# Secure Cloud Storage with Machine Learning-Optimized Attribute-Based Access Control Protocols

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**Abstract:** Cloud storage's scalability, accessibility, and affordability have made it essential in the digital age. Data security and privacy remain a major issue due to the large volume of sensitive data kept on cloud services. Traditional encryption is safe but slows data recovery, especially for keyword searches. Secure, fine-grained access control and quick keyword searches over encrypted data are possible using attribute-based keyword search (ABKS). This study examines how ABKS might optimize search efficiency and data security in cloud storage systems. We examine index compression, query processing improvement, and encryption optimization to decrease computational cost and preserve security. After a thorough investigation, the article shows how these methods may boost cloud storage system performance, security, and usability. Tests show that improved ABKS speeds up search searches and lowers storage costs, making it a viable cloud storage alternative. Exploring sophisticated machine learning algorithms for predictive search improvements and strengthening ABKS against emerging security vulnerabilities are future research priorities.

**Key words:** ABKS, Secure Cloud Storage, Data Encryption, Access Control, Search Optimization

## Introduction:

Cloud computing has transformed data management and storage by providing unmatched scalability, flexibility, and cost-effectiveness. However, rising cloud storage use has raised data security and privacy issues. As sensitive data being outsourced to third-party cloud providers, security is crucial. Traditional encryption methods secure data but make data recovery difficult. Specifically, efficiently searching encrypted data without compromising security is difficult.

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Attribute-Based Keyword Search (ABKS) may solve this problem. ABKS lets users search encrypted data using keywords and regulate access by user traits. Only authorized users may

search and obtain relevant data, protecting cloud data privacy. However, ABKS implementation is difficult. The processing expense of encryption and decryption slows search queries, especially in big cloud systems.

Optimization can improve ABKS performance and efficiency to overcome these issues. While retaining strong security measures, these methods reduce computing load, query processing time, and storage needs. Index compression can lower the encrypted index size, speeding up search. Parallel processing, caching, and other query processing improvements help speed up search requests.

Along with these technological enhancements, machine learning methods can improve ABKS efficiency in a unique way. Machine learning may minimize computing burden and enhance user experience by anticipating user search behavior and improving search queries. Homomorphic encryption and lightweight cryptography offer new ways to optimize ABKS in cloud storage.

Many obstacles persist despite these advances. Trading security and efficiency is tricky, so optimizing ABKS requires careful consideration. Cloud infrastructures' fluctuating workloads and user demands complicate optimization. Thus, continued research is needed to improve optimization methods to meet these problems and assure safe and efficient cloud data storage.

This research explores ABKS optimization methods to improve its speed and usability in cloud storage systems. We want to improve cloud storage system security and efficiency by analyzing these methods. Our goal is to enable more robust and scalable solutions that address the changing demands of people and businesses in the digital era.

The safe cloud storage method begins with data encryption before uploading it to the cloud. Data confidentiality requires encryption, even if unwanted access happens. Data is usually protected via homomorphic or symmetric key encryption. Keywords are used to create an encrypted index after data encryption. This index maps encrypted data to keywords, making keyword searches faster. Creating this index allows users to search encrypted data without decrypting the full information, retaining security and efficiency. The encrypted index must be properly crafted to hide sensitive details about the items it refers. Searchable or order-preserving encryption can balance search efficiency with data security. The index and encrypted data are kept in the cloud for authorized users to query. This process step blends encryption and searching to protect data storage and retrieval.

