

Quality Assured Optimal Resource Provisioning and Scheduling Technique Based on Improved Hierarchical Agglomerative Clustering Algorithm (IHAC)

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Abstract: Resource allocation is the task of convenient resources to different uses. In the context of an resources, entire economy, can be assigned by different means, such as markets or central planning. Cloud computing has become a new age technology that has got huge potentials in enterprises and markets. Clouds can make it possible to access applications and associated data from anywhere. The fundamental motive of the resource allocation is to allot the available resource in the most effective manner. In the initial phase, a representative resource usage distribution for a group of nodes with identical resource usage patterns is evaluated as resource bundle which can be easily employed to locate a group of nodes fulfilling a standard criterion. In the document, an innovative clustering-based resource aggregation viz. the Improved Hierarchical Agglomerative Clustering Algorithm (IHAC) is elegantly launched to realize the compact illustration of a set of identically behaving nodes for scalability. In the subsequent phase concerned with energetic resource allocation procedure, the hybrid optimization technique is brilliantly brought in. The novel technique is devised for scheduling functions to cloud resources which duly consider both financial and evaluation expenses. The efficiency of the novel Resource allocation system is assessed by means of several parameters such the reliability, reusability and certain other metrics. The optimal path choice is the consequence of the hybrid optimization approach. The new-fangled technique allocates the available resource based on the optimal path.

Keywords: Resource allocation, resource discovery, Hierarchical Agglomerative Clustering, Global search optimization, Adaptive Genetic algorithm.

I. INTRODUCTION

In the domain of cloud computing, the computational resources are significantly implanted in the “cloud”. The related services and applications are furnished by means of the virtual machines functioning in the cloud platform. The resource allocation algorithm has been extensively explored in the modern investigation relating to the subject of collective communication and computing technologies [1]. A cloud, in quintessence, represents a unique category of parallel and disseminated mechanism encompassing a compilation of inter-related and virtualized computers which are energetically provisioned and offered as one or multiple unified computing resources in accordance with the service-level agreements generated by means of negotiation between the service provider and the consumers” and available as a composable service through web 2.0 technologies [5]. The up-and-coming cloud computing technique can be integrated into multimedia social networks to successfully address the related hassles. The corresponding multimedia clouds are well-equipped with the skills of storing, processing, and disseminating the live streaming by way of sharing the computation and communication resources in a social network scenario [2]. The cloud computing throws open the vast potential for the media content providers to transform the upfront infrastructure investment to working expenses levied by the cloud providers. For instance, the Netflix has been able to move its streaming servers to Amazon Web Services (AWS) [3]. A host of service providers boast of being endowed with the cloud computing (CC) solutions, in which a stream of virtualized and animatedly scalable computing power, storage, platforms, and the related services are offered on demand to customer by means of the Internet on a pay as you go basis [4].

The resource allocation in the domain of cloud computing presents further complicated problems vis-à-vis those in the parallel disseminated mechanisms such as the Grid computing platform, as it is imprudent to share the computing resources among the multiple applications concurring running atop it on account of the unavoidable reciprocal performance hindrance between them [6]. As of now, the cloud designs are plagued by a host of various hassles. A large majority of the cloud services created on top of a centralized structural design are likely to face rough weather as they encounter the denial-of-service (DoS) assaults, sudden outages, and restricted kitty of computational resources [7]. On the other hand, the corresponding corporations have initiated an architectural design taking cues from a host of commodity servers. Challenges relating to the processing crawled documents or rebuilding a web index are invariably segmented into various autonomous ancillary functions, scattered among the accessible nodes, and evaluated separately [8]. The ever-zooming intricacy of the IaaS paves the way for the consequential ineffective individual supervision and management, at times to the tune of making it unviable. Hence, in order to keep aloof from the direct management actions in resource allotment, VM provisioning, VM pricing, and supervision, it is essential to have effective self-management and self-optimizing systems [9]. In this regard, the mobile cloud has appeared as an ideal service model which entails the mobile devices to exploit the resource from the cloud dispensing with the need for any sort of complicated hardware and software setups at the device end. In view of the rocking mobility of the mobile users, it is highly essential to have the location based cloud resource provisioning with the motive of cutting down the end-to-end transmission hindrance [10].

Many an investigator has spotted ‘customer delight’ as the most effective forerunner to user reliability in market based science. As in the case of commercial settings like the cloud, the clients make payment for the utilization of services and consequently, the loyalty of the customer has a telling impact on the profitability of the service provider [11]. In this regard, the cloud model dispenses with the relative practice by providing automatic scale up and down in accordance with the load variation. In addition to scaling down the expenditure towards the hardware, it goes a long way in saving the precious electric energy, which is accountable for a considerable segment of the functional overheads in the titanic large data centers [12]. The cloud environment envisaged here is identical that of the PaaS model, in which the users are offered the facility of forwarding multifaceted, requests each one comprising the off-the-shelf web services. Each service is related with a price, which is allocated by its provider. When a user forwards a compute request (or a task) which needs other services, he has to make payment for the utilization of such services, the quantum of payment being decided by the quantity of resource which are to be utilized [13]. In the domain of Cloud computing, resources have to be energetically (re-)configured and bundled by means of virtualization to offer several service profiles as and when required. As the Cloud participants representing the clients, brokers, and providers are autonomous entities with diverse motives, strategies, and requisites, negotiation is a must to resolve their varied perspectives [14]. For the purpose of reaching an accord between the consumer and the provider for making use of the Cloud service, certain vital factors have to be taken into account, which are detailed as follows.

- 1) A prudent decision has to be taken regarding the time for availing the service.
- 2) Further, the cost of availing service has to be decided.

Although these are vital factors, it is unfortunate that no appropriate machinery seems to have been envisaging computerizing the negotiation of price and time slot for Cloud services till now [15].

