iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VIII Month of publication: August 2021

DOI: https://doi.org/10.22214/ijraset.2021.37856

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

Resource Allocation Using Particle Swarm Optimization Algorithm in Cloud Computing

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Abstract: Cloud computing is now widely used in organisations and bussiness firms because of its on-demand accessibility of framework assets, web innovation, and pay-as-you-go principle. Despite of numerous advantages of cloud computing, such as availability and accessibility, it also has few significant drawbacks. The most fundamental issue is the resource management, where Cloud computing provides IT assets such as memory, network, storage, and so on based on a virtualization concept and a pay-as-you-go model. Much research has gone into the administration of these assets. The suggested framework employs the particle swarm optimization algorithm method for assigning and performing the tasks of an application. The proposed algorithm will likely reduce task completion time, cost by utilizing the maximum resources. The proposed system is evaluated using the cloudsim toolkit.
Keywords: Particle swarm optimization algorithm, Resource allocation, Cloud computing.

I. INTRODUCTION

Cloud computing , because of the advancement of virtualization and Internet advances, Cloud processing has arisen as another figuring stage .Cloud computing can be characterized as a sort of conveyed framework comprising of an assortment of Interconnected and virtualized PCs that are progressively provisioned. It gives at least one solidified processing resource dependent on help level arrangements (SLA) between the specialist organizations and administration buyers Cloud figuring has a few difficulties (e.g., security, execution, resource the board, dependability, and so on) . One of the resource management issue is identified with task planning. Undertaking planning on Cloud registering alludes to assigning the clients' errands on the accessible resouce for further develop execution of undertakings, and increment resource usage. As the assignment of Cloud asset depends on SLA, the undertaking execution cost is viewed as one of the principle execution boundaries of the errand booking calculation . Then again, the assignment booking calculation is viewed as a perplexing interaction since it should plan countless undertakings into the accessible resouce. In the opposite side, there are numerous boundaries that ought to be thought about to foster an errand booking calculation. A portion of these boundaries are significant from the Cloud client viewpoint (i.e., assignments Compilation time, cost, and reaction time). Different boundaries are significant from the Cloud supplier viewpoint (i.e., asset use, issue open minded, and force utilization) .The assignment planning issue is viewed as NP-Complete issue. Accordingly, streamlining approaches could be utilized to tackle it by thinking about execution boundaries (i.e., fulfillment time, cost, asset use, and so on) The point of this paper is to foster an undertaking booking calculation in the Cloud figuring climate dependent on particle swarm optimization algorithm for dispensing and executing free assignments to further develop task culmination time, decline the execution cost, just as, boost asset use.

II. LITERATURE SURVEY

V. Vignesh, K. Sendhil Kumar, and N. Jaisankar proposed "Resource management and scheduling in cloud environment,".The cloud providers require an efficient resource scheduling method to manage the increasing number of virtual machine requests. We try to study resource allocation techniques based on various matrices in this research, and it points out that some strategies are more efficient than others in some respects. As a result, the applicability of each method can differ depending on the application.
“Palanikkumar, D. and 2G. Kousalya [2] proposed Evolutionary Algorithmic Approach based Optimal Web Service Selection for Composition with Quality of Service”.
Web services are a type of technology that allows for interconnection and flexibility between various dispersed applications across the Internet and intranets. In the Existings online services can joined to create a online service when a client request can’t be fulfilled by any one . When there is a numerous available online services, it is difficult to locate a online services composition execution path that will fulfill the given request, because the search space for this problem is exponentially growing.
In this study, we examine and contrast two algorithms for optimizating the problem of optimal online service selection.

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R. Buyya, R. N. Calheiros and R. Ranjan, proposed "Modeling and simulation of scalable Cloud computing environments and the CloudSim toolkit: Challenges and opportunities,".
Cloud computing enables application specialised co-ops to rent server farm capabilities for delivering applications based on customer QoS (Quality of Service) requirements. Different component, layout, and organisation requirements apply to cloud applications. Measuring the display of asset assignment approaches and application booking calculations at higher levels of granularity in Cloud processing conditions for various application and administration models under varying burden, energy execution (power utilisation, heat scattering), and framework size is a difficult problem to solve.
To address this problem, we provide CloudSim, an expandable reenactment tool module that allows for the demonstration and replication of Cloud registration situations. The CloudSim tool cache allows for the presentation and production of at least one virtual machine (VM) on a reenacted Data Center hub, as well as the allocation of positions to suitable VMs. It also enables the recreation of numerous Data Centers, allowing for research into collaboration and related tactics for VM relocation for unwavering quality and programmed scaling of uses.

III. PROPOSED SYSTEM

The aim of proposed system is to conveniently distribute the unique duty to each of the cloud hosts in order to improve both asset utilisation and execution time. It distributes the upcoming tasks to all available VMs. To achieve adjusting and avoid blockage, the proposed calculation distributes tasks to the least stacked VM and prevents the distribution of assignments to a VM when the difference between this VM's preparation time and the normal handling season of all VMs is greater than or equal to a limit esteem. As a result, the overall reaction time and the host's preparation season are reduced.

A. Advantages

1) Load distribution between virtual machines is well balanced.
2) Quickness of execution.
3) Shorten the response time.

