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Cloud Service Selection System Approach based on QoS Model: A Systematic Review

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Abstract— The Internet of Things (IoT) has received a lot of interest from researchers recently. IoT is seen as a component of the Internet of Things, which will include billions of intelligent, talkative "things" in the coming decades. IoT is a diverse, multi-layer, wide-area network composed of a number of network links. The detection of services and on-demand supply are difficult in such networks, which are comprised of a variety of resource-limited devices. The growth of service computing-related fields will be aided by the development of new IoT services. Therefore, Cloud service composition provides significant services by integrating the single services. Because of the fast spread of cloud services and their different Quality of Service (QoS), identifying necessary tasks and putting together a service model that includes specific performance assurances has become a major technological problem that has caused widespread concern. Various strategies are used in the composition of services i.e., Clustering, Fuzzy, Deep Learning, Particle Swarm Optimization, Cuckoo Search Algorithm and so on. Researchers have made significant efforts in this field, and computational intelligence approaches are thought to be useful in tackling such challenges. Even though, no systematic research on this topic has been done with specific attention to computational intelligence. Therefore, this publication provides a thorough overview of QoS-aware web service composition, with QoS models and approaches to finding future aspects.

Keywords - Cloud service, Clustering, Fuzzy, Deep Learning, QoS models.

I. INTRODUCTION

Cloud Computing is one of the most useful information innovations as it has numerous advantages [1]. While cloud computing offers many benefits in terms of service provisioning, In terms of the QoS nature, it creates different obstacles, such as execution of the cloud-based applications and availability. Nowadays, QoS is complicated for the users, who want to get the providers of highly standard SaaS, PaaS, and IaaS, also they need providers who hold control between operational prices and the quality of services [2,3]. Since for the various high level of quality of services, the cloud services are varied and the QoS based services are helped the user to pick up the appropriate services. The optimal based fitness aware cloud service composition interact with several factors of quality of services and it helps in giving solutions, also it satisfied the balancing of parameters and by utilizing Adaptive Genotype Evolution based Genetic Algorithm (AGEGA), the limitation of the service composition has been taken place [4,5]. Likewise, the data mining-based parallel and distributed cloud computing environments have provided a lot of optimal outcomes. Another well-known cloud platform is Hadoop which is also be utilized in data mining. Also, in cloud services, some of the machine learning techniques based on MapReduce models were executed [6]. However, these techniques are implemented in MapReduce, the results attained in every cycle are loaded and written from Hadoop Distributed File System (HDFS). Also, Apache Spark is observed to be one of the great cloud platforms. It supports RDD architecture, which is a Resilient Distributed Datasets & Directed Acyclic Graph (DAG) model, these are built based on memory computed foundation, not like Hadoop. Another greatest data mining algorithm is the Random Forest (RF) [7]. However, in the service selection methods, there is a critical task to be there as the cloud services have similar functions with a multiplicity of services. At this point, cloud service provider's resource restrictions lead to composite services which as a result, the hardest user's job cannot be accomplished with single cloud service providers. So the

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total number of demanded cloud service provider enhance the temporal hard situation of the SC process [8] in terms of rising search space. Across the different IoT service providers, the above-described issue is considered to be the service composition methods and broker-based services. When [9] the single service provider is not efficient to satisfy the user's complex necessities, a user request is submitted automatically to the appropriate service provider for the precise outcomes, here the service composition elements are enacted as a broker in the IoT, and as a consequence, the QoS related web services are evaluated as it yields alike functionalities across the not aligned environment [10]. However, for the service composition processed, transactional support is the significant essence to yield the proper execution and the constant results. In the service composition environment, a long lasted computations and loosely interconnected autonomous systems are not able to share the data and the administration [11,12]. Furthermore, among the many web services, Web Service Selection (WSS) problem is regarded as the formation of the toughest business processes. The above occurred just because of the well-organized interfaces, loose coupling, integration, and the last-minute integration of the web-based services, a lot of suppliers provide similar web services which in turn leads to WSS is a critical issue to be resolved. To accomplish certain activities in a workflow, the objective of the web service issue is to discover the suitable match for the web services. Here, workflow is considered to be the set of processes that transforms client requirements into a group of subordinary tasks [13], and by utilizing the preference approach, the multiple objective issues to be resolved to show the difficulty [14] in the web service. The applications of the web services are utilized in SOC which is Service-Oriented Computing, which offers faster development of the application, provides platform independence, yields reasonable cost, can able to reuse the code, and offers ease of maintenance of applications [15]. However, some of the researchers come with a solution to handle the WSS-related issues with shorter computation time and good quality of results, also, some of the other issues like semantic web, multidimensional Knapsack, and traveling salesman are solved by ACO techniques (Ant Colony Optimization) [12,16]. Here, in the service selection techniques which is an autonomous composition that includes transactional and quality of service constraints in the selection process. Here, the good concept here is that combining both the embedded quality of service selection along with the transactional service selection, also we need to employ local QoS optimization [3,15]. Here we apply near-optimal solutions for this issue and a lot of heuristic methods were utilized. As a result, in a shorter period, these algorithms were designed to discover greater solutions [17]. Because it combines several CMfg possibilities [18] to provide value-added services like composite cloud manufacturing services (CCMSs) that fulfill an extensive of manufacturing needs, CMfg service composition is a crucial approach for boosting manufacturing development. The primary objective of the CMfg is to supply users with good maintenance, manufacture as required, well-prepared, worthy testing, and provide accurate simulation and other manufacturing lifestyle methods [19]. CMCSS is made with cloud-based services (MCSs) along with comparative and similar functional qualities and it offers various services which vary the quality of services for the cloud-based execution and QoS service selection [20]