II. LITERATURE SURVEY

With the help of mobile cloud computing, wireless body area networks may be considerably enhanced for the massive deployment of pervasive healthcare applications. However, several technical issues and challenges are associated with the integration of WBANs and MCC. In this article, Jiafu Wane *et al.* [16] proficiently proposed a cloud-enabled WBAN architecture and its applications in pervasive healthcare systems. Further, they have focused on the techniques for communicating critical sign data to the cloud by employing energy-efficient routing, cloud resource allocation, semantic interactions, and data security mechanisms.

The cloud computing has emerged as the novel paradigm of functioning in the domain of information technology. While cloud computing infrastructures possess several benefits, their energy utilization trend is causing grave concern. The data centers, which have habitually offered the infrastructure and resource pool for cloud computing, utilize a huge quantity of energy. Further, the up-and-coming energy utilization forecasts of the related data centers also have appeared as further grave concerns. In order to cutback this type of excessive energy utilization, the carbon footprint and greenhouse gas emission of cloud computing, and information technology in general, energy-efficient techniques of execution have to be properly assessed and followed. Moreover, the renewable energy utilization instead of the non-renewable is also capable of leading to considerable decrease in carbon emission. Nevertheless, in view of its intermittency and volatility, it is not at all possible to exploit the renewable energy to its full potential. In their investigation, Uttam Mandal *et al.* [17] proficiently proposed the renewable-energy-aware cloud service and virtual machine migration to relocate

energy demand by means of energetic and flexible cloud resource allocation methods, and assist in the reduction in challenges regarding renewable energy.

These days, the user-envisioned accomplishment maintains its supreme position as the most vital QoS indicator in the cloud-based data centers. In this regard, the efficient allotment of the virtual machines (VMs) to successfully tackle the CPU intensive and I/O intensive workloads has assumed as a critical performance administration skill in the virtualized clouds. It is an undeniable fact that several investigations have been conducted which are devoted to the evaluation and proper scheduling of diverse tasks among the VMs. Still, there are some deficiencies involved, as there is an absence of an all-inclusive comprehension of the performance phases which have a telling effect on efficacy and efficiency of the resource multiplexing and scheduling among the VMs. In their document, Xing Pu, *et al.* [18], excellently proposed the test investigation on performance interference in the parallel processing of the CPU-intensive and network-intensive workloads on the Xen virtual machine monitor (VMM). As per their investigation, they have finalized five vital findings which were very vital for the efficient performance administration and tuning in the virtualized clouds. At the outset, co-locating the network-intensive workloads in remote VMs resulted in incredible expenditure of the switches and events in Dom0 and VMM. Further, collocation of the CPU-intensive workloads in remote VMs led to superior CPU contention owing to the quick I/O processing in the I/O channel. Moreover, the management of the CPU-intensive and network-intensive workloads in combination necessitated the minimum resource contention, ushering in superior overall performance.

The cloud elasticity effectively facilitates the energetic resource provisioning in phase with the genuine application requirements. A host of feedback control techniques have been launched successfully for the purpose of allotting scarce resources effectively in the physical servers. Nevertheless, the cloud dynamics transforms the design of a precise and consistence resource controller a daunting task, particularly when the application-level efficiency is deemed as the calculated output. In fact, the application-level efficiency invariably depends on the nature of workload and is susceptible to the cloud dynamics. In order to effectively tackle the related hassles, Jia Rao *et al.* [19], remarkably green-signaled an innovative self tuning fuzzy control (STFC) technique, primarily designed for feedback time guarantee in the web servers to resource allotment in the virtualized scenarios. They effectively proposed novel techniques for the adaptive output amplification and adaptable rule choice in the STFC technique with the intention of realizing superior flexibility and consistency. In accordance with STFC approach, they brilliantly brought to limelight a novel two-pronged QoS provisioning structure viz. DynaQoS, which was able to effectively support the adaptive multi-objective resource allotment and service discrimination. Further, they accomplished an archetype of the DynaQoS on a Xen-based cloud testbed.

Balaji Palanisamy, *et al.* [20], brilliantly brought to light a novel MapReduce cloud service model, Cura, for provisioning cost-conscious MapReduce services in a cloud. By striking a different note from the modern MapReduce cloud services such as a generic compute cloud or a devoted MapReduce cloud, Cura boasted of a multitude of distinctive advantages. At the outset, Cura was devised to offer a cost-conscious solution to effectively handle MapReduce production workloads endowed with a considerable quantity of interactive jobs. Further, quite divergent from the modern services which invariably entailed the clients to determine the resources to be employed for the jobs, Cura controlled the MapReduce profiling to automatically generate the superior cluster configuration for the jobs. Whereas the modern models permitted only a per-job resource optimization for the jobs, Cura was competent to perform a globally effective resource allocation technique which considerably cut down the resource usage overhead in the cloud. Moreover, Cura was able to leverage distinctive optimization chances while tackling the workloads which could survive certain amount of negligence. By efficiently multiplexing the accessible cloud resources among the tasks in accordance with the job requisites, Cura realized considerably lower resource usage expenses for the tasks. Cura's core resource management techniques integrated the cost-aware resource provisioning, VM-aware scheduling and online virtual machine reconfiguration.

Onur Atan *et al.* [21] amazingly launched an innovative Video-based object or face detection services on mobile devices which attracted zooming enthusiasm, in view of the fact that video cameras were then ever-present in the entire mobile communication tools. In a strikingly distinctive environment for the related services, each mobile device captured and communicated video frames over wireless to a far-flung computing cluster (a.k.a. "cloud" computing infrastructure) which effectively carried out the heavy-duty video feature extraction and detection function for a major chunk of the mobile gadgets. However, a vital issue emerges from the relative environments on account of the immensely changing contention levels in the wireless communication, and also the modification in the task-scheduling jamming in the cloud. With an eye on enabling each tool to acclimatize the communication, the feature extraction and investigation constraints and incredibly increase its object or face identification tempo in the backdrop of the related contention and variation in overcrowding, they brilliantly brought in a methodical learning structure in accordance with the multi-user multi-armed bandits.