IV. FLOW CHART OF PROPOSED SYSTEM

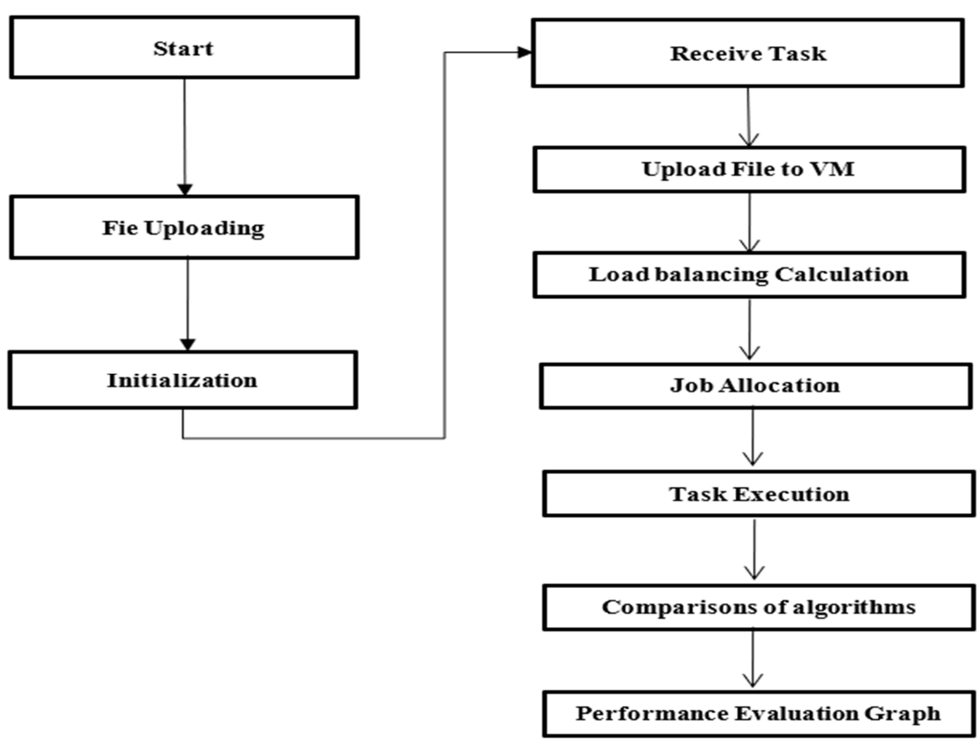

Fig 4.1 Flowchart Of Proposed system

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V. METHODOLOGY

A. Algorithm Of Proposed System

1) *Step1 :* Initialization

Initialize position (X_i^t)and velocity (V_i^t) randomly for each particle

2) *Step2 :* Evaluate fitness value

Calculate fitness value for each particle

3) *Step3 :* For each particle calculate velocity and position

Calculate particle position by : $X_{ij}^{t+1} = X_{ij}^t + V_{ij}^{t+1}$

Calculate velocity : $V_{ij}^{t+1} = wV_{ij}^t + c_1 r_1^t (pbest_{ij} - X_{ij}^t) + c_2 r_2^t (gbest_{ij} - X_{ij}^t)$

4) Step4 : Find the current Global best value
5) Step5 : Update the global best value
6) Step6 : Output gbest and X_i^t

Where, X_i^t = position
V_i^t= velocity
w = interia weight
$c_1 c_2$= two positive constants.
$r_1 r_2$= two random parameters
pbest = best particle position
gbest = best group position

PSO is a search optimization method that finds the best optimal solution. It is one of the algorithms that make up a simulation inspired by animal social behaviour. PSO algorithms work with a swarm of particles, each of which represents a problem solution in the search space. Each particle has two values: one represents the best personal experience (pbest), and the other indicates the best solution among all particles in the swarm (gbest).The particle position is determined by the difference between the prior and current positions, and the velocity is determined by the difference between the particles previous and current positions. Using the inertia w parameter, the particle velocity is utilised to govern particle mobility and prevent particles from falling into the local optima. PSO updates particle xi at iteration t to move the particle position in each iteration, and the velocity is then adjusted depending on the two best values and inertia w.

The constant constants c1 and c2 govern the particle acceleration values, with high values corresponding to previous sub-optimal solutions and low values allowing particles to fall into local optima. pbest is determined by the c1 constant, while c2 determines the c2 constant. Gbest is connected to how well the particle follows the swarm. The particle in question is a result of its own best location and the best position of its neighbours, the values are modified. The initialization of the particles with the available solutions is the first step in a normal PSO algorithm. The fitness function of each particle is then computed using established criteria to determine the best fitness value. Following that, each particles velocity and position are updated. Following that, the best value for each particle is chosen and compared to the pbest and gbest values. Finally, until a halting condition is met, these procedures are repeated.

VI. IMPLEMENTATION

A. Registration

It is the process of enrolling in the cloud or becoming cloud-enabled. Enrollment is required in order to schedule the task. During this method, your basic information, such as email and contacts, is retrieved and stored on the Cloud. A user cloud id will be generated automatically throughout the registration procedure.

Secret key: Every user should develop a secret key and use it to identify something when there is a strong probability that the identifier does not already exist or will exist to identify something else. Independent parties can use a secret key to label information, which can subsequently be incorporated into a single database or sent over the same channel without having to re-enter the information.

B. Initialization

We must initialise this module.

Datacenter: It's a collection of hosts or servers that supply infrastructure. The resources in a datacenter can be heterogeneous or homogeneous.

Hosts: A physical entity that serves as a resource for tasks.

Job: The task Service Broker determines which VM will supply the requested service.

CloudSim's VM allocation policies model the allocation of resources to tasks.

C. Uploading files

The amount of files that must be uploaded before the task may be scheduled. As if it were a file upload, the task is handled as such. Within the time limit, all of the files are uploaded to the cloud server. The cloudsim simulator is used for a variety of purposes. The feasibility of task scheduling, such as file uploading, is being investigated.