II. SERVICES COMPOSITION BASED ON VARIOUS TECHNIQUES

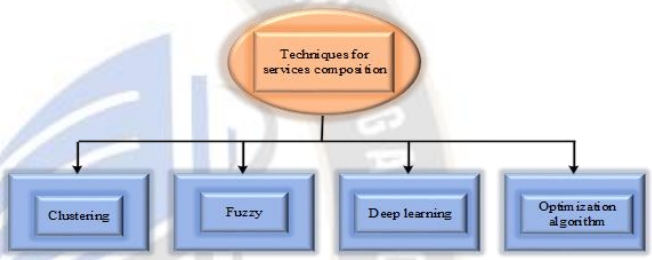

Figure 1: Techniques involved in service composition

Clustering

To effectively adopting with the challenges in larger resources, a network-based service composition based on the clustering network method (Feng Lia , et al, 2017) [21] was approached. Here, in the initial stage, the services were grouped into abstract services, after that the abstract services get executed. Also, in the service composition environment, QoS is considered one of the challenges and trust value in the reliable service selection was also considered as a major challenge, to rectify the NP complexities of the service composition, a honeybee mating optimization algorithm (Kouros Zanbouri, et al, 2019) [22] and to resolve the trust challenges a trust-based clustering algorithm was also implemented. However, in constructing composite services, clustering-based and QoS-aware services composition algorithm (CQCA) (Mohamed Essaid Khanouche, et al ,2019) [23] was implemented. Here, to mitigate the execution time and enhance the composite optimality, the candidate services were splitted into clusters, then the new form of utility based features of the resulting clusters was executed in terms of QoS.Eventually search based tree was constructed to to discover the near-to-optimal composition.

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Fuzzy

To constructively enhance the prediction performance, there was a need in incorporating the intelligent techniques into some Q-learning prediction techniques. As a result of this, QoS prediction with the combination of fuzzy neural network with Adaptive Dynamic Programming (ADP) (Xiong Luo, et al., 2015) [24] was established. This approach took out the QoS data from the fuzzy rules and makes the ADP method a fuzzy rule of the parameter learning. Similarly, based on the genetic algorithm (GA) and fuzzy set theory (FST), a triangular fuzzy genetic algorithm (Jiajun Xu, et al, 2018) [25] was established to rectify the service composition challenges, also to enhance the model which was most appropriate for the service composition and it increased the solutions described in the fuzzy attributes. Likewise, in cloud manufacturing models, a cloud manufacturing service composition was considered to be a significant issue, to rectify the cloud service composition issues, bat algorithm based on fuzzy operator (Bin Xu, et al, 2016) [26] was established. Here, in FBAT, To replace the bat algorithm's coding and decoding techniques, fuzzy encoding and decoding algorithms are proposed. In addition to that, a virtual bat is created to aid increase the algorithm's convergence speed by utilizing historical beneficial knowledge to influence the flying direction of bats.Likewise, to estimate the global QoS fuzzy of manufacturing service composition, new fuzzy quality of service model was established and it allocate various subtasks with different weighing portions,also along with this the enhancement of flower pollination algorithm (FPA) (Shuai Zhang, et al, 2017) [27] was incorporated to efficiently solve the service composition issue with various weights in a fuzzy manufacturing environment.