The Virtual Machine (VM) allotment for several tenants has emerged as a vital issue in furnishing effective infrastructure services in the cloud data centers. The tenants perform applications on their allotted VMs, and the network distance between the VM of a tenant would incredibly have a telling effect on the Quality of Service (QoS) offered to him. In their investigation, Jiaxin Li et al. [22], effectively elaborated and effectively devised the multi-tenant VM allotment issue in the cloud data centers, taking due account of varied VM needs of diverse tenants, and briskly brought in the allotment objective of scaling down the total diameters of the VM network in respect of the entire tenants. Further, they deftly designed an innovative Layered Progressive resource allotment technique for the multi-tenant cloud data centers as per the Multiple Knapsack Problem (LP-MKP), which effectively employed a multi-stage layered progressive approach for the multi-tenant VM allotment and successfully tackled the unrefined tenants at each and every phase. Thus the abridged resource segmentation in the cloud data centers was instrumental in bringing down the divergences in the QoS among tenants, and considerably enhancing the tenants' overall QoS in the cloud data centers.

III. PROBLEM IDENTIFICATION

The cloud computing has achieved unprecedented advancement in its progress with momentum mounting up in phase with the ever-zooming enjoyment of the ever-present web services. It is endowed with the skills of providing the easiest access to the documents, pictures and the media on cloud storage with the help of the internet services. On the back of continued victory in the domain of technology, the specialists are perturbed by the zooming safety requisites of the cloud computing scenario. In fact, several entities have made valiant efforts to effectively fix the cloud computing security concerns and the common challenges encountered in this regard are discussed as follows.

- ❖ In the confidential cloud computing scenario also, it becomes essential to confide in the cloud provider for the private data storage.
- ❖ The providers exemplarily performing the duty of safeguarding the secrecy of the customer data from outsiders, taking special care to ensure that even their own technical staff is kept aloof, with no access to the secret data of the clients.
- ❖ In fact, there are two vital problems encountered by the client at the time of availing the facility of cloud computing services. The major concern revolves around the hacking challenges both from within and from outside. The other challenge causing concern is the non-viable nature of encryption of the entire data, without taking due account of its secrecy level.
- ❖ In the modern [16], the performance of the QoS of cloud-enabled WBANs is found to be not up to the expected levels. Thus, the cloud-enabled WBANs have turned out to be non-appealing in view of the gigantic attention and investigation efforts required.
- ❖ In the modern [17], it fails to take due account of the diverse optical layer network architectures. Moreover, it leads to an excessive utilization of energy the network.

The drawbacks of several modern methods detailed in the foregoing section have provided sufficient inspiration needed to perform the current investigation

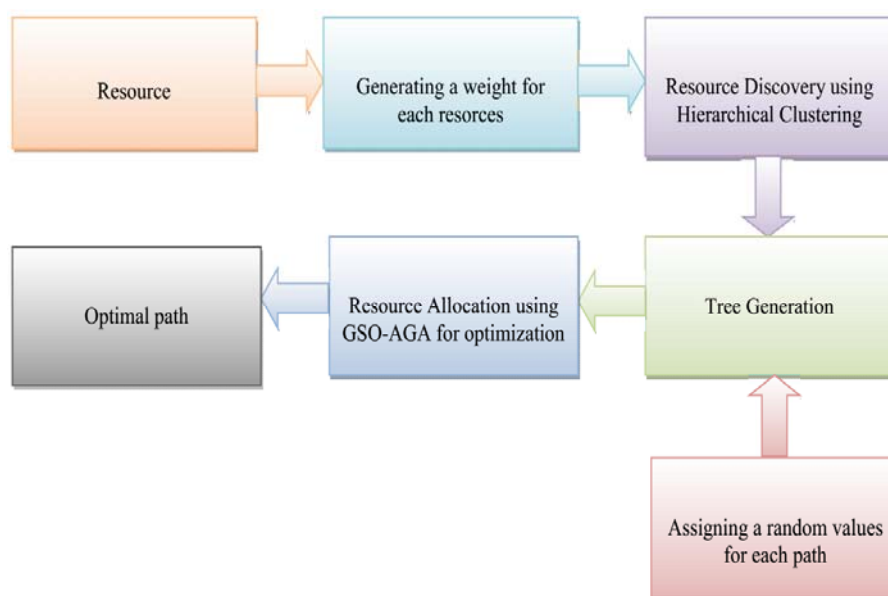


Fig 1. Block Diagram for Proposed GSOAGA

IV. PROPOSED METHODOLOGY

The cloud computing has emerged as an appealing computing model as it permits the provision of resources as and when demanded. In the Cloud system, the resource discovery represents the important procedure for locating the appropriate resources as per the application needs. In this regard, a host of techniques and algorithms are in the pipeline to locate the resources in the cloud scenario. The underlying motive behind the current investigation is targeted at identifying the resources and apportioning them in a cost-conscious method. The innovate techniques encompasses various phases such as the 1) Resource discovery and 2) Resource allocation 3) Quality Assurance. In the initial phase, a representative resource usage distribution for a group of nodes with identical resource usage patterns is evaluated as resource bundle which can be easily employed to locate a group of nodes fulfilling a standard criterion. In the document, an innovative clustering-based resource aggregation viz. the Improved Hierarchical Agglomerative Clustering Algorithm (IHAC) is elegantly launched to realize the compact illustration of a set of identically behaving nodes for scalability. In the subsequent phase concerned with energetic resource allocation procedure, the hybrid optimization technique is brilliantly brought in. The novel technique is devised for scheduling functions to cloud resources which duly consider both financial and evaluation expenses. The efficiency of the novel Resource allocation system is assessed by means of several parameters such the reliability, reusability and certain other metrics. The novel segment is well-executed in the CloudSim along with Java.

A. Resource Discovery

At the outset, weights are generated arbitrarily for each node in the resource. The innovative technique generates the tree structure in accordance with the weights. At present, the adapted hierarchical agglomerative clustering technique is used for the tree structure which is concisely detailed below.

