilitate the scheduler to produce near-optimal schedule in imperfect time period. It investigation the space to yourself guard of outsourced data by test is approved out on the storeroom of manuscript records with changeable dimension. The safekeeping & recital examination give you an idea that the planned means is highly proficient than alive system concert. [6]

S.K.Aparnaa et.al, (2014)in this paper, the standing algorithms does not deliberate the memory restriction of each cluster which is one of the main possessions for scheduling data rigorous jobs. Due to this the job failure rate is also very high. To offer an explanation to that problem Improved Adaptive Scoring Job Scheduling algorithm is presented. The jobs are recognized whether it is data intensive or computational intensive and based on that the jobs are planned. The jobs are owed by computing Job Score along with the memory condition of each cluster. Due to the active nature of grid environment, each time the status of the resources unconventionalities and each time the Job Score is totalled and the jobs are assigned to the most apposite properties.[7]

Alaka Ananth et.al, (2014) focus on game theory based methods for job scheduling in cloud. Review of existing approaches and numerous issues in game theory based job scheduling is the main objective of this paper. They study the existing methods for job scheduling converging game theoretic approaches and analyse the open issues for research in this area.[8]

AV.Karthick et.al,(2014) offered as, methodology depicts the perception of clustering the jobs based on burst time. During the time of scheduling the traditional methods such as First Come First Serve, Straight Job First, EASY, Combinational Backfill and Improved backfill using balance spiral method are creates fragmentation. The planned method overcome this problem and reduces the starvation with in the process. This paper also attention some existing scheduling algorithm and issues related to them in cloud computing.[9]

Swachil Pate et.al,(2013) Cloud Computing is the use of computing assets (Hardware & Software) that are transport as a check over a system to the customers. It means to split great scale equipment's& possessions for calculation, luggage section, in order & in sequence for technical investigate. In cloud computing, there are several jobs entail to be performed by the obtainable income to attain best appearance, negligible total time for termination, straight reply time, process of reserve practice & etc. as of these varied objectives & high presentation of computing surroundings, we require to design, expand, suggest a scheduling algorithm to break appropriate allotment map of jobs due todissimilar issue.[10]

VaishaliChaharet.al(2013) Multilevel Queuing & Multilevel Feedback Queuing is common in the CPU scheduling methods used in operating systems. These methods are common but still have some subjects & have a wide scope of development. Very less literature review is near on these scheduling techniques. So in this paper dissimilar methods for scheduling these techniques future by different authors has been composed & discussed.[10]

Chengkuan ZENG et.al, (2013) purposed of this investigation is to clarify and enhance the job shop scheduling problematic below the environment of mixture operations of machining. The machining operations of the jobs could not be ended in own plant and thus inter-cell productions were considered. First, they clarify the features of the above job shop scheduling difficult in detail and propose a new optimization criterion which accords with fact problems. [11]

Saad Bani-Mohammad et.al, (2012)described the concert of non-contiguous provision can be knowingly affected by the job scheduling approach used for determining the order in which jobs are particular for execution. In this paper, the routine of the well-known Greedy Offered Busy List non-contiguous apportionment strategy for 2D mesh-connected multi computers is re-visited considering several significant job scheduling strategies. These are the First- Come-First-Served, Out-of-Order, and Window- Based job scheduling strategies. General simulation consequences based on synthetic and real assignment models indicate that the Window Based job scheduling approach exhibits good presentation when the scheduling window size is large and weighty system masses**.[13]**

Wei Tang et.al, (2012)proposed an adaptive metric-aware job scheduling approach. First, they proposed metric aware scheduling which enables the scheduler to stability challenging scheduling goals characterized by different metrics such as job waiting time, fairness, and system utilization. Second, they improved the scheduler to adaptively adjust scheduling strategies based on comment information of monitored metrics at runtime.[14]