Deep learning:

Owing to the immense search space in cloud computing, QoS based cloud service composition becomes very critical process. To overcome this issue, Long Short-Term Memory (LSTM) with Particle Swarm Optimization (PSO) algorithm-based service composition (Samar Haytamy, *et al*, 2020) [28] model was employed for reducing the user cost function. Similarly, Deep neural network (DNN) approach was (Zhengchao Liu, et al, 2019) [29] incorporated with the multi objective preference analysis as well as glow worm swarm optimization algorithm to create training set by means of user preference and users selection process. Here, DNN was utilized to examine the user's services and to give a suggestion. Likewise, auto encoder approach was presented (YUYU YIN, et al, 2019) [30] to identify the missed QoS parameters in mobile edge service recommendation system. Furtherly, Euclidean distance-based computation approach was employed to enhance the prediction level.

Particle swarm optimization

To effectively choosing the optimum services in cloud computing platform, particle swarm optimization (PSO) approach (Afshin Naser, *et* al, 2019) [31] was employed by minimizing the multiple resources and delay time. Here, the services were composed by recognizing the QoS parameters.

Genetic algorithm

To rectify the core Manufacturing Service Composition Optimal Selection (MSCOS) issues like optimal allocation, manufactures to user mode paradigm (Yi Que, et al, 2018) [32] was developed. Initially, QoS parameters of the network was computed by the mathematical evaluation framework. After that, the information entropy immune genetic algorithm (IEIGA) was used as a simulation result. Similarly, semi heuristic genetic algorithm was (Pooya Shahrokh, et al, 2016) [33] presented to minimize the computational duration in cloud service composition. The presented approach was an amalgamation of genetic algorithm and heuristic approach. here, heuristic approach was utilised to modify the chromosomes with respect to the discontented constraints. Likewise, to obtain the global optimization with respect to the service constraints (Mohammad Bagher Karimi, et al, 2017) [34] in the cloud service environment, genetic algorithm was employed. Also, service clustering approach was utilized to minimize the search space issue. Similarly, genetic algorithm-based correlation aware model (Hong Jin, et al, 2017) [35] was employed to enhance the QoS parameters in cloud computing. Similarly, Genetic algorithm was employed (Qingping Xue, 2021) [36] for selecting the web services with respect to the QoS parameters. Also, chromosome coding approach was utilized to rectify the multi path selection issues. On other hand, QoS framework was presented (Zhen Ye, et al, 2011) [37] to compute the QoS service parameters in cloud computing. Furtherly, genetic algorithm was utilized for composing the services in cloud environment. Likewise, genetic algorithm with enhanced crossover and mutation operator (Miao Zhang, et al, 2015) [38] based service composition framework was employed to permits the consumers to select the best composition option based on preferences.

Cuckoo search algorithm

To choose the best services on the basis of QoS parameters for the development of web services in cloud platform, cuckoo search algorithm (CSA) was (Mostafa

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Ghobaei-Arani, et al, 2018) [39] employed. Similarly, multi cuckoo approach (HEBA KURDI, et al, 2018) [40] was presented to resolve the service composition difficulties in multiple cloud environment. Likewise, to maximize the performance and the security of the communication service system, (BINGJI LI, 2019) [41] improved cuckoo search algorithm (MCSA) was presented. Also, semantic similarity algorithm was integrated with the MCSA to fulfil the user's condition.

Distributed co-evolutionary algorithm

To obtain the effective service selection within minimum duration in big service composition, (Avik Dutta, et al, 2021) [42] Distributed co-evolutionary algorithm was employed. Here, distributed NSGA-III was utilized to attain the optimum pareto front. Also, distributed multi-objective Jaya algorithm was employed to improve the solution.

Moth flame optimization

To optimally choosing and compose the web services in cloud environment, moth-flame optimization (MFO) algorithm (Mostafa Ghobaei-Arani, et al, 2018) [43] was employed to enhance the QoS parameters in distributed cloud environment.

Ant Colony optimization

The service composition difficulties like response time, energy consumption, and cost function in cloud platform were rectified by improving the QoS parameter through (SeyedSalar Sefati, et al, 2021) [44] ant colony optimization based hidden Markov framework. Furtherly, Viterbi algorithm was utilized to enhance the transition and emission matrices.