1) *Modified Hierarchical Agglomerative clustering algorithm*: The hierarchical clustering successively segregates a dataset with a specific distance measure. In this sequential separation procedure, an algorithm builds nested partitions layer by layer by means of grouping objects into a tree of clusters entirely in accordance with the distance measure without the necessity to recognize the number of clusters well-ahead. There are two techniques to a tree of clusters such as the Agglomerative Hierarchical clustering algorithm or AGNES (bottom up) and the Divisive Hierarchical clustering algorithm or DIANA (top down). Both these techniques are exactly the reverse of each other. The top down approach assumes that all objects in a dataset are initially in a distinct cluster and subsequently the cluster is repeatedly segmented into smaller and smaller clusters until a stopping criterion is satisfied. In contrast, the bottom up approach, well-known as the agglomerative technique, assumes that all objects in a dataset are atomic clusters of a particular element. Subsequently, all the atomic clusters unite to form into a bigger cluster. Our novel approach follows the Agglomerative Hierarchical clustering technique. With an eye on augmenting the efficiency in performance of the conventional agglomerative technique, the adapted Agglomerative Hierarchical clustering algorithm is employed. At this juncture, clustering of each node is in accordance with the minimum distance with the random weight. The specific procedure of the adapted hierarchical agglomerative clustering algorithm with example is shown as follows.

Input: No of nodes with random weight

Output: Cluster hierarchy or dendrogram

Initialization: Number of node (E_i , where $i=1,2,..k$)

Random weights (w_i)

Disjoint clustering level $L(0) = 0$

Sequence number $n = 0$.

Start

Step 1: Assess all pair-wise distances among nodes

Add each node as its own cluster

Step 2: Erect a distance matrix by means of the distance values

$D_c [(E_1), (E_2)]$

Step 3: Pair the node with the shortest distance

$E = (E_1 \cup E_2)$ // Merge the node

Step 4: increase $e=e+1$,

Set the level to $L(e) = d_c [(E_1), (E_2)]$

Step 5: Revise the distance matrix

Distance between the new clusters

$D_c [(E_3), (E)] = \min (D_c [(E_3), (E_1)], D_c [(E_3), (E_2)])$

Step 6: Replicate till the distance matrix is decreased to a single element

Stop

Example:

Let us take the case of a resource consisting of five nodes. Now each node is characterized as E1, E2, E3, E4 and E5. At the outset, we generate the random weight for each of the five nodes. Thereafter, we proceed to create the tree according to the weight by means of the agglomerative hierarchical clustering technique.

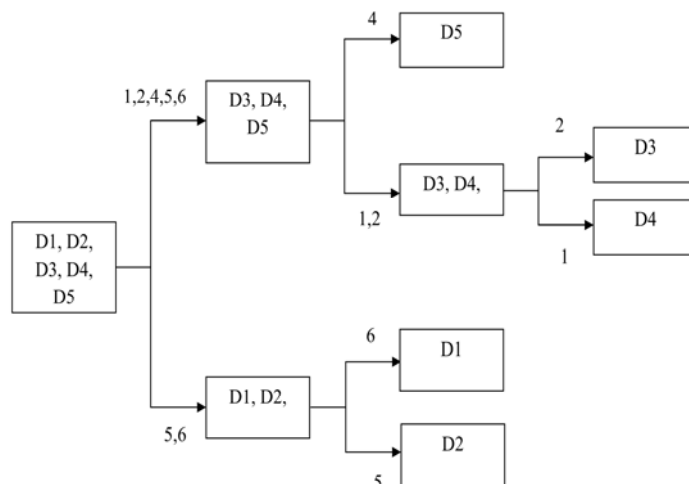


Fig.2. Modified agglomerative hierarchical clustering algorithm

At this juncture, the arbitrary weights like 1, 2, 3, 4 and 5 are chosen. The clustering among the nodes is in accordance with the distance and the weight. Here, nodes E3 and E4 represent the minimum weights so that they are clustered together (E3, E4). Likewise, as nodes E1 and E2 characterize the minimum weights they are grouped together (E1, E2). Subsequently, the new group (E3, E4) and node E5 encompass the minimum weight and hence a novel group or cluster (E3, E4, and E5) is generated. In the long run, all the nodes are grouped together to form a single cluster (E1, E2, E3, E4, and E5). Now, phase two is performed after the tree generation.

B. Resource Allocation

In this phase, in accordance with the hybrid optimization technique, the resource is assigned. To allocate the resource for the task, we generate the random value for each path in the tree construction with an eye on locating the best path. Each path in the tree construction generates arbitrary values ranging from 0 to 1. These paths are optimized with the help of the hybrid optimization technique. In this resource allocation phase will perform the hybrid optimization technique with the aid of GSO-AGA.

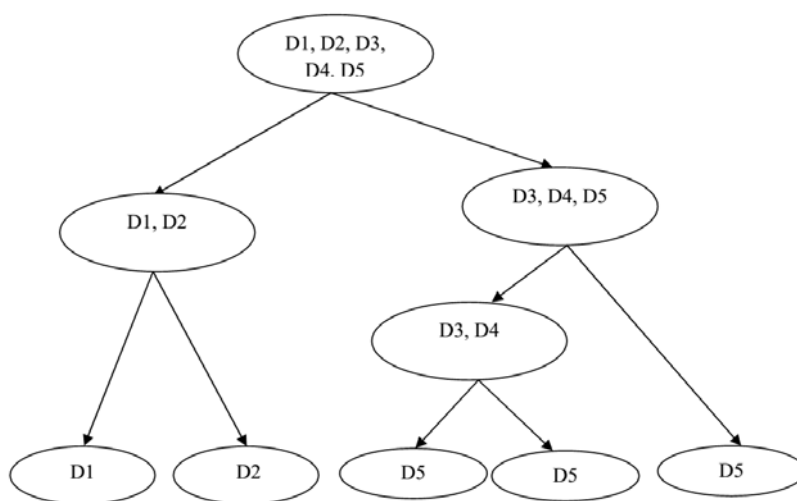


Fig.3. The tree construction with path root

Path1: (D1)-(D1D2)-(D1D2D3D4D5)