D. Identification of the Loads

Cloud Simulator is in charge of load balancing amongst virtual computers.We'll have to choose which virtual machine to use. Having the most available resource space We distribute jobs to virtual computers to accomplish load balancing. Then go ahead and make all of the necessary initializations. The amount of RAM, the broker
id, the job id, and the host id of the Virtual machines.

E. Job Allocation

The fundamental concept is to assign jobs to the virtual machine until it becomes overloaded, i.e. the load on the virtual machine exceeds a threshold value. This VM is now processing fewer tasks than other VMs, and its processing time differs from the average processing time of all VMs by less than a value.

Transferring a file from the cloud to a virtual PC is one of our Task Scheduling tasks. When a VM example fails to arrive before the project deadline, new VM cases are assigned and the work is reassigned. A people group cloud is used in the proposed structure, which is made up of a collection of organisations. A short reaction time is crucial when all businesses and associations give their timesheets to the cloud. This is one of the most major obstacles influencing the local administration system. I'm also working on a handful of applications at the same time. The cloud scheduler is no longer capable of managing publicly accessible assets.

$$V_{ij}^{t+1} = wV_{ij}^{t} + c_1 r_1^t (pbest_{ij} - X_{ij}^t) + c_2 r_2^t (gbest_{ij} - X_{ij}^t)$$

And

$$X_{ij}^{t+1} = X_{ij}^{t} + V_{ij}^{t+1}$$

Where

i=1,2,3,….p and j=1,2,3,….n

Eq.(1) indicates that there are three different contributions to a particle's movement in an iteration, hence it has three terms that will be studied further. Eq. (2), on the other hand, updates the particle positions. The inertia weight constant is parameter ww, which is a positive constant value in the conventional PSO version. This is crucial for balancing the worldwide search, also known as exploration (when higher values are set),and exploitation, which is a type of local search (when lower values are set). It's possible to observe something interesting about this parameter that it is one of the most significant differences between the old PSO and various versions evolved from it.

F. Evaluation

Finally, we'll look at the performance of these four algorithms and create a comparison bar chart. The cloudsim simulator is used to assess the task scheduling overall performance.

