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Eco Friendly Green Cloud Computing

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ABSTRACT

Cloud computing has played major role for storing and handling huge data by the virtualization of data centres and servers to make them very efficient. Cloud computing gives power to compute and provides service to the users around the whole world. Thus providing customers with higher performance which is of lower cost compared to dedicated high-performance computing machines. IT sectors consume large amount of power and energy, resulting as a main source of Carbon dioxide emission. To overcome this, we need Green Cloud Computing for IT resources to be energy efficient and operating at cheaper cost. In order to reach optimal standards for green_cloud computing. The efficiency of the power of Cloud must be very meticulously analysed. Cloud computing is a better alternative being greener than individual datacentres by usingless number of servers.Data centres using cloud are far better than the traditional ones. Thereby the impact of carbon is reduced.

KEYWORDS: Cloud Computing, Carbon dioxide emission Green cloud computing, Clustering, Data Virtualization, Proportional Computing, Energy efficiency

I. INTRODUCTION

One of the cutting edge technologies is cloud computing. It helps organizations to outsource various IT services like computational, resource planning and data storage services [1]. The efficiency of Cloud computing increases depending on the utility of computing, how the processes are scalable and IT outsourcing of IT. The survey conducted by MacAfee that develops antivirus revealed that the electricity required by the trillions of emails which are spam mails is as much as the electric power required for 2 million houses in USA [2-5]. The green house gases produced by the information transmission of these spam mails is almost equal to the harmful gases emitted by 3 million small vehicles like cars. There is a huge demand for Eco-friendly operations and procedures used in the

business procedures [9]. Due to this lot of innovations are taking place. One such innovation is Green computing. Green cloud computing boosts the performance as well as makes sure that the environment is not harmed [6-8]. A company can prove its worthiness by adopting technologies like green computing and green cloud computing is one of them. The computing power consumption with green house gas emission such as CO2 is shown in figure 1. Usage of Green cloud computing it has been reduced [9]. It prevents wastage of energy. Therefore many corporates especially in the IT field have adopted Green cloud computing. Many surveys done in USA and Europe have revealed that lot of green house effect is due to various reasons [10-12]. One such reason is the CO2 emission during transmission of information [13]. Therefore they decided to make sure all the companies have energy consumption policy [14]. They decided imposing such policies on companies will make them are of the harm they are causing to the environment and thus switch over to technologies that consume lesser power [15-17]. This has led to the popularization of green computing. Hence Green cloud computing is play a major role in green computing to save our planet [18-19].
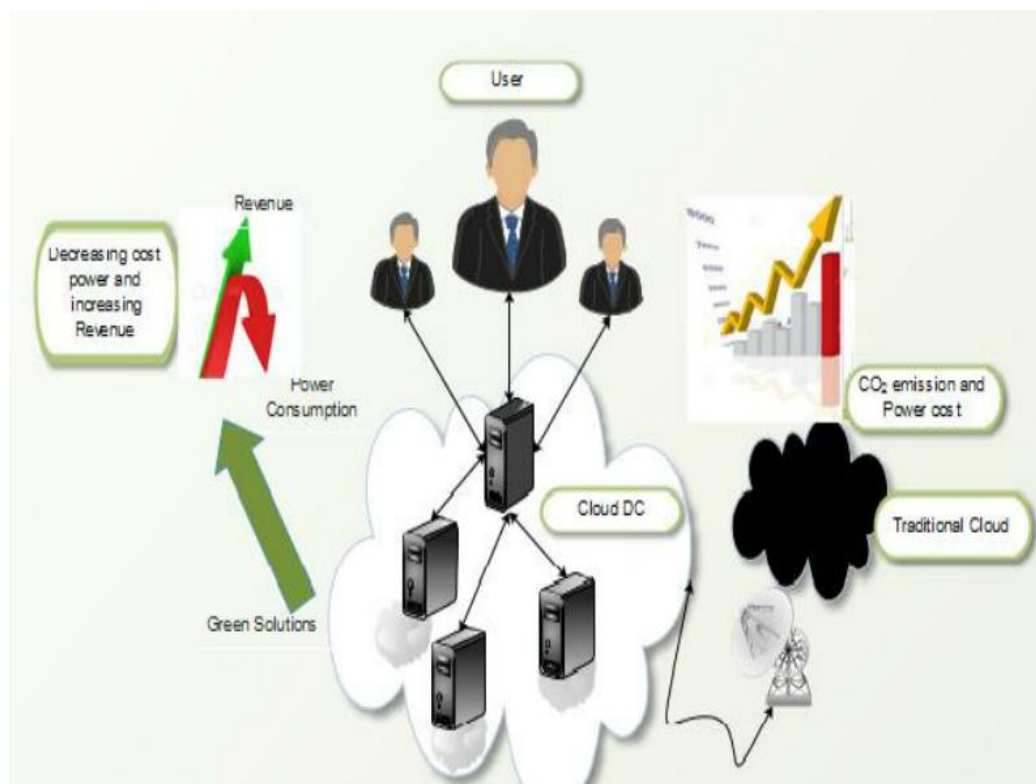