Grey wolf optimization

To lessen the energy consumption and to choose the better service in cloud manufacturing platform, (Yefeng Yang, et al, 2019) [45] modified grey wolf optimization algorithm was utilized to enhance the QoS parameters.

Chaos control optimal algorithm

To address the optimal cloud service selection difficulties in cloud manufacturing scenario, the chaos control optimal algorithm (CCOA) (Biqing Huang, et al, 2014) [46] was presented.

Artificial bee colony

For cloud service composition, Artificial Bee Colony (ABC) algorithm based on discrete Gbest strategy (Ying Huo, et al, 2015) [47] was employed to choose best service solution with minimum computational duration. Similarly, artificial bee colony-based service selection framework (Xianzhi Wang, et al, 2016) [48] was employed with respect to the QoS parameter to permits the efficient local search in discrete space. Likewise, To efficiently tackle the multi-objective Service Composition Optimal Selection (SCOS) issues, an Improved ABC algorithm (Jiajun Zhou, et al, 2018) [49] was utilized by introducing the new diversity maintenance design, in addition to that, a different evolution operator has been incorporated with the algorithm to exchange the information among the foraging bees, and along with this reproduction operator in the control, parameters were modified. Similarly, for the transportation of impact analysis, the QoS-based geo perspective which correlated services from one cloud to another cloud service has been presented. Also, the service composition was a comprehensive process by means of execution time, to resolve this, the ABC algorithm (Jorick Lartigau, et al, 2014) [50] based on initialization improvement has been established. However, to effectively resolve the NP hardest cloud manufacturing service optimal selection (CCSS), a multi-population parallel self-adaptive differential artificial bee colony (MPsaDABC) (Jiajun Zhou, et al, 2016) [51] was implemented.

Brain storm optimization:

To make the better web service in terms of providing the effective search paradigm with different combination, multi clusters adaptive - brain storm optimization (BSO) algorithm (SHUNSHUN PENG, et al, 2020) [52] was employed. Furtherly, Support vector machine (SVM) approach was incorporated with BSO to effectually separating the search space.

Ranking Chaos Algorithm

To efficiently conquer the Dual Scheduling of Cloud Services and Computing Resources (DS-CSCR), a new Ranking Chaos Optimization (RCO) was executed (Yuanjun Laili, et al., 2013) [53] Here, DS-CSCR was the combination of Optimal Allocation of Computing Resources (OACR) and Service Composition Optimal Selection (SCOS) under virtualization, to correct the highly tensile and agile service provision and resource sharing among sub-enterprises and partner-enterprises. Furthermore, the novel adaptive chaos operator is meant to cover more areas in a short period of time, taking into account large-scale irregular solution spaces, also, ranking sections and dynamic heuristics were established to overcome the chaos evolution.

BAT optimization algorithm

To constructively get rid of the manufacturing service composition problem (MSC), the SABA Self-Adaptive Bat Algorithm (SABA) was employed (Bin Xu, et

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al., 2017) [54]. Here, accomplishing the manufacturing task completely with suitable services was considered to be the MSC problem.

Binary Gravitational Search Algorithm

To efficiently address the challenges faced in the ranking prediction techniques and identification process of QoS values, an improvised Improved Binary Gravitational Search Strategy (IBGSS) approach (Nivethitha Somu, et al, 2019) [55] was implemented. In addition to that this algorithm employed Newton-Raphson inspired Binary Gravitational Search Algorithm (NR-BGSA) and enhanced the cosine similarity specifications.