N. Mansouri et.al, (2011),described data grid is a geographically distribute situation that deals with large – scale data concentrated problematic. The main difficulties in data grid are job scheduling and data management. In data network, operative scheduling strategy should deliberate both computational and data storage possessions. In this paper a new job scheduling technique, called combine scheduling approach is planned that considers numeral of jobs to come in the queue, position of necessary data and the capacity of sites.[15]

Bo Yang et.al, (2011) described cloud computing service concerned with features advance a new way of service provisioning called usefulness based computing. Though, toward the applied application of commercialized Cloud, they happenstance two challenges:
- i)   Near is no well-defined job scheduling algorithm for the Cloud that contemplates the system state in the upcoming, mainly under overloading conditions;
- ii)   The current job scheduling algorithms under helpfulness computing standard do not take hardware or software failure and retrieval in the Cloud into account.

In an effort to address these experiments, they familiarize the failure and recovery situation in the Cloud computing articles and suggest a Reinforcement Learning based algorithm to make job scheduling fault supportable while maximizing efficacies attained in the long term.

Manoj Kumar Mishra eta.la,(2011)analysed and exploration on job scheduling can be carried out to increase the performance of assemblage based scheduling algorithm in grid computing. This study means to achieve better performance by ranging the thought of group based job scheduling. Therefore, this paper proposed "A modified combination based job scheduling in computational grid" with the autonomous of reducing overhead time and computation time, thus dropping overall processing time of jobs. [17]

III.   Problem Statement

The Green Cloud computing solves the problem of global warming by providing eco-friendly atmosphere. We calculated that the heat emission increases with increase in energy consumption. The main aim of Green Cloud computing is to reduce the energy consumed by physical resources in data centre and save energy and also increases the performance of the system.

There are several scheduling algorithms such as Adaptive Min-Min Scheduling Algorithm; Multilevel Feedback Queue Scheduling Algorithm etc. are utilized in green cloud computing to lower the energy consumption and time.

So, to solve this problem, in this work weighted round robin scheduling algorithm is tobe implemented. On the basis of them, energy consumption takes place will be reduced after using improved Adaptive Min-Min Scheduling Algorithm.Most data centres, by design, consume massive quantity of energy in an unsuitably wasteful way, interviews &permit explains. As an effect, data centres can dissipate 90%or more of the power they pull off the network, there additional authority expenditure & leftovers of time. So there is a strong require of optimisation over 3 feature CPU utilization, reaction time & no. of jobs perform per unit time. The present research distress is the unnecessary power operates, energy obsessive and extra time obsessive in data centre which is exceptionally attainment consideration of researchers with admiration to preparation of the computing capital. In realism, Provision providers create high excellence use of IaaS and PaaS for initial their services not including thought of substantial hardware, while operators as well can admission on-demand & pay-peruse services everywhere in Cloud computing. But one of the main issues in information centres originate is to manage most select power, control usage in the scheme.
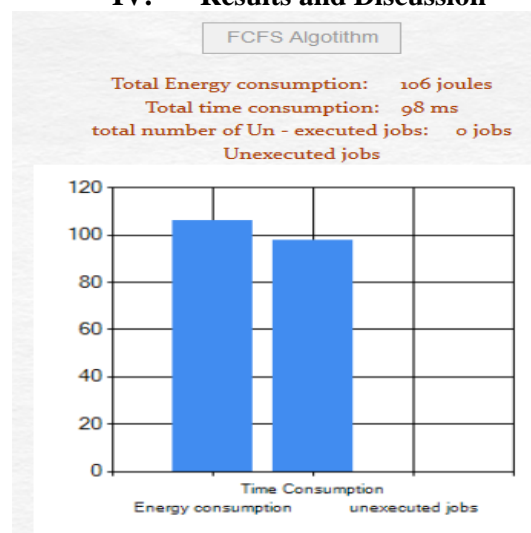
IV.   Results and Discussion