VII. RESULTS

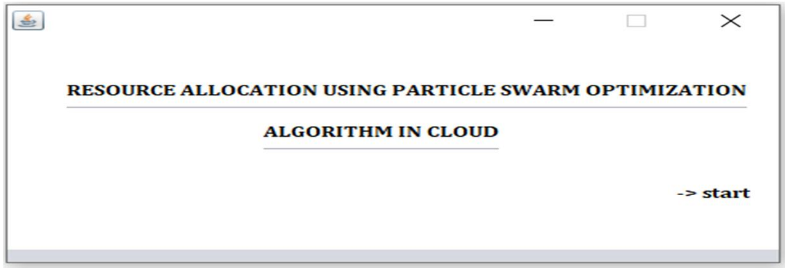

Fig 7.1 Home page

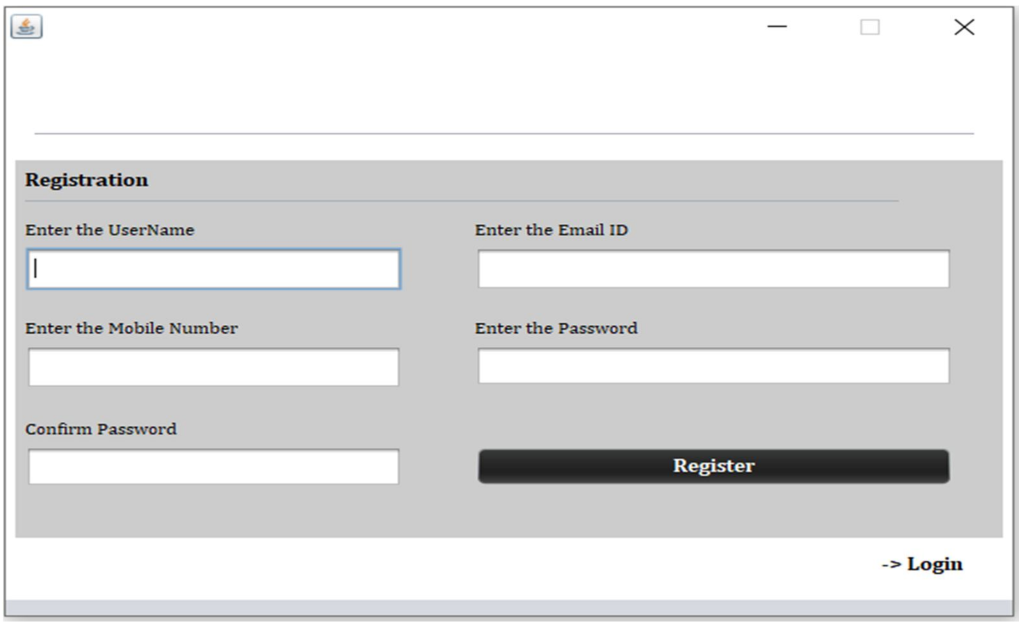

Fig 7.2 Registration page

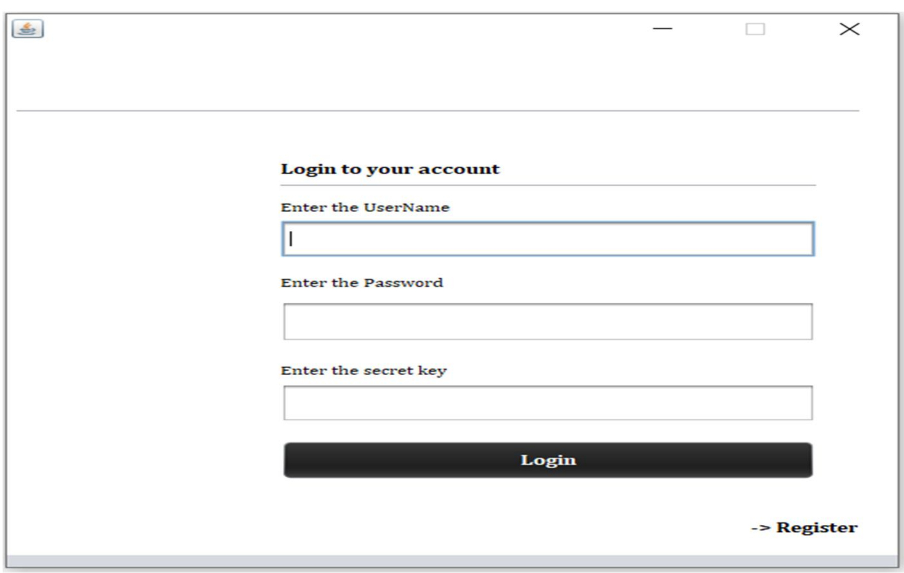

Fig 7.3 Login page