Figure 1. Cloud and Environment

II. EXISTING APPROACHES

Contributions to carbon green cloud computing architecture belongs to the third-party. Green offer and carbon emission are the two types of directories. Users and providers use the green services provided to them by the directories. Green offer Directory is used by the providers to register the services. These services are organised by the green broker. The organization is done based on the time, price, service that has the minimum emission of carbon dioxide [20]. The cooling capacity of cloud and data centres and energy used by them are stored in Carbon Emission Directory. Whenever there is a request for services, it is provided by the green_broker [21]. The directories are used by the green_broker to choose the green offer and information about the energy efficiency. These are allocated to the private clouds and results are provided to the users.

There are 2 elements in this architecture namely client and server side. Client side consists of manager and users. The job's execution destination is in theClient side. Green cloud computing middleware is in server. Server side also consists of green_brokeralong with various sub_serversnamely storage servers, processing servers. The green_broker layer in IGCA uses the concept of directory. Information in public cloud is organised in directory.It provides excellent green service for users [22].

There are 2 components in the middleware of green cloud computing. The manager deals with one component of middle ware and it acts as the main incharge. the information of middlewareis stored by the manager. Middle are component also consists of each server's frequencies, energy used, capacity of storage [23].

If the client sends request to manager,then manager divides it in to different types of jobs. These aredispersed among the users. Simultaneously information about job are also stored into component [24]. Energy consumed for the execution of the jobs and also the emission of carbon dioxide by private cloud, public cloud or PC of the client is calculated and shown to users. Servers show private cloud, public cloud use green_broker. The manager selects the best green option based on the level of security of job [25-26]. This information will be stored in the XML file while the manager is making the decision. This is for future use.

All users for reading the XML file can access the second component. All information of execution of job is stocked in this file. according to the addresses,registration of the job locations aredone in a file. Later they will execute [27]. Execution of the job will be on the personal computer of client or in a private cloud if job entry is not available in the file. In 3 places execution of job takes place. This client sideinformation is stored if first the job is locally executed (on requester side). When request arrives

next time, it will not get through middleware [28]. The location and server name areobtained from the file in caseif the job's execution is in private cloud. Thegreen_brokerhelps to obtain the efficient green decision for executing job if it is in public cloud. All the information about the three places.