FIGURE: 2Test Result FCFS with 5 tasks

Fig. 2 above shows the time and energy consumption for FCFS algorithm with five tasks. Total energy consumption is 106 joules and total time consumption is 98ms.
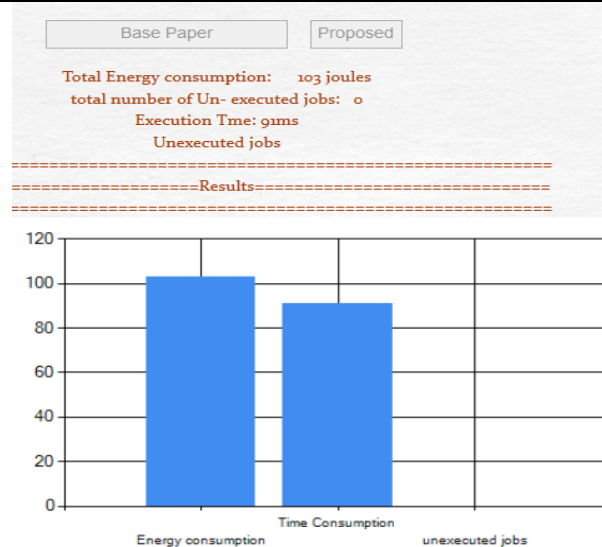
FIGURE: 3Test Result Base Paper algorithm with 5 tasks

Fig. 3 above shows the time and energy consumption for Base Paper algorithm. Total energy consumption is 103 joules and total time consumption is 91 ms.
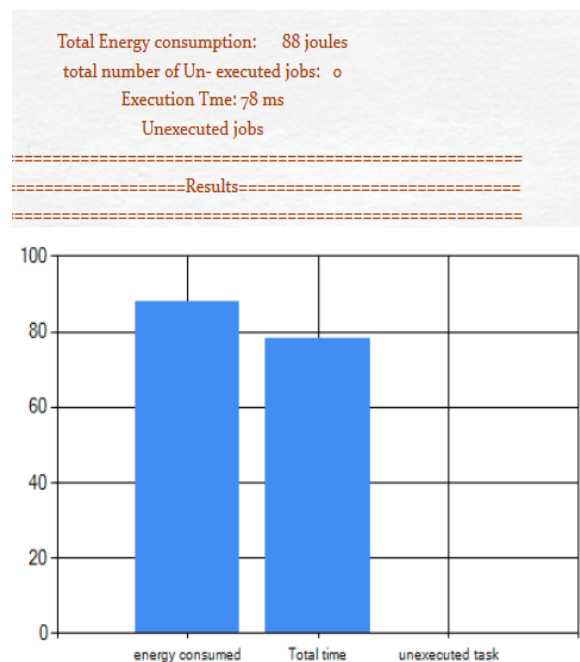

FIGURE:4 TestResult Hybrid Algorithm with 5 tasks

Fig. 4 above shows the time and energy consumption for Hybrid algorithm with five tasks. Total energy consumption is 88 joules and total time consumption is 78ms. This algorithm is hybrid of two different approaches, "WEIGHTED ROUND ROBIN" works on outer module, "Adaptive Min-Min algorithm" works on inner module. Because both cases are handled with the help of hybrid algorithm so it reduces the maximum waiting time and energy consumption of overall execution. The performance of this hybrid approach is better in all the cases as shown in the figure.

Table: 1 Comparison between FCFS, base and Hybrid algorithms in energy consumption

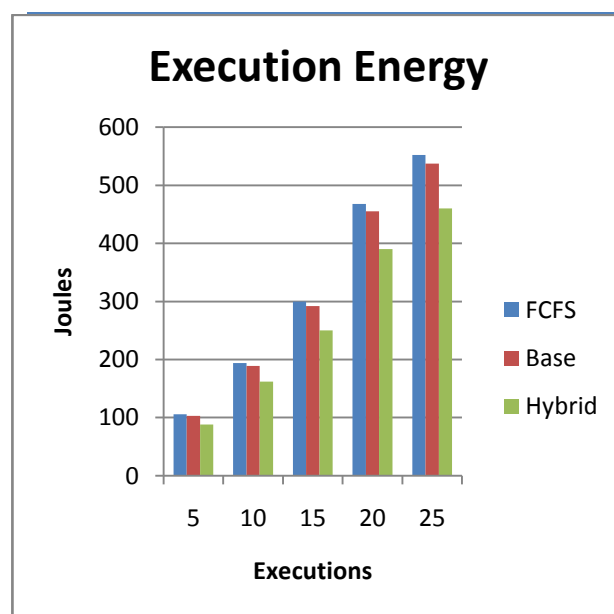| Executions	FCFS	Base	Hybrid
5	106	103	88
10	194	189	162
15	300	292	250
20	468	455	390
25	552	537	460