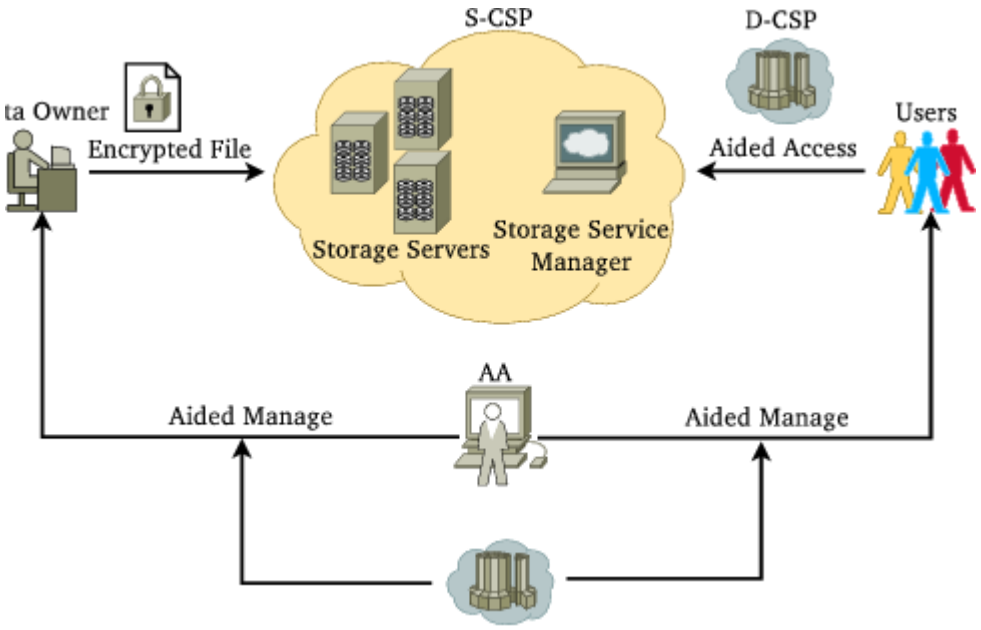


**Fig.1. Attribute-based searchable encryption architecture.**

Attribute-Based Access Control: After data encryption and index creation, construct access control methods to restrict data search and retrieval. Only authorized users can search encrypted data using attribute-based access control (ABAC). ABAC allows user characteristics rather than roles, making it more flexible than traditional access control. These might be user roles, organizational hierarchy, security clearances, or project assignments. A user may only be able to look for data if they have a certain job title or project. User-specific access reduces data exposure. The properties are compared to data owner access control policies. Users can search encrypted data using keywords if their properties fulfill the requirements. Fine-grained access control ensures that only authorized users may access sensitive data, improving data security. The attribute-based paradigm is flexible and versatile, making it suited for dynamic cloud settings with changing user roles and permissions.

## Methods of Optimization:

To work well in real-world cloud systems, attribute-based keyword search (ABKS) must be optimized. Index compression shrinks the encrypted index as the initial optimization method. A smaller index uses less storage and searches faster, speeding up the search process. Prefix encoding, dictionary-based compression, and Huffman coding can compress indexes. Index compression enhances search efficiency and decreases cloud storage costs by lowering storage overhead. Parallel query processing improvements speed up search processes. Parallel processing and caching methods reduce query response times by executing many searches simultaneously and storing frequently searched phrases. ABKS also predicts user search trends using machine learning methods. These algorithms improve query execution, prefetch pertinent material, and prioritize resources for high-probability searches by assessing previous

search activity. Search results are quicker with this predictive technique, reducing computing burden and improving user experience. These optimization methods make the ABKS system more efficient, cost-effective, and secure for large-scale data searches.

### Search and Retrieve:

The procedure concludes with authorized users searching and retrieving encrypted data from the ABKS system. User keyword queries are handled by the ABKS framework utilizing efficient methods. To allow the search, the system validates the user's characteristics. When the user passes the access control check, the system searches the encrypted index for keyword matches. Even for big datasets, index compression and query processing techniques make this search efficient. The user receives encrypted data from the cloud after identification. In this step, the user decrypts the data locally using their keys. Data is encrypted during search and retrieval, reducing the danger of illegal access during transmission. The procedure is smooth, safe, and efficient, allowing users to easily discover and retrieve information without compromising data security. Cryptography, access control, and optimization ensure that search and retrieval match the high needs of current cloud storage systems, delivering a safe data management solution.

### Conclusion

This research shows how optimization strategies may improve the performance of attribute-based keyword search systems in secure cloud storage settings. Index compression, query processing enhancements, and machine learning-based prediction algorithms can boost search performance and data security. However, cloud technology advancement provides new obstacles and possibilities. To keep ABKS relevant in the face of new security concerns, future research should refine current methods and explore new ones, such as quantum-resistant encryption algorithms and more advanced machine learning models.

### Reference:

1. Kumar, M. P., & Vinay, K. M. (2023). Development and mechanical properties evaluation of basalt-glass hybrid composites.
2. Vinay, K. M., & Manujesh, B. J. (2014). Design and fabrication of hybrid composite springs. Int J Mech Eng Technol IJMET, 5(9), 133-140.
3. Nayak, S., Kumar, M. P., & Vinay, K. M. (2024). Wear Behavior Evaluation of Natural Fibre Composite Using Taguchi Technique.
4. Vinay, K. M., & Kumar M, P. (2023, December). Characterization of E-glass fibre and silk fibre hybrid composites. In AIP Conference Proceedings (Vol. 2399, No. 1). AIP Publishing.
5. Shikalgar, N. (2019). Energy and exergy analysis of a domestic refrigerator: approaching a sustainable refrigerator. Journal of Thermal Engineering, 5(5), 469-481.