is knownby the he middleware. the middleware calculates energy which is used by workers in the company for taking further decisions [29-30].
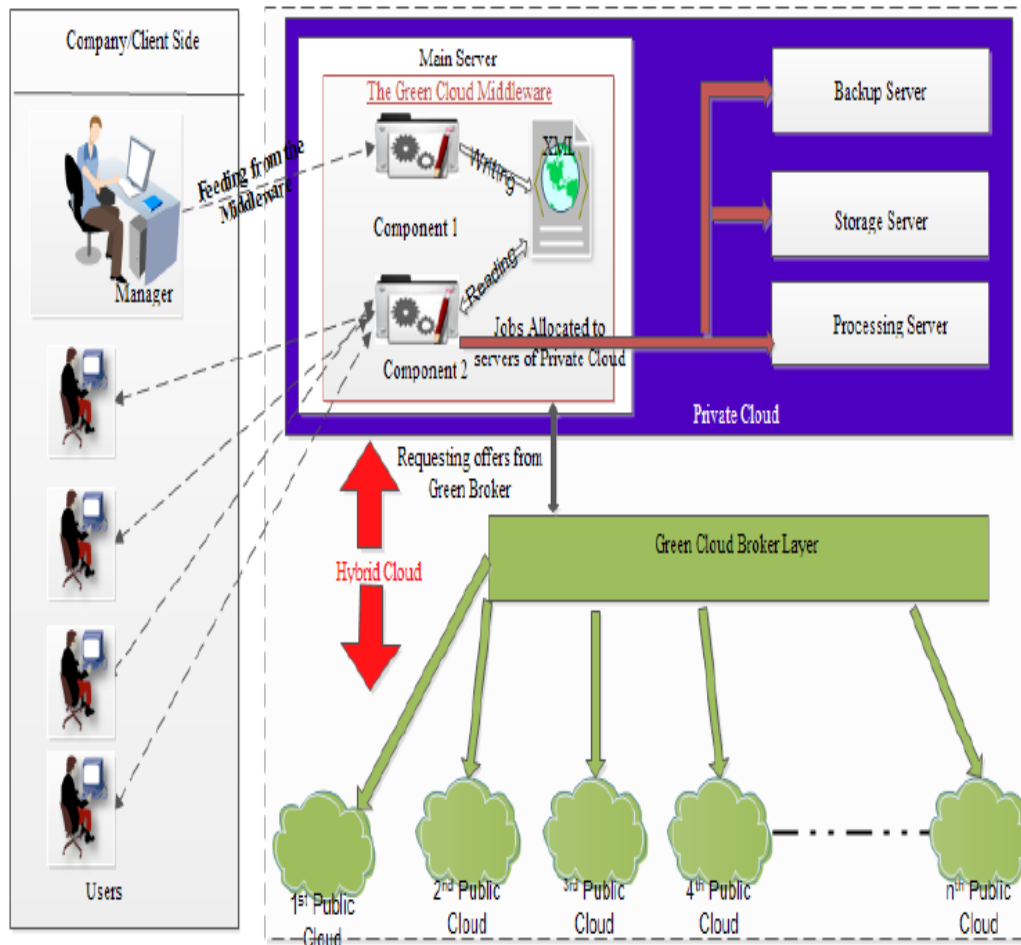

Figure 2. Integrated Green Cloud Architecture

The most suitable location for the job execution depends on the speed of processing, bandwidth, consumption of energy, etc [31]. Middleware considers the factors for computing and deciding the place by considering the places. The job execution is balanced by the IGCA [32-38]. It provides security to the clients. The IGCA is responsible for the good quality service provided to clients. By considering the three places, manager categorizes the task. It also considers these places for providing high quality green computing solution. These places are local host, private and public places [39-43].

In the given architecture the role of central coordinator is played by the manager. The jobs are allocated by the manager to users. Manager is the one who makes all the decisions [44-51]. If the manager cannot perform that is if the manager fails, the architecture becomes useless. This makes the manager as the vulnerable or the weakest point in the architecture.

III.   RESULT AND DISCUSSION

Many scientists and researchers have put lot of effort to save our planet by proposing Green computing. The Table 1 shows the comparison of various researches in Green cloud computing.

Table 1: Comparison of researches done in Green cloud computing

Year of publication	Highlight of the work	Limitations
2019 [10]	Gives a view about green computing by surveying numerous papers on green cloud computing.	
2018 [11]	Focus is on Green computing life cycle.	It doesnot stress specifically on green cloud computing
2017 [13]	Focuses on current and future trends in green computing and issues related to that	It is theoretical approach
2016 [14]	Focus is on the Critical success factors for developers of green computing software	Obtaining the Critical success factors is difficult
2016 [15]	Focus is on different metrics for green cloud computing	Have not implemented

2016 [2]	Focuses on how to reduce harmful gases produced as an effect of electronic toxic waste.	Needs to implement robustly
2016 [16]	Analysis was done by surveying different metrics for green computing.	Lack of implementation
2015[17]	Focuses on Green Cloud computing Framework for managing energy efficiently.	Implementation needs more improvement.
2015 [18]	Focus is on CO2 emissions which are causing hazards and if unchecked may lead to fatal Carbon monoxide. They have specified that green cloud computing is the need of the day.	It is still in nascent development stage
2015 [20]	Focus is on power consumption by ICT tools. It showcases how power consumption can be reduced using Green cloud computing'	It is just in design stage and yet to be implemented
2014 [21]	Focus is on energy saving in data centers with the help of Green computing.	Yet to be fully implemented

IV.   CONCLUSION

This paper gives the glimpse of the various problems which are occurring due to computer waste. It includes emission of Carbon dioxide which will shortly lead to the increase of carbon monoxide in the atmosphere. It will be fatal to have more toxic gases in the environment. Wastage of energy can be prevented by switching over to Green computing, as there is increased usage of cloud computing especially in data centres, shifting to Green-Cloud Computing gives a ray of hope for the survival of living beings on Earth. Lot of scope is there for carrying out researches in field of Green-CloudComputing which is Eco friendly.