Hybrid optimization

The genetic optimization algorithm was integrated with the fruit fly optimization algorithm (HGA) (Fateh Seghir, et al, 2016) [56] to minimize the computational duration and to keep the genetic algorithm's balance between the exploitation and exploration phases to rectify the cloud service issue. furtherly, the parameter of the HGA was tuned through the taguchi approach. Similarly, grey wolf optimization algorithm was (Hamed Bouzary, et al., 2019) [57] integrated with the genetic algorithm to provide better Selection and composition of services. Likewise, to efficiently implement the best cloud service composition and selection, a multi objective hybrid artificial bee colony algorithm (MOHABC) (Jiajun Zhou, et al., 2017) [58] was presented. Also, the presented approach utilizes the theory of Pareto dominance to keep the non-dominated solution. In addition to that, along with the Pareto dominance, cuckoo search with Levy flight algorithm had been incorporated to attain the greater distributed solutions and to retain the exploration and exploitation capacity of MOHABC, a detailed technique was constructed in the viewer search in such a way that every bee in the archive learn from external archive storage. Similarly, to resolve challenges in cloud services selection and composition, hybrid particle swarm optimization (HPSO) along with PSO (Particle swarm optimization) and FOA (Fruit fly) was implemented (S. Bharath Bhushan, et al., 2018) [59]. Here, the FOA yielded a good fitness value which intern maximizes the convergence speed. However, in cloud manufacturing, some restrictions were still presented in the service composition, as the service composition related to QoS was not considered to be fixed, as a result, it's not feasible for cloud manufacturing, then, the traditional approaches were not that efficient during significant challenges in task scheduling in the cloud resource pool, Hence to resolve these limitations, the hybrid teaching–learning-based optimization (HTLBO) was executed (Jiajun Zhou, et al., 2017) [60] for the exceptional service compositions. Also, to solve the various service composition across the several QoS properties, which challengingly fulfill the need of end-users, Eagle strategy with Whale Optimization (Siva Kumar Gavvala, et al., 2018) [61] was implemented to ensure the appropriate control over the exploitation and exploration. Similarly, as uncertainties occurred in the cloud services and it affected the smoother execution of the tasks and also impacts the composite manufacturing services inefficiently. In addition to that, to resolve the reliability in the CM's (Cloud Manufacturing services) an optimal selection method was established. For this, every reliable CMs were organized as sub-tasks then the robust service composition and optimal selection (rSCOS) built the expected QoS, along with this, to solve any inefficiency in the rSCOS, a guiding artificial bee colony – grey wolf optimization (gABC-GWO) algorithm (Bo Yang, et al, 2020) [62] was incorporated, which designed based on the features of GWO. Also, to effectually provide the services across the cloud, a hybrid approach of ACO (Ant Colony optimization) with GA (Genetic Algorithm) was established (Fadl Dahan, et al, 2021) [63] to sort out and combine the optimal services over the cloud in terms of service composition. Likewise, to efficiently resolve the service composition challenges, Cloud-based QoS-Provisioning Service Composition (CQPC) framework was considered and in addition to that Hybrid Bio-Inspired QoS provisioning (HBIQP) was approached for the applicability of the service based compositions, and then to form the composite services with higher accuracy with a certain amount of duration, the MapReduce fruit fly Particle swarm Optimization (MR-FPSO) (Waleed M. Bahgat, et al, 2020) [64] yielded a massive scale of services.

III. SUMMARY

According to the study, research publications were searched and used from (2010 to 2021). Non-scientific papers are eliminated from the analysis because this work is primarily based on scientific publications. The research for literature is based on the appropriate facts in each component. Then, individually, identify and summarise the relevant articles.

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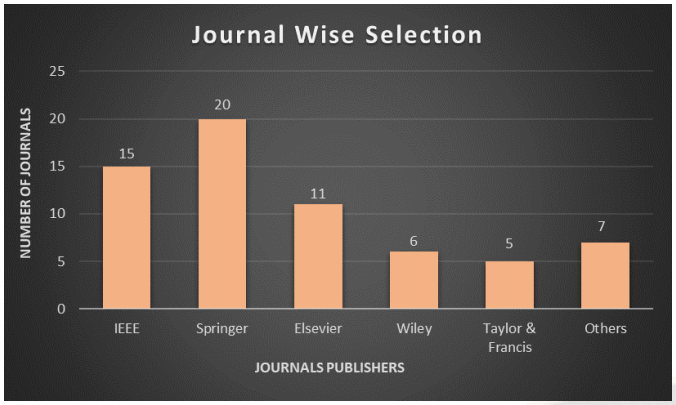

Figure 2: Journals wise selection

From the above Figure2, the graphical chat is based on journals publishers and it numbers including Google Scholar, Science Direct, IEEE Xplore, Springer, ResearchGate, Wiley, MDPI, etc. For this research 64 papers are reviewed. For this analysis, 15 articles are taken from IEEE Xplore, from Science direct (Elsevier) publisher 11 research paper are taken. Comparing to the all the publishers, most of the research articles are taken from the springer publisher.