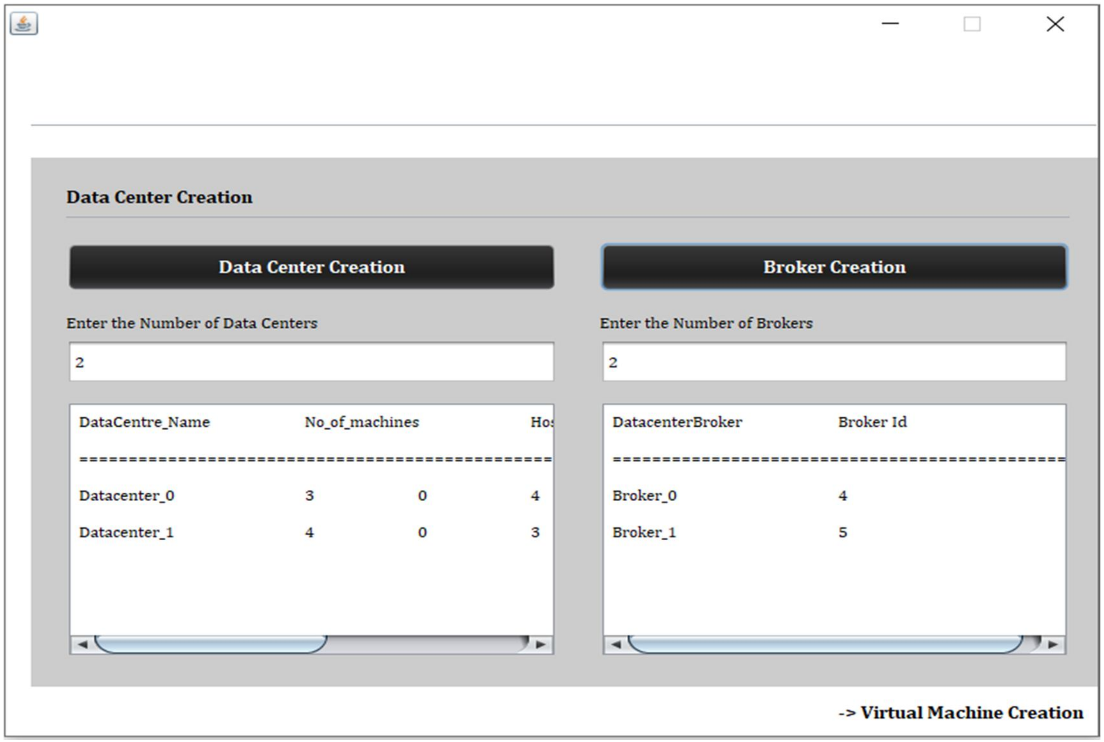

Fig 7.4 Initialization of Datacenters and Brokers

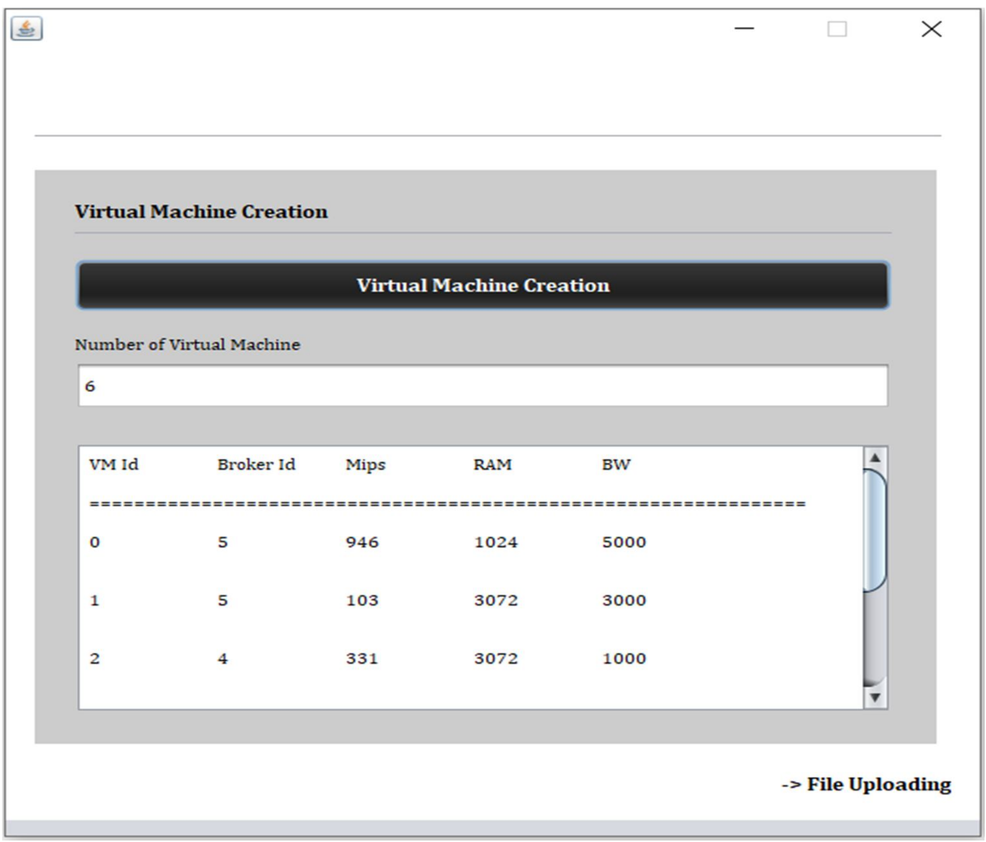

Fig 7.5 Initialization of VMs

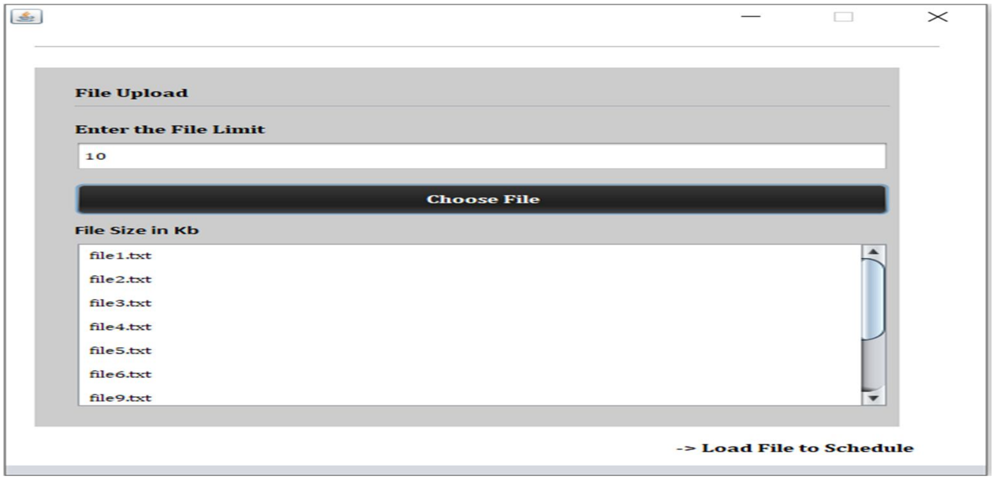

Fig 7.6 Uploads files