REFERENCES

[1]   Mavinder Singh, Anup Singh Sidhu,Green Computing Vol 7,No -6 special issue,IJARCS,ISSN No 0976-5697,Nov-2016.

[2]   https://www.techopedia.com/definition/14753/green-computing

[3]   Bhuvaneswary, N., S. Prabu, S. Karthikeyan, R. Kathirvel, and T. Saraswathi. "Low Power Reversible Parallel and Serial Binary Adder/Subtractor." Further Advances in Internet of Things in Biomedical and Cyber Physical Systems (2021): 151.

[4]   Rachana, C.R., Banu, R., Ahammed, G.A. and Parameshachari, B.D., 2017, August. Cloud Computing–A Unified Approach for Surveillance Issues. In IOP Conference Series: Materials Science and Engineering (Vol. 225, No. 1, p. 012073). IOP Publishing.

[5]   Bhuvaneswary, N., S. Prabu, K. Tamilselvan, and K. G. Parthiban. "Efficient Implementation of Multiply Accumulate Operation Unit Using an Interlaced Partition Multiplier." Journal of Computational and Theoretical Nanoscience 18, no. 4 (2021): 1321-1326.

[6]   https://www.eukhost.com/blog/webhosting/10-benefits-of-cloud- computing-for-businesses/

[7]   Chakraborty, C., Roy, S., Sharma, S., Tran, T., Dwivedi, P. and Singha, M., 2021. IoT Based Wearable Healthcare System: Post COVID-19. The Impact of the COVID-19 Pandemic on Green Societiesenvironmental Sustainability, pp.305-321.

[8]   Seyhan, K., Nguyen, T.N., Akleylek, S., Cengiz, K. and Islam, S.H., 2021. Bi-GISIS KE: Modified key exchange protocol with reusable keys for IoT security. Journal of Information Security and Applications, 58, p.102788.

[9]   Fathima, N., Ahammed, A., Banu, R., Parameshachari, B.D. and Naik, N.M., 2017, December. Optimized neighbor discovery in Internet of Things (IoT). In 2017 International Conference on

Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT) (pp. 1-5). IEEE.

[10]   Yashwant Singh Patel, Neetesh Mehrotra, Swapnil Soner, Green Cloud Computing: A Review on Green IT Areas for Cloud Computing Environment, 2015 1st International Conference on Futuristic trend in Computational Analysis and Knowledge Management (ABLAZE-2015)

[11]   Prerana Chaithra, Shantharam Nayak, "Quality Assurance Techniques in SRS Documents", Elsevier-Scopus indexed International Journal of Innovative Technology and Exploring Engineering, ISSN: 2278-3075, Volume-9, Issue-2S, December 2019.

[12]   Rajendran, Ganesh B., Uma M. Kumarasamy, Chiara Zarro, Parameshachari B. Divakarachari, and Silvia L. Ullo. "Land-use and land-cover classification using a human group-based particle swarm optimization algorithm with an LSTM Classifier on hybrid pre-processing remote-sensing images." Remote Sensing 12, no. 24 (2020): 4135.

[13]   Vertika Bansal and M.T.M Khan, Green Computing: A Study of Perception, Approach, and Acceptance among Faculty Members andStudents of Galgotias University, Greater Noida,

[14]   Parameshachari, B. D., Rashmi P. Kiran, P. Rashmi, M. C. Supriya, Rajashekarappa, and H. T. Panduranga. "Controlled partial image encryption based on LSIC and chaotic map." In ICCSP, pp. 60-63. 2019.

[15]   International Journal of Information Dissemination and Technology |July-September 2019 /Vol. 9/ Issue 3

[16]   Naeem, M.A., Nguyen, T.N., Ali, R., Cengiz, K., Meng, Y. and Khurshaid, T., 2021. Hybrid Cache Management in IoT-based Named Data Networking. IEEE Internet of Things Journal.

[17]   Data Centers in IT Based Industries, MATEC Web of Conferences 150, 05048 (2018) | MUCET 2017

[18]   IbtehajAlMusbahi, Reem H. Nahhas, Bashair AlMuhammadi, Ola Anderkairi, Hemalatha M., Survey on Green Computing: Vision and Challenges, International Journal of Computer Applications (0975 8887) Volume 167 No.10, June 2017

[19]   Nguyen, Tu N., Bing-Hong Liu, and Shih-Yuan Wang. "On new approaches of maximum weighted target coverage and sensor connectivity: Hardness and approximation." IEEE Transactions on Network Science and Engineering 7, no. 3 (2019): 1736-1751.