FIGURE:5 Graph showing Energy Consumption

Here various approaches are compared with hybrid approach in terms of energy consumption. The results of hybrid approach are better in all the execution as compare to others. Proposed hybrid algorithm is saving more energy in all the executions.

Table: 2 Comparison between FCFS, base and Hybrid algorithms in time consumption

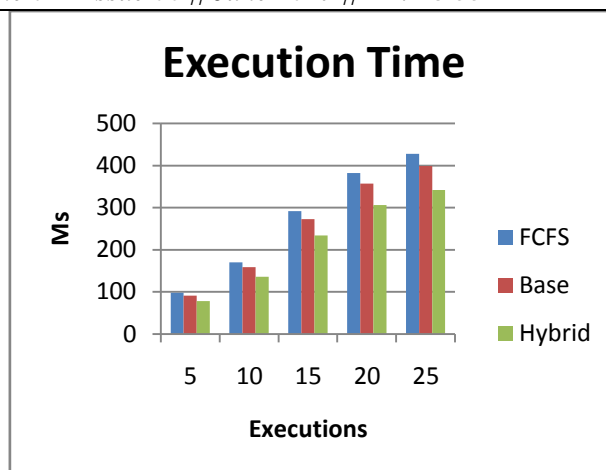| Executions	FCFS	Base	Hybrid
5	98	91	78
10	170	159	136
15	292	273	234
20	382	357	306
25	428	399	342

FIGURE:6 Graph showing execution Time

Time of execution is overall time consumption of algorithm to process the tasks on cloud network. Here some existing algorithms are compared with the hybrid approach and the results of hybrid algorithm are better in all execution in terms of execution time.

V.   Performance Parameters

5.1 Energy consumption:
Energy consumption is used to check the cost behind execution over a cloud network. This is main factor which defines a cost of cloud in a particular time stamp. If the scheduling approach be good enough, then the cost of network processing will also be minimum. If the scheduling approach is not so good, then as work load will be increase the energy consumption will also increase and the cloud network will be a costly thing in future.

5.2 Time consumption:
Time consumption is another performance parameter which defines that the network is responsive or not. If the waiting time of job will be maximum, then the total time will maximum in the execution. As the increment in time will showing the delay in processing response to their users. To optimise this parameter scheduler need to decrease the waiting time of jobs with proper management of inner and outer module of execution.

VI.   Conclusion

Job scheduling is an essential requirement in cloud computing environment with the given constraints. The scheduling algorithms should order the jobs in a way where balance between improving the performance and quality of service and at the same time maintaining the efficiency and fairness among the jobs. This thesis proposed the solution to scheduling problem based on multilevel queue priority based algorithms. The queuing method has increased the satisfaction of the user and utilizes the free unused space of resources for increased performance. We deploy hybridization of weighted round robin and Adaptive Min-Min scheduling Algorithm to achieve overhead problem. Mainstream of the prior investigation work done in the area of analyzing power/ energy utilization mainly distillates on Job scheduling in the middle with respect to Job allocation among the application servers, directed power saving or the criteria seeing thermal factors and hybridization of weighted round robin and Adaptive Min-Min scheduling algorithm only.

VII.   Future Scope

This algorithm is designed for functions like advertisement websites where hosts have to upload pictures and messages in bulk quantity for customers. In future this can be modified for variety of users and functions. For implementation of our system we have worked on minimal hardware. In future it can be extended for more number of nodes. So that more number of instances can be created and more compute intensive functions can be run on the designed cloud computing system. Future plan to develop an on demand category and reservation category for scheduling algorithm may return better result for users based on time.