Path2: (D2)-(D1D2)-(D1D2D3D4D5)

Path3: (D3)-(D3D4)-(D3D4D5)-(D1D2D3D4D5)

Path4: (D4)-(D3D4)-(D3D4D5)-(D1D2D3D4D5)

Path5: (D5)-(D3D4D5)-(D1D2D3D4D5)

In our ground-breaking technique, we allot the random values for each path after locating the path for the entire leaf node. Our tree structure comprises five paths, each path allotting the random values in the range of zero to one. Subsequently the paths are optimized with the help of the hybrid artificial bee colony coupled with cuckoo search algorithm. The detailed procedure of the hybrid optimization is explained below.

Path1: (D1)-(D1D2)-(D1D2D3D4D5) → 0.5

Path2: (D2)-(D1D2)-(D1D2D3D4D5) → 0.7

Path3: (D3)-(D3D4)-(D3D4D5)-(D1D2D3D4D5) → 0.9

Path4: (D4)-(D3D4)-(D3D4D5)-(D1D2D3D4D5) → 0.2

Path5: (D5)-(D3D4D5)-(D1D2D3D4D5) → 0.4

The various paths are achieved by employing the above two phases. For allotting the resources, an optimal path is required as the time utilized is high while employing several paths. From the number of paths, the optimal path is found out by means of a hybrid optimization algorithm. The hybrid optimization represents the blend of the artificial bee colony algorithm (ABC) and the cuckoo search (CS) algorithm which offers the optimal paths for resource allocation in accordance with the best nodes.

1) *Optimization using Hybrid GSO-AGA Algorithm*

GSO Algorithm

The Group search optimization technique is designed duly inspired by the searching behaviour of animals, which is fundamentally intended for the purpose of effectively resources which consist of food and shelter. In this novel technique, the population is labeled as a group and the individuals staying within the group are called the members, which are subdivided into three distinct types such as the producers, the scroungers and the rangers. The actions of the producers and the scroungers are invariably dependent on the PS model. On the other hand, the rangers move about in a random way.

Producers: They are entrusted with the task of going in search for resources.

Scroungers: They elegantly link the resources, located by the producer.

Rangers: They represent the members who move in a random way and carry out the investigation in an orchestrated manner, with the intention of locating resources effectively.

In the course of each and every single period of investigation, the producer emerges as the member located at the utmost dynamic location, and comes out successful in ushering in an excellent fitness value. The producer efficiently scans the environments to detect the resources, by rotating its head in several degrees. In other words, it is competent to scan at zero degree, at right hand side hypercube and also at left hand side hypercube. The producer's head tends to turn to zero degree in cases, when the producer lacks the skills to identify a superior position.

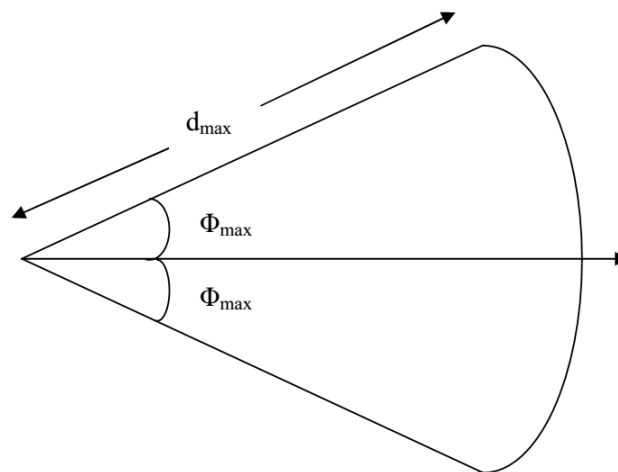


Fig 4. Producer scanning field

Φ_{max} represents the maximum search angle and d_{max} denotes the maximum search distance. Fig.2 beautifully depicts the scanning field over which the producer carries out the scanning function. The producer's position is revealed with the apex. When the investigation process in the GSO is performed, the scrounger or the ranger

acquires the opportunity to locate a better position than that of the current producer or other members in the course of the time the producer finds it difficult to locate the better position. A scrounger or a ranger which has located the better position emerges as the producer in the succeeding investigation session. Further the producer and the parallel members in the earlier investigation session takes up assignment of performing the scrounging task.

Initialize the search solution as well as the head angle:

The solution which is obtained after the search takes into account the thickness, period, the wall size and the temperature which are applied.

$$Z_i = \begin{bmatrix} z_{11} & z_{12} \dots z_{1m} \\ z_{21} & z_{22} \dots z_{2m} \\ z_{n1} & z_{n2} \dots z_{nm} \end{bmatrix} \tag{1}$$

For each and every individual, the head angle is expressed as per Equation (2) shown below.

$$\Psi_i^s = (\Psi_{i1}^s \dots \Psi_{i(n-1)}^s) \tag{2}$$

The member's direction of search depends on the head angle and it is expressed by means of the following Equation (3).

$$L_i^s(\Psi_i^s) = (l_{i1}^s \dots l_{i(n)}^s) \tag{3}$$

Polar and Cartesian coordinate transformation is effectively used to evaluate the direction of search in accordance with the head angle.

$$L_{i1}^s = \prod_{p=1}^{n-1} \cos(\Psi_{ip}^s) \tag{4}$$

$$L_{ij}^s = \sin(\Psi_{i(j-1)}^s \prod_{p=j}^{n-1} \cos(\Psi_{ip}^s)) \quad \text{where}(j = 2..n-1) \tag{5}$$

$$L_{in}^s = \sin(\Psi_{i(n-1)}^s) \tag{6}$$

Fitness function

The Optimization in the mathematical modeling is easily carried out by means of the sigmoid function, when it is integrated in the procedure involving the GSO The extent of flaws in the mathematical model is effectively estimated as the difference between the original value and the attained value.

$$fitness = \min \sum_{i=1}^s \text{random values for each path} \tag{7}$$

Find the producer Z_p of the group:

The member with the best fitness of Z_i is known as the producer and it is represented as Z_p.