[20]   Muhammad salam, Siffat Ullah Khan, Developing Green and Sustainable Software: SuccessF actors for Vendors, 978-1-4673- 9904-3/16/$31.00 Â©2016 IEEE

[21] Subramani, Prabu, Ganesh Babu Rajendran, Jewel Sengupta, Rocío Pérez de Prado, and Parameshachari Bidare Divakarachari. "A block bi-diagonalization-based pre-coding for indoor multiple-input-multiple-output-visible light communication system." Energies 13, no. 13 (2020): 3466.

[22] Prerana Chaithra, Shantharam Nayak, NandaKumar A. N. " Segmentation and Clustering of Stakeholders using Data Mining Techniques ", Advanced International Journal, ISBN -13915, ISSN: 978-81-936820-0-5, Vol-1, June 2018, pp 482-488

[23] Rubyga. G, Dr.Ponsy R.K SathiaBhama, A Survey of Computing Strategies For Green Cloud 2016 Second International Conference on Science Technology Engineering and Management (ICONSTEM),2016

[24] Tribid Debbarma, K Chandrasekaran, Green Measurement Metrics Towards a Sustainable Software: A Systematic Literature Review IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE-2016), December 23-25, 2016, Jaipur, India

[25] Prerana Chaithra, Vijayalakshmi, Shantharam Nayak, "Analysis of Various Methodologies for reducing Ambiguities in Software Analysis", Indian Technology Congress 2014, Nimhans Convention Centre, Bangalore, 21-22 August 2014, pp. 29.

[26] Puttamadappa, C., and B. D. Parameshachari. "Demand side management of small scale loads in a smart grid using glow-worm swarm optimization technique." Microprocessors and Microsystems 71 (2019): 102886.

[27] Shivam Singh, Green Computing Strategies & Challenges, 2015 International Conference on Green Computing and Internet of Things (ICGCIoT),2015, 978-1-4673-7910-6/15/$31.00_c 2015 IEEE

[28] Amlan Deep Borah, DeborajMucharary, Janmoni Borah and Sandeep Kumar Singh, Power Saving Strategies in Green Cloud Computing Systems, International Journal of Grid Distribution Computing.Vol.8, No.1 (2015)

[29] Nguyen, Ngoc-Tu, Ming C. Leu, and Xiaoqing Frank Liu. "RTEthernet: Real-time communication for manufacturing cyberphysical systems." Transactions on Emerging Telecommunications Technologies 29, no. 7 (2018): e3433.

[30] Boregowda, S.B., Babu Prasad, N.V., Puttamadappa, C. and Mruthyunjaya, H.S., 2015. Energy Balanced Fixed Clustering protocol for Wireless Sensor Networks. International Journal of Computer Science and Network Security, 11(8), pp.166-172.

[31] Sreevathsa, C.V., Daina, K.K., Hemalatha, K.L. and Manjula, K., 2016, July. Increasing the performance of the firewall by providing customized policies. In 2016 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT) (pp. 561-564). IEEE.

[32] Arun, M., Baraneetharan, E., Kanchana, A. and Prabu, S., 2020. Detection and monitoring of the asymptotic COVID-19 patients using IoT devices and sensors. International Journal of Pervasive Computing and Communications.

[33] Chakraborty, C., Roy, S., Sharma, S., Tran, T., Adhimoorthy, P., Rajagopalan, K. and Jebaranjitham, N., 2021. Impact of Biomedical Waste Management System on Infection Control in the Midst of COVID-19 Pandemic. The Impact of the COVID-19 Pandemic on Green Societiesenvironmental Sustainability, pp.235-262.

[34] Shivappriya, S. N., S. Karthikeyan, S. Prabu, R. Pérez de Prado, and B. D. Parameshachari. "A modified ABC-SQP-based combined approach for the optimization of a parallel hybrid electric vehicle." Energies 13, no. 17 (2020): 4529.

[35] Hu, Liwen, Ngoc-Tu Nguyen, Wenjin Tao, Ming C. Leu, Xiaoqing Frank Liu, Md Rakib Shahriar, and SM Nahian Al Sunny. "Modeling of cloud-based digital twins for smart manufacturing with MT connect." Procedia manufacturing 26 (2018): 1193-1203.

[36] Rajendrakumar, Shiny, and V. K. Parvati. "Automation of irrigation system through embedded computing technology." In Proceedings of the 3rd International Conference on Cryptography, Security and Privacy, pp. 289-293. 2019.