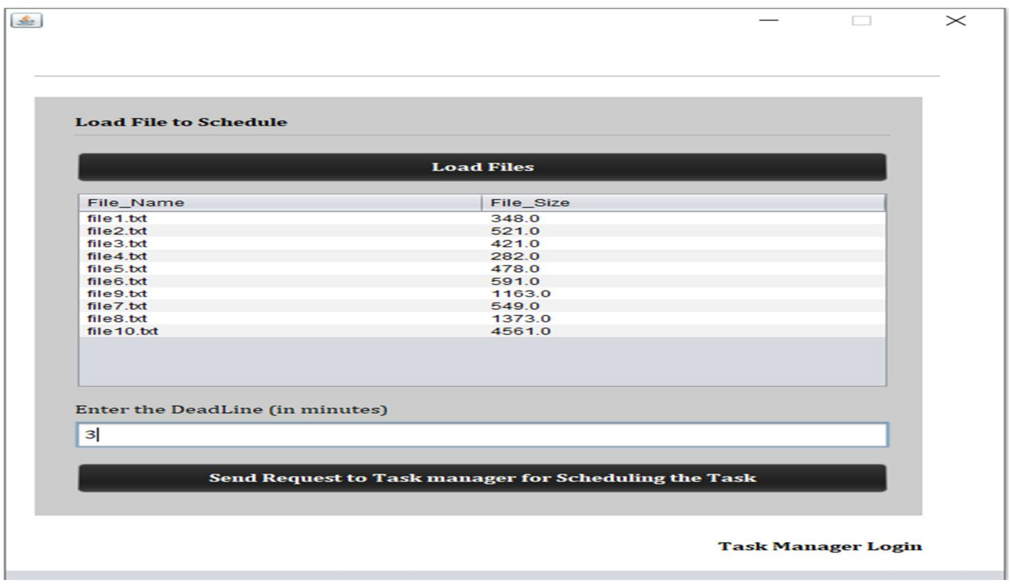

Fig 7.7 Load files to schedule

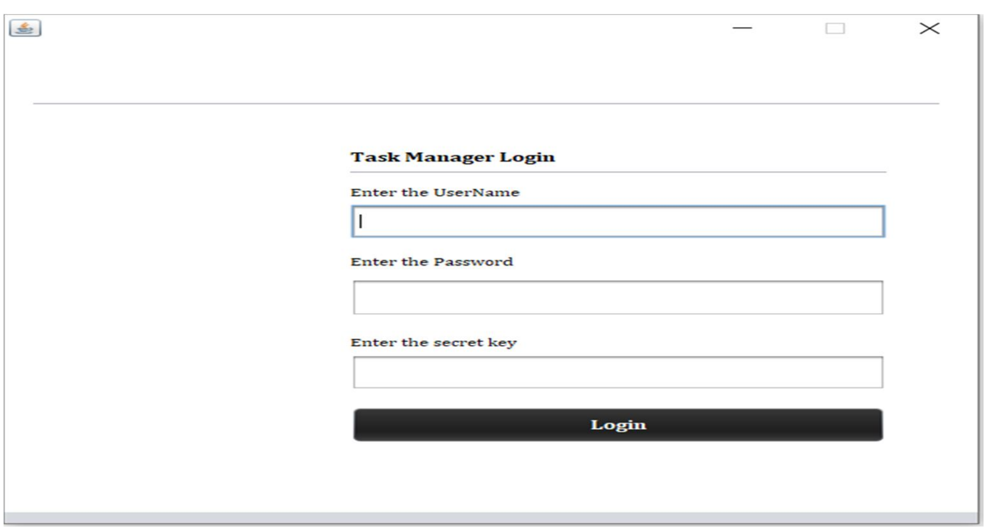

Fig 7.8 Taskmanager login

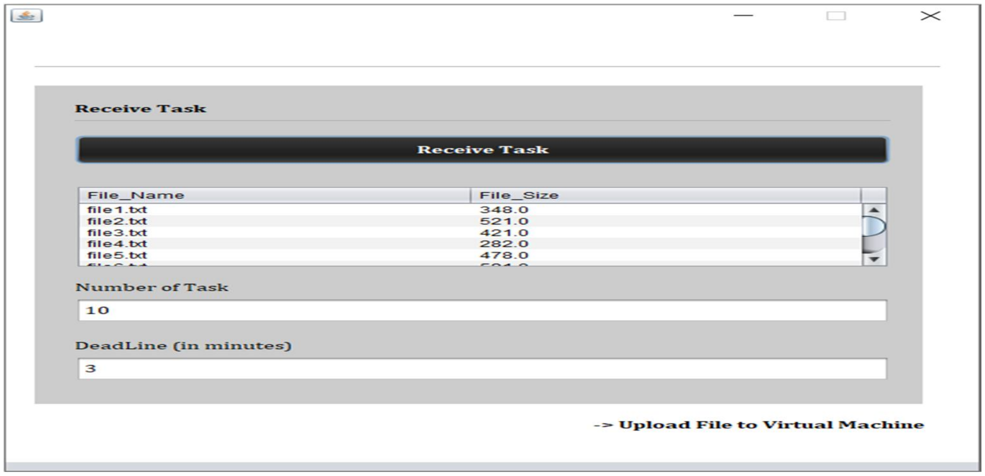

Fig 7.9 Receive tasks