• **Producer performance**

In the course of performance of the GSO technique, the action of the producer Z_p at 's' iteration is represented below.

(i) The producer carries out the scanning function at zero degree.

$$Z_z = Z_p^s + \varepsilon_1 d_{\max} L_p^s(\Psi^s) \tag{8}$$

(ii) The producer carries out the scanning function at the right hand side hypercube

$$Z_r = Z_p^s + \varepsilon_1 d_{\max} L_p^s \left(\Psi^s + \varepsilon_2 \frac{\Phi_{\max}}{2} \right) \tag{9}$$

(iii) The producer executes the scanning task at the left hand side hypercube

$$Z_l = Z_p^s + \varepsilon_1 d_{\max} L_p^s \left(\Psi^s - \varepsilon_2 \frac{\Phi_{\max}}{2} \right) \tag{10}$$

Where, ε_1 represents a usually disseminated arbitrary number with zero mean and unity standard deviation and ε_2 indicates the homogeneously distributed arbitrary sequence which assumes values in the range of 0 and 1..

The maximum search angle Φ_{\max} is illustrated by means of Equation 11 shown as follows.

$$\Phi_{\max} = \frac{\pi}{c^2} \quad (11)$$

Now, the constant c is illustrated as per the following Equation 12.

$$C = \text{round}(\sqrt{n+1}) \quad (12)$$

Where, n represents the dimension of the search space.

$$\therefore \Phi_{\max} = \frac{\pi}{n+1} \quad (13)$$

The evaluation of maximum search distance d_{\max} is carried out by means of Equation 15 shown below.

$$d_{\max} = \|d_U - d_L\|$$

$$d_{\max} = \sqrt{\sum_{i=1}^n (d_{Ui} - d_{Li})^2} \quad (14)$$

Where, d_{Ui} and d_{Li} illustrate the upper and lower limits of i th dimension, correspondingly.

The best location consisting of the most advantage resource is attained with the help of equations (9), (10) and (11). The present best location assumes a new best location, if its resource is found to be inferior to that in the new location. Otherwise, the producer preserves its location and turns its head in accordance with the head angle direction which is randomly created by means of the following Equation (16).

$$\Psi^{s+1} = \Psi^s + \varepsilon_2 \tau_{\max} \quad (15)$$

Where, τ_{\max} illustrates the maximum turning angle which is effectively evaluated by means of Equation 17 shown below.

$$\tau_{\max} = \frac{\Phi_{\max}}{2} \quad (16)$$

When the producer finds it very difficult to spot a superior location even after the conclusion of m iterations, its head begins to regain its initial location as expressed in the following equation (18).

$$\Psi^{s+c} = \Psi^s \quad (17)$$

• **Scrounger performance**

In all the iterations, many members with the exception of the producer are selected and labelled as the scroungers. The scrounging behavior of the GSO habitually includes the area copying task. In the course of the s th iteration, the function of area copying which the i th scrounger carries out may be shaped as a movement to arrive at the producer in an intimate manner, which is illustrated by means of the following Equation 19.

$$Z^{s+1} = Z_i^s + \varepsilon_3 o(Z_p^s - Z_i^s) \quad (18)$$

Where, o specifies the Hadamard product which evaluates the product of the two vectors in an entry-wise manner and ε_3 denotes a uniform random sequence lying in the interval of (0, 1). The i th scrounger continues its searching activity to make a choice of the better occasion for linking. The designing of the scrounging action involves the turning of the head in the i th scrounger to a novel and arbitrarily generated angle as illustrated in equation (16).

• **Ranger performance**

The rangers stay behind as the residual members of the group, which are relocated from their existing position. They are also capable of effectively locating the resources by means of arbitrary walks or an orchestrated investigation process. The arbitrary walks are desired in cases, where the resources are located for

the purpose of dissemination. The head angle and the distance related to the ranger are produced in an arbitrary manner. As a substitute for the ranger performance an innovative Adaptive genetic algorithm is elegantly launched.

2) *Weight Optimization Using Adaptive Genetic Algorithm:* The novel Adaptive genetic algorithm is used to optimize the weights. The conservative genetic algorithm is improved with the assistance of the mutation operator. In the innovative approach, at the outset, the population is generated arbitrarily and two individuals are thereafter chosen in accordance with the fitness. In case A possesses fitness superior to that of B, then A is chosen, ignoring B. Nevertheless, they reproduce to create one or multiple offspring. Subsequently, the offspring is mutated arbitrarily. The procedure is carried on till an appropriate solution is arrived at or a specified number of generations have passed, in accordance with the requirements of the user.

Generation of chromosomes

The initial solutions are generated randomly and each solution is termed as the gene. The individual genes are incorporated as chromosomes and it is called the solution set. The numbers of genes are included with the chromosomes and the solution set for the population is created. The population of the genetic algorithm encompasses the chromosomes and the population size is activated as permanent. The numbers of solutions are activated ohm accordance with the typical genetic technique. In this case, the initial solutions are called the weight.

Cross over

In the cross over, the two parent chromosomes are chosen with the intention of exchanging their genes between them. The following example illustrates the parent chromosomes parent 1 and parent 2.

1	2	3	1	2	3	1	2
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Parent 1

3	2	1	3	2	1	3	1
---	---	---	---	----------	----------	----------	---

Parent 2

In parent 1 & 2 chromosomes, the bold lettered remain without any modification in their locations and the remaining gene of the chromosomes is exchanged between the parent chromosomes. Subsequent to the crossover, the chromosome takes the following shape.