[37] Nguyen, Ngoc-Tu, Bing-Hong Liu, Shao-I. Chu, and Hao-Zhe Weng. "Challenges, designs, and performances of a distributed algorithm for minimum-latency of data-aggregation in multi-channel WSNs." IEEE Transactions on Network and Service Management 16, no. 1 (2018): 192-205.

[38] Lingappa, H., H. Suresh, and S. Manvi. "Medical image segmentation based on extreme learning machine algorithm in kernel fuzzy c-means using artificial bee colony method." Int. J. Intell. Eng. Syst 11 (2018): 128-136.

[39] Hemalatha, K. L., Sunilkumar Manvi, And Hn Suresh. "Adaptive Weighted-Covariance Regularized Kernel Fuzzy C Means Algorithm For Medical Image Segmentation." Journal of Theoretical & Applied Information Technology 95, no. 14 (2017).

[40] Parameshachari, B. D., H. T. Panduranga, and Silvia liberata Ullo. "Analysis and computation of encryption technique to enhance security of medical images." In IOP Conference Series: Materials Science and Engineering, vol. 925, no. 1, p. 012028. IOP Publishing, 2020.

[41] Nguyen, Ngoc-Tu, and Bing-Hong Liu. "The mobile sensor deployment problem and the target coverage problem in mobile wireless sensor networks are NP-hard." IEEE Systems Journal 13, no. 2 (2018): 1312-1315.

[42] Nguyen, Tu N., Bing-Hong Liu, Nam P. Nguyen, and Jung-Te Chou. "Cyber security of smart grid: attacks and defenses." In ICC 2020-2020 IEEE International Conference on Communications (ICC), pp. 1-6. IEEE, 2020.

[43] S. Chen, L. Zhang, Y. Tang, C. Shen, R. Kumar, K. Yu, U. Tariq, and A. K. Bashir, "Indoor Temperature Monitoring Using Wireless Sensor Networks: A SMAC Application in Smart Cities", Sustainable Cities and Society, vol. 61, p. 102333, July 2020.

[44] C. Feng, K. Yu, M. Aloqaily, M. Alazab, Z. Lv and S. Mumtaz, "Attribute-Based Encryption with Parallel Outsourced Decryption for Edge Intelligent IoV," IEEE Transactions on Vehicular Technology, vol. 69, no. 11, pp. 13784-13795, Nov. 2020, doi: 10.1109/TVT.2020.3027568.

[45] Y. Gong, L. Zhang, R. Liu, K. Yu and G. Srivastava, "Nonlinear MIMO for Industrial Internet of Things in Cyber–Physical Systems," IEEE Transactions on Industrial Informatics, vol. 17, no. 8, pp. 5533-5541, Aug. 2021, doi: 10.1109/TII.2020.3024631

[46] Z. Guo, L. Tang, T. Guo, K. Yu, M. Alazab, A. Shalaginov, "Deep Graph Neural Network-based Spammer Detection Under the Perspective of Heterogeneous Cyberspace", Future Generation Computer Systems, https://doi.org/10.1016/j.future.2020.11.028.

[47] Y. Sun, J. Liu, K. Yu, M. Alazab, K. Lin, "PMRSS: Privacy-preserving Medical Record Searching Scheme for Intelligent Diagnosis in IoT Healthcare", IEEE Transactions on Industrial Informatics, doi: 10.1109/TII.2021.3070544.

[48] C. Feng et al., "Efficient and Secure Data Sharing for 5G Flying Drones: A Blockchain-Enabled Approach," IEEE Network, vol. 35, no. 1, pp. 130-137, January/February 2021, doi: 10.1109/MNET.011.2000223.

[49] Z. Guo, K. Yu, Y. Li, G. Srivastava, and J. C. -W. Lin, "Deep Learning-Embedded Social Internet of Things for Ambiguity-Aware Social Recommendations", IEEE Transactions on Network Science and Engineering, doi: 10.1109/TNSE.2021.3049262.

[50] Z. Guo, K. Yu, A. Jolfaei, A. K. Bashir, A. O. Almagrabi, and N. Kumar, "A Fuzzy Detection System for Rumors through Explainable Adaptive Learning", IEEE Transactions on Fuzzy Systems, doi: 10.1109/TFUZZ.2021.3052109.

[51] Z. Guo, A. K. Bashir, K. Yu, J. C. Lin, Y. Shen, "Graph Embedding-based Intelligent Industrial Decision for Complex Sewage Treatment Processes", International Journal of Intelligent Systems，2021, doi: 10.1002/int.22540.