6. Niyaj, D. S., & Sapali, S. N. (2017). Performance evaluation of a domestic refrigerator with a thermal storage arrangement using propane as a refrigerant. Energy Procedia, 109, 34-39.
7. Imran, A. A., & Jafal, H. M. (2009). Numerical modeling of wire and tube condenser used in domestic refrigerators. Journal of Engineering and Sustainable Development, 13(2), 1-17.
8. Pal, J. S., Sapali, S. N., Ramakrishna, A. T., Shikalgar, N. D., & Shinde, A. (2022). Exergy Criteria of Performance of Waste Heat Recovery Applied for Marine Auxiliary Boiler. International Journal of Heat and Technology, 40(1), 297-303.
9. Tupe, A. S., Sapali, S. N., & Shikalgar, N. (2023). Experimental investigation of a capillary tube for 2 TR water chiller with R22 & R407C refrigerant. Materials Today: Proceedings, 77, 818-822.
10. Mandake, S., Shikalgar, N., & Deshmukh, A. M. (2023). Design and development of an adequate ventilation system to preserve freshly harvested onions. Materials Today: Proceedings, 72, 943-950.
11. Shikalgar, N., Chitale, P., & Sapali, S. N. (2023). Optimization of 3D Plate Fin Heat Sinks Through Analytical Modelling. In Recent Advances in Thermal Sciences and Engineering: Select Proceedings of ICAFFTS 2021 (pp. 139-150). Singapore: Springer Nature Singapore.
12. Ilag, P., Sapali, S. N., & Shikalgar, N. (2023). Design, Development and Experimentation of Distillation Unit for Essential Oil. Materials Today: Proceedings, 72, 664-671.
13. Shikalgar, N. D., Sapali, S. N., & Shinde, A. B. (2022, November). Mathematical Modeling of a Skin Condenser with Angular Contact for Domestic Refrigerator. In Applications of Computation in Mechanical Engineering: Select Proceedings of 3rd International Conference on Computing in Mechanical Engineering (ICCME 2021) (pp. 327-335). Singapore: Springer Nature Singapore.
14. Deshmukh, A. M., Sapali, S. N., Shinde, A. B., & Shikalgar, N. D. (2022, November). Design, Development, and Numerical Analysis of Mist Nozzle and Its Impact on Performance Parameters of an Evaporative Cooler. In Applications of Computation in Mechanical Engineering: Select Proceedings of 3rd International Conference on Computing in Mechanical Engineering (ICCME 2021) (pp. 371-380). Singapore: Springer Nature Singapore.
15. Shikalgar, N. D., Gujari, P. R., Sapali, S. N., & Chavan, V. D. (2022). Predictive Analysis of Air-Cooled Condenser by Considering Fouling Using Machine Learning Algorithm. In Recent Advances in Fluid Dynamics: Select Proceedings of ICAFFTS 2021 (pp. 225-234). Singapore: Springer Nature Singapore.
16. Tongkachok, K., Garg, S., Balakrishnan, S., & Vijayalakshmi, N. S. (2022). Impact of transformational leadership on organizational performance through employee motivation. ECS Transactions, 107(1), 12873.

17. Sakthimala, B., & Deepalakshmi, G. (2023). EMPLOYMENT ENGAGEMENT A REVIEW OF CURRENT RESEARCH AND ITS IMPLICATIONS. A THEORETICAL FRAMEWORK. Multidisciplinary Handbook of Social Exclusion Research, 126.
18. Choudhary, N., Sakthimala, B., & Dhanalakshmi, D. HRM PRACTICE IN BANKING SECTOR: AN ANALYSIS OF EMPLOYEE TRAINING IN PRIVATE BANKS. MULTI DISCIPLINARY STUDIES: PROSPECTS AND PROBLEMS IN MODERN ERA, 139.
19. Deepalakshmi, G. Cyber Law, Policies.
20. Kandi, V., Balakrishnan, S., Sivakumar, G., & Vijayalakshmi, N. S. (2022). Impact of Social Media Marketing on Organizational Performance: A Case Study of Amazon India. ECS Transactions, 107(1), 12749.
21. Sakthimala, B., & Deepalakshmi, G. RELATIONSHIP OF GREEN HRM WITH ENVIRONMENTAL PERFORMANCE: BIBLIOMETRIC ANALYSIS USING SCOPUS DATABASE.
22. Sakthimala, B., & Deepalakshmi, G. (2024, March). Work Satisfaction and Green HRM Mediate the Effect of Corporate Ecological Culture on Employee Performance. In Advancements in Business for Integrating Diversity, and Sustainability: International Analytics Conference 2023| IAC 2023 February 2& 3, 2023| Virtual Conference (p. 110). Taylor & Francis.
23. Karras, D. A., Thakur, S., & Oruganti, S. K. (Eds.). (2024). Advancements in Business for Integrating Diversity, and Sustainability: International Analytics Conference 2023| IAC 2023 February 2& 3, 2023| Virtual Conference. Taylor & Francis.
24. Mishra, N., Rajkumar, M., & Mishra, R. (2019). Micromanagement: an employers' perspective. International Journal of Scientific & Technology Research, 8(10), 2949-2952.
25. Mishra, N., Mishra, R., & Singh, M. K. (2019). The impact of transformational leadership on team performance: The mediating role of emotional intelligence among leaders of hospitality and tourism sector. International Journal of Scientific & Technology Research, 8(11), 3111-3117.
26. Mishra, R., Sharma, M. P., Seth, K., & Singh, V. (2023). A study on consumers' travel purchase intention through travel apps. Prabandhan: Indian Journal of Management, 16(7), 25-42.
27. Mishra, R., & Singh, V. (2022). A study on destination loyalty of tourists at the UNESCO world heritage site: A case study of old Goa in India.
28. Mishra, M. R., & Pal, M. K. Strengthening the Delivery Mechanism in Hospitality Management Education by Applying the Implications of Sound Pedagogical Theories.
29. Mishra, N., Rajkumar, M., & Mishra, R. (2022). Emotional intelligence as a moderator between micromanagement leadership and employee performance. Prabandhan: Indian Journal of Management, 15(10), 63-70.
30. Rana, V. (2017). Trends, issues and women in hospitality and tourism industry. RET International Academic Publishing ISBN, 978-93.