1	2	3	1	2	1	3	2
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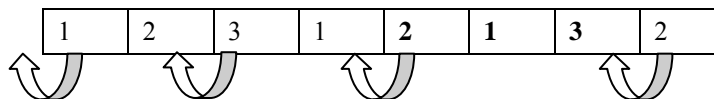
New chromosome 1

3	2	3	1	2	1	3	1
---	----------	----------	----------	---	---	---	---

New chromosome 2

Mutation

Subsequent to the crossover, the new chromosome is transformed for augmenting the effectiveness of the solution and the bold depicts the transformed gene of the chromosome. In the novel mutation process, the matching order is selected within the offspring and it is exchanged from its position to other place for achieving the most brilliant optimal solution. The shift varying mutation approach is used in the mutation function and the orders of each chromosome are moved to leave one step and replaced by the new order. After the shift the modifications within the off-spring are exhibited below.



Mutation process

From the above the gene of the off spring is moved one step left and the adapted new solution is achieved by the mutation procedure. The optimal solution is attained after completion of the mutation function and it illustrates the ultimate output of the outcome with their minimal optimized time, yielding the least make span duration.

Optimal Solution

When the mutation function is completed, the new chromosomes are generated for the new solution sets. Later on, the fitness value is evaluated for the new solutions. The solution which offers the best value is

shortlisted and is considered as the optimal solution. Otherwise, the processes mentioned above are repeated for the new solution sets.

In the long run, we arrive at the optimal path from the hybrid GSO with AGA algorithm. Now each optimal path is home to a number of optimal nodes. If a new task emerges for the allocation of the resource, the innovative technique employs the optimal path in which the best nodes are shortlisted for the new task. With an eye on selecting the best nodes, the performed techniques deploy the resource cost, time and memory capacity. In accordance with this, the innovative technique allots the

V. RESULTS AND DISCUSSION

The innovative resource discovery and resource allocation with modified hierarchical agglomerative clustering employing hybrid GSO with AGA is performed in the working platform of JAVA with CloudSim. The cost and memory values are also estimated and its average value is contrasted with that of the current method. The table appearing below illustrates the cost value of our hybrid GSOAGA.

TABLE.1. No of iteration with the cost value of the HGSOAGA

No of Iterations	Cost value of HGSOAGA
15	4.75647634
30	4.457324164
45	4.2546516741
60	4.014187456

Now the number of iteration of the innovative HGSOAGA technique is altered and the cost value of for each iteration is calculated. Table 1 illustrates that the GSO and the AGA have the least cost value when it completes the iteration 45. The average cost value of the innovative HGSOAGA technique is 4.25, thus it is able to attain the least cost value. The pictorial depiction of the cost value for the innovative technique is presented below.

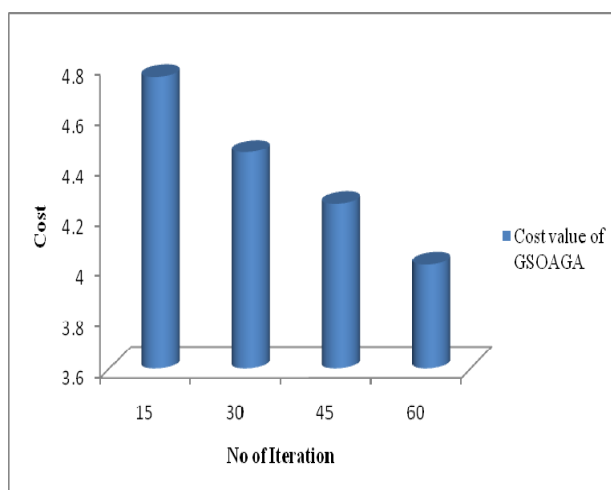


Fig 5. Cost value of proposed GSOAGA

Table 3 represents the memory value of iteration in the innovative technique. In the 15th iteration the memory value of the Global search algorithm and Adaptive Genetic algorithm is 9864185 and in the 30th iteration the memory allotted for the HGSOAGA is 10000141. So the innovative technique utilizes the least memory allocation for the number of iteration for each resource.

TABLE.2. The memory value of the GSOAGA

No of Iterations	Memory
15	9864185
30	10000141
45	12345415
60	13546541

The pictorial depiction of Table.3 is given below. Here x axis represents the number of iterations and y axis represents the memory value.

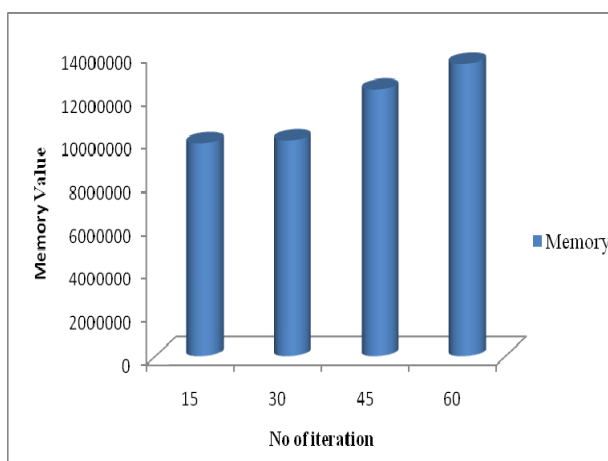


Fig 6. Memory value of proposed HGSOAGA

TABLE.3. Time taken for the proposed HGSOAGA

No of Iterations	Time
15	9654
30	11654
45	18954
60	31451

Table 4 reveals the time taken for each iteration based on seconds. To finish the 15th iteration the innovative technique spends 9654 seconds. The corresponding value for finishing the 45th iteration is 18954 seconds. The novel approach finishes the 60th iteration in 31451 seconds. The average time duration taken to finish the HGSOAGA technique, the time taken is about 18954 seconds. The graphical illustration is exhibited in Fig.7.