References

[1]   Cheng, Dazhao, et al. "Resource and deadline-aware job scheduling in dynamic hadoop clusters." Parallel and Distributed Processing Symposium (IPDPS), 2015 IEEE International. IEEE, 2015.

[2]   Gupta, Abhishek, et al. "A theoretical comparison of job scheduling algorithms in cloud computing environment." Next Generation Computing Technologies (NGCT), 2015 1st International Conference on. IEEE, 2015.

[3]   Huang, Daochao, et al. "Multi-resource packing for job scheduling in virtual machine based cloud environment." Service-Oriented System Engineering (SOSE), 2015 IEEE Symposium on. IEEE, 2015.

[4]   Tripathy, Lipsa, &RasmiRanjanPatra. "SCHEDULING IN CLOUD COMPUTING."International journal,2014.

[5]   Kaur, Rajveer, &SupriyaKinger. "Analysis of Job Scheduling Algorithms in Cloud Computing." International Journal of Computer Trends & Technology (IJCTT) 9.7 (2014): 379-386.

[6]   Jung, Chihyun, et al. "An effective problem decomposition method for scheduling of diffusion processes based on mixed integer linear programming." Semiconductor Manufacturing, IEEE Transactions on 27.3 (2014): 357-363.

[7]   Aparnaa, S. K., and K. Kousalya. "An Enhanced Adaptive Scoring Job Scheduling algorithm for minimizing job failure in heterogeneous grid network." Recent Trends in Information Technology (ICRTIT), 2014 International Conference on. IEEE, 2014.

[8]   Ananth, Alaka, and K. Chandra Sekaran. "Game theoretic approaches for job scheduling in cloud computing: A survey." Computer and Communication Technology (ICCCT), 2014 International Conference on. IEEE, 2014

[9]   Karthick, A. V., E. Ramaraj, and R. Ganapathy Subramanian. "An efficient multi queue job scheduling for cloud computing." Computing and Communication Technologies (WCCCT), 2014 World Congress on. IEEE, 2014

[10]   Patel, Swachil, &UpendraBhoi. "Priority Based JobScheduling Techniques In Cloud Computing: A Systematic Review." international journal of scientific & technology research 2 (2013): 147-152.

[11]   VaishaliChahar et.al," International Journal of Advanced Research in Computer Science & Software Engineering," Volume 3, Issue 1, January 2013.

[12]   Zeng, Chengkuan, Jiafu Tang, and Huabo Zhu. "Two heuristic algorithms of job scheduling problem with inter-cell production

[13]   mode in hybrid operations of machining." Control and Decision Conference (CCDC), 2013 25th Chinese. IEEE, 2013.

[14]   [Bani-Mohammad, Saad. "On the performance of job scheduling for noncontiguous allocation in 2D mesh-connected multicomputers. "Electrotechnical Conference (MELECON), 2012 16th IEEE Mediterranean. IEEE, 2012.

[15]   [Tang, Wei, et al. "Adaptive metric-aware job scheduling for production supercomputers." Parallel Processing Workshops (ICPPW), 2012 41st International Conference on. IEEE, 2012.

[16]   [Mansouri, Najme, Gh Dastghaibyfard, and A. Horri. "A Novel Job Scheduling Algorithm for Improving Data Grid's Performance." P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC), 2011 International Conference on. IEEE, 2011.

[17]   Yang, Bo, et al. "An utility-based job scheduling algorithm for cloud computing considering reliability factor." Cloud and Service Computing (CSC), 2011 International Conference on. IEEE, 2011.

[18]   Mishra, Manoj Kumar, Prithviraj Mohanty, and G. B. Mund. "A modified grouping-based job scheduling in computational grid." Engineering (NUiCONE), 2011 Nirma University International Conference on. IEEE, 2011.