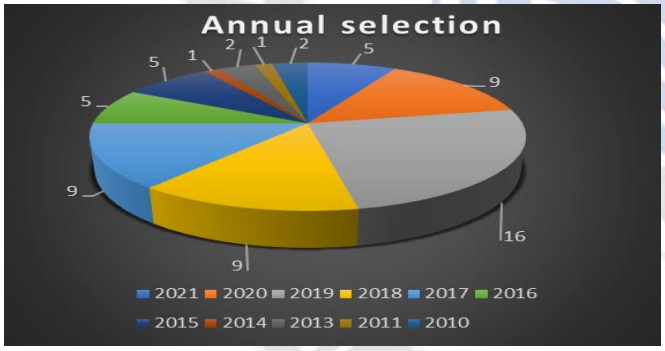

Figure 3: Annual selection From the above figure 3

Number of published research articles taken for analysis and the research article is reviewed in Annual selection and analysed from the year 2010 to 2021 bases. Overall, a maximum number of articles are taken from 2019.

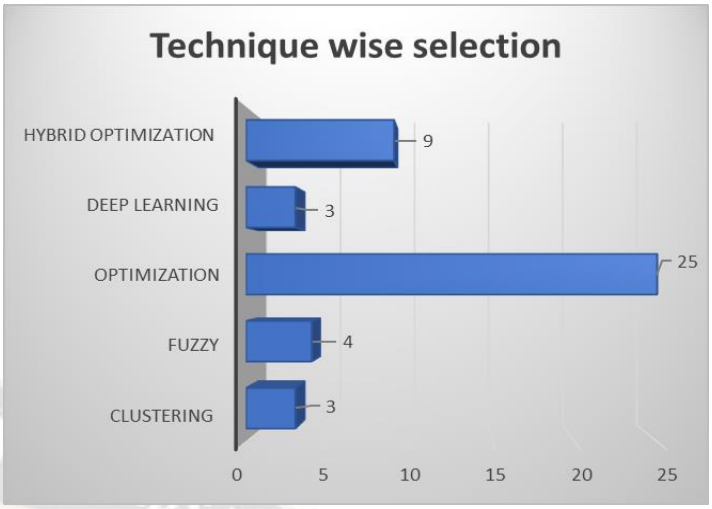

Figure 4: Technique wise graph

The Figure 4 represents the graphical representation of technique wise selection. Here, the research articles are categorized and reviewed based on different approaches such as clustering method, fuzzy logic, deep learning, optimization and hybrid optimization. Most of the research articles uses the optimization algorithm to rectify the QoS-based cloud service composition issues.

Future Scope:

In this paper 55 research articles were taken for this survey and each paper have a solution for service composition issues. However, there is a research gap. To overcome that, some of possible aspects are suggested below,

In real time, executing the several tasks at same time is crucial. Hence, not only selecting an appropriate selection of services, but also establish the actuation time for each service.

Even at a price fluctuation in cloud service, cost function and load balance should be maintained by an appropriate service selection.

Multi objective optimization algorithm to be established for dealing with the multi cloud layers.

dynamic activity may be missed by the QoS backdrop and the short-term promotion. Therefore, incorporating the dynamic behaviour requirements and an efficient composition model into the anticipate model's design.

To minimize the execution time for the service composition, association rule mining algorithm to be incorporated with the evolutionary algorithms.

While designing the service composition model, the factors need to be considered such as monitoring through the push and pull model, complaints checking model based on legislation dynamic management process.

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CONCLUSION

An essential element of the IoT is cloud computing, which expands applications producing enormous amounts of data and improves efficiency. Web services and web service composition are robust technology that can switch conventional, scalable, and dynamically interconnected software components out of applications, hardware, and software resources. As a result, this research provided a thorough description and investigation of the Quality of Service based Cloud Service Composition (QoSCSC) from the perception of AI, which can serve as a strong foundation for investigators as well as practitioners and provide numerous advantages. To begin with, it can serve as an initial phase for researchers who are interested in a particular arena, saving time and allowing them to make greater progress. In this case, QoS-aware service composition, we assessed current techniques and identified current trends and open research issues, here, the Genetic Algorithm is the most promising representation of the use of (meta-) heuristics also reviewed about strategies that used in the establishment of services like Clustering, Fuzzy, Distributed co-evolutionary algorithm, Moth flame optimization, etc. In the IoT, QoS metrics must first be specified before users can comprehend and communicate their needs using these data. By evaluating and classifying the most successful service composition techniques against the proposed taxonomy, we were also able to give a systematic study of the most successful service composition approaches.

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