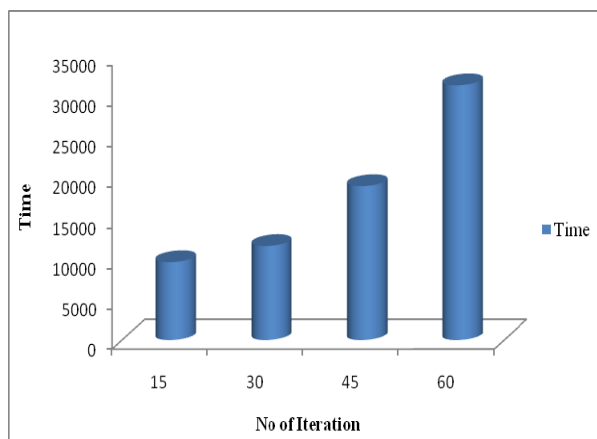


Fig 7. Time value of proposed HGSOAGA

TABLE.4. Throughput value of HGSOAGA

No of Iterations	Throughput
15	814
30	963
45	793.25
60	719

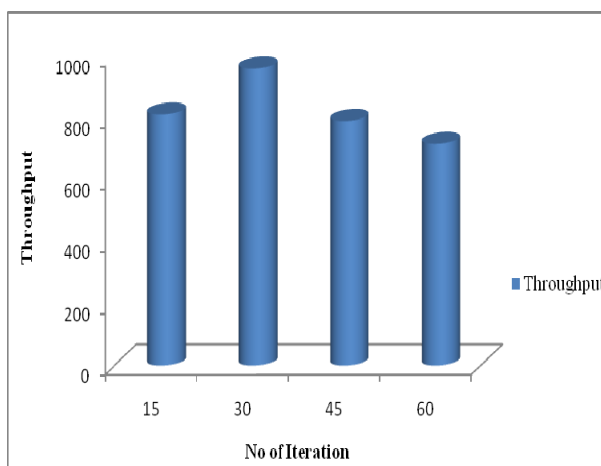


Fig 6. Throughput value of proposed HGSOAGA

The general throughput value of the HGSOAGA is 814. The tabulation of the innovative throughput value and their related graphical illustration is presented in Fig.8. The throughput value ranges from 0 to 814 in the 15th iteration. When the HGSOAGA technique arrives at the 45th iteration the throughput value ranges from 0 to 793.25. Hence, by modifying the number of iteration the throughput value of the HGSOAGA also undergoes change.

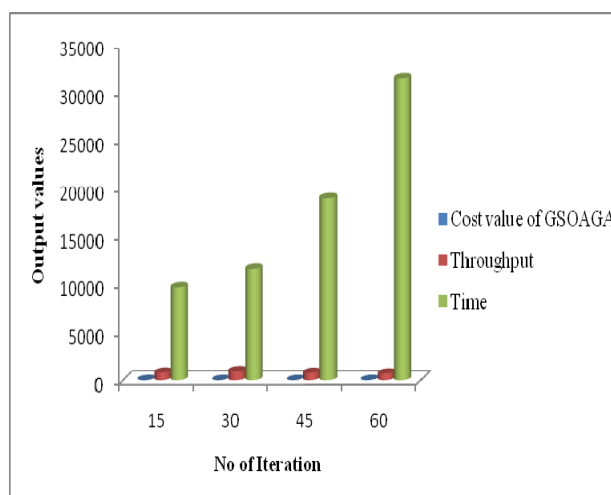


Fig 7. No of iteration vs. throughput cost and time

Fig.7shows the graphical illustration of number of iteration vs. throughput, cost and time. In the number of iteration the cost value for the innovative technique is minimum and the time utilization for each iteration is exhibited in Fig.7.

A) Comparative Analysis

Here the existing works are compared with our proposed work, in order to prove the proposed work is better one. For this existing [19] is taken to compare the result with our method The following table is shown the comparative result. The graphical representation of comparative analysis is shown in fig.8.

TABLE.5. Comparison result of proposed method

Metrics	Existing method	Proposed method
Execution time (s)	129855	17928

Here Fig.8 illustrates the graphical representation of comparative analysis. It is shown in below,

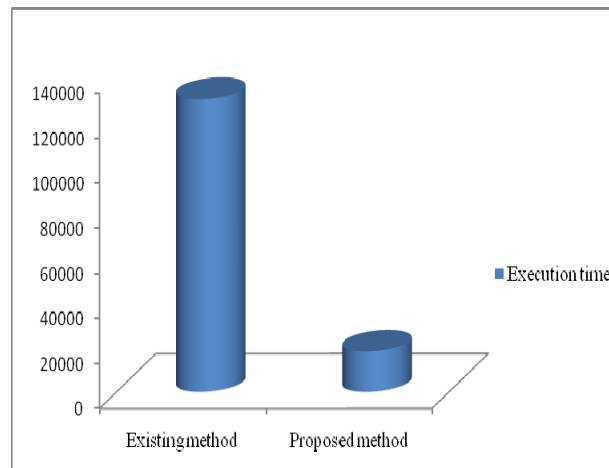


Fig 9. Comparative analysis of proposed method

From our results of comparison, we can say that our proposed work rescues the execution time. The existing work [20] is taken 129855 seconds to complete our proposed HGSOAGA takes minimum execution time. It takes nearly 17928 seconds to complete the clustering process. From these existing works, we can say that our proposed reduces the execution time when compared to the existing method.

VI. CONCLUSION

In this register the optimal resource discovery and dynamic resource allocation are proposed. At the outset, the resources are located in conformity with the adapted hierarchical agglomerative clustering algorithm (MHAC) and the tree construction is carried out. Eventually the resources are allocated with the help of the hybrid optimization algorithm and in this investigation; the Global search algorithm with Adaptive genetic algorithm are consider to be hybrid. In our technique, the Global search algorithm with Adaptive genetic algorithm is used to optimize the path and modify. It is clear from the captivating outcomes that the available resources are allocated in the most effective manner with least computation duration. It is hoped that the upcoming investigator will have ample opportunities to facilitate with their own optimization approach and scale newer heights of excellence in performance.

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