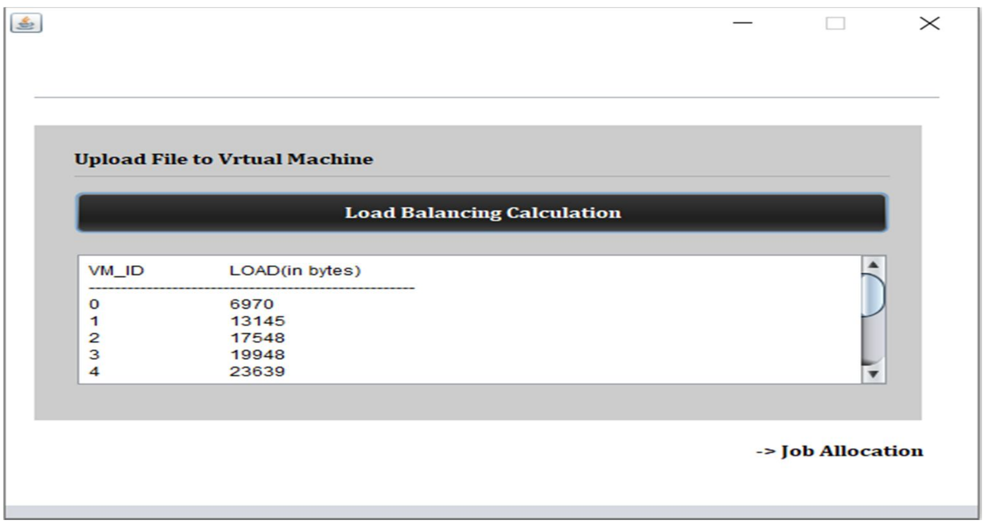

Fig 7.10 Load balancing

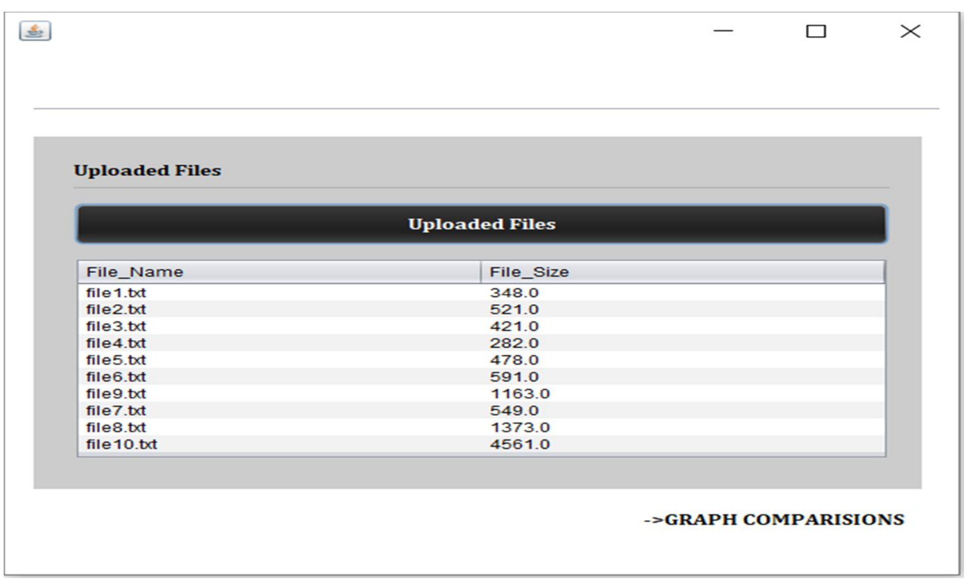

Fig 7.11 Files uploaded

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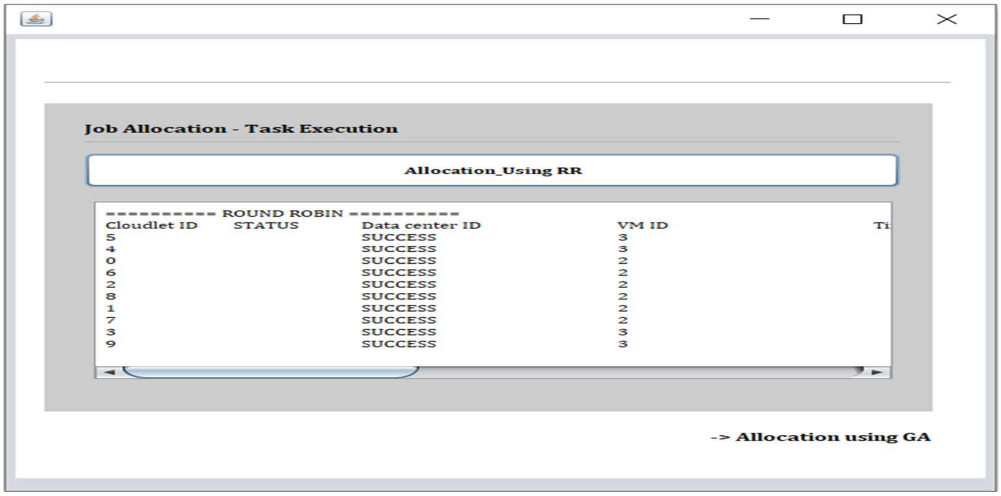