31. Jagannath, D., Mishra, R., Pal, S., Mishra, N., & Singh, M. K. (2017). Is Internship Influencing Hotel Management Students' Perception about Hospitality Industry?. International Journal of Economic Research, 14(9), 391-400.
32. Mishra, R., & Singh, M. K. (2015). Imperatives for Teacher Empowerment in Devising Extension Education as Part of the Holistic Curriculum for Hospitality and Tourism Domains: A Conceptual Study in Indian Context. Journal of Tourism and Hospitality Management, 3(9-10), 181-191.
33. Mishra, M. R., Kannan, S., & Singh, M. K. (2015). An Integrated Framework for Promoting Eco Initiatives: Role of Educational Institutions as Execution Specialists. Global Journal of Management and Business Research, 15(1), 45-50.
34. Mishra, R., & Pal, K. (2013). Empowering Front Office Professionals with Understanding of Guests' Personality Psychology. Global Journal of Management and Business Research, 45-50.
35. Abhishek, T. K., Mishra, R., Mishra, N., & Singh, M. K. A Critical Review on the Recommendations and Proposals of the Ministry of Tourism for Twelfth Five Year Plan: Imperatives for Paradigm Shift in Human Resource Development and Capacity Building Initiatives in Hospitality and Tourism Sectors.
36. Mishra, R., & Singh, M. K. (2015). Imperatives for Teacher Empowerment in Devising Extension Education as Part of the Holistic Curriculum for Hospitality and Tourism Domains: A Conceptual Study in Indian Context. Journal of Tourism and Hospitality Management, 3(9-10), 181-191.
37. Mishra, R., & Pal, K. (2011). Application of Customer Relationship Management Methodologies as an Enterprising Strategy for the Hospitality and Tourism Education.
38. Mishra, R., & Pal, K. (2009). A Theoretical Framework Involving Principles of Instructional Design to Reinforce the Simulation Based Learning in Hospitality Management Education. MMU Journal of Management Practices'(MMUJMP), 3(1&2), 29-44.
39. Abhishek, T. K., Mishra, R., Mishra, N., & Singh, M. K. A Critical Review on the Recommendations and Proposals of the Ministry of Tourism for Twelfth Five Year Plan: Imperatives for Paradigm Shift in Human Resource Development and Capacity Building Initiatives in Hospitality and Tourism Sectors.
40. Girish Santosh Bagale, Sudhakar Sengan, Arodh Lal Karn, Bhavana Raj Kondamudi., Deepesh Kumar Srivastava, and Ravi Kumar Gupta. (2022). Measuring the Determining Factors of Financial Development of Commercial Banks in Selected SAARC Countries. Journal of Database Management. Vol. 33, No. 1, pp. 1–21. ISSN: 1063-8016, E-ISSN: 1533-8010. EISBN13: 9781799893301. https://doi.org/10.4018/JDM.311092.
41. Chaubey PK, Arora TK, Raj KB, Asha GR, Mishra G, Guptav SC, Altuwairiqi M, Alhassan M. (2022). Sentiment Analysis of Image with Text Caption using Deep Learning Techniques. Computational Intelligence and Neuroscience. pp. 1-11. ISSN: 1687-5265, E-ISSN: 16875273. https://doi.org/10.1155/2022/3612433 .

42. Dr. K. Bhavana Raj . (2022). “Industry 4.0: Smart Manufacturing in Industries - The Future”.(2022). Machine Learning and Data