Fig 7.12 Allocation using Round robin

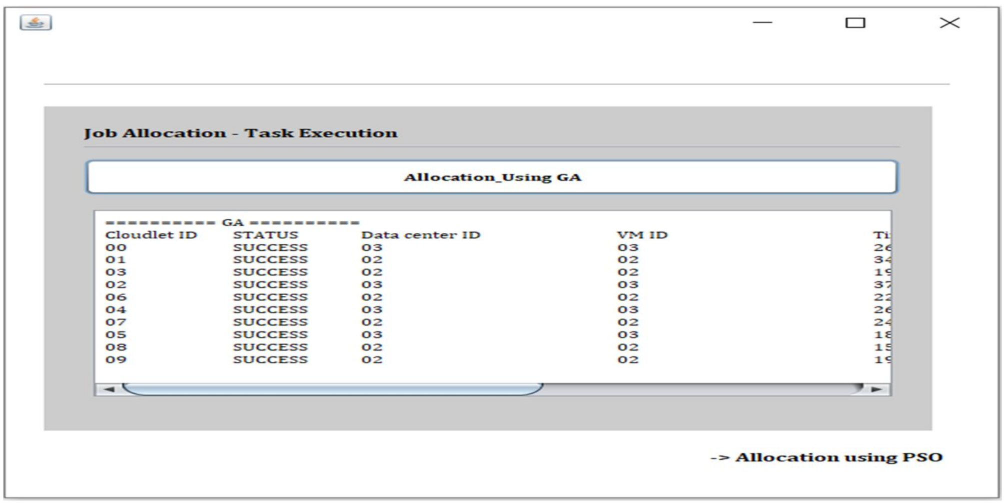


Fig 7.13 Allocation using Genetic algorithm

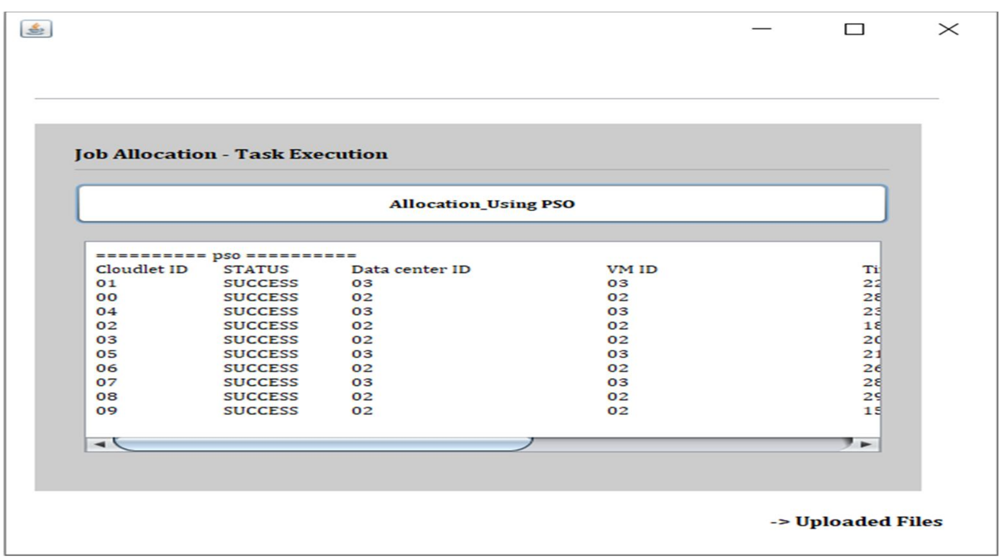
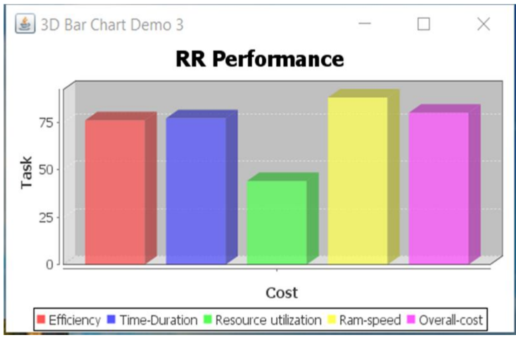
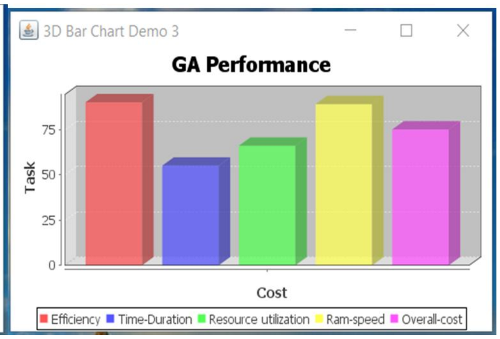
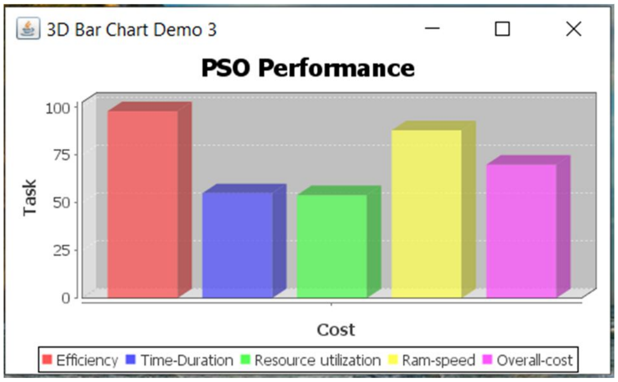
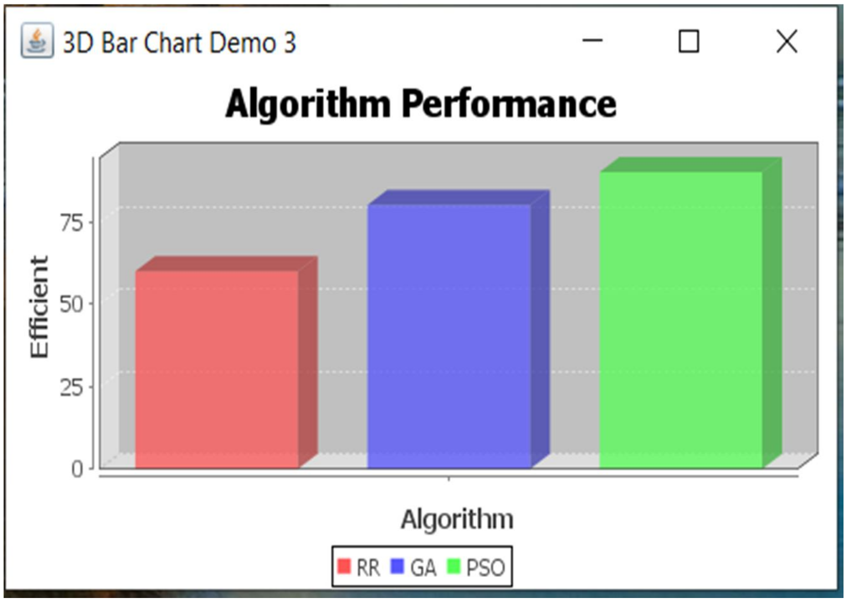


Fig 7.14 Allocation using PSO









VIII. CONCLUSION

This project effectively schedules work by reducing task completion time and cost while maximising resource utilisation. The cloudsim simulator is utilised in this research to effectively evaluate the task scheduling performance.

The proposed algorithm can be modified in the future to include the possibility of dynamic virtual machine characteristics using a run Genetic algorithm. Furthermore, more characteristics can be added based on the needs of the consumer.

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IX. ACKNOWLEDGEMENT

While bringing out this project to its final form, I came across a number of people whose contributions in various ways helped my field of research and they deserve special thanks. It is a pleasure to convey my gratitude to all of them. First and foremost, I would like to express my deep sense of gratitude and indebtedness to my supervisors Dr.E.Padmalatha and Mr.B.Ramana Reddy for his valuable encouragement, suggestions and support from an early stage of this research and providing me extraordinary experiences throughout the work. I am also thankful to the Head of the Department Dr. Y. Rama Devi for providing excellent infrastructure and such a nice atmosphere for completing this project successfully. Finally, I would like to take this opportunity to thank my family and friends for their support throughout this work. I also sincerely acknowledge and thank all those who gave directly or indirectly their support in completion of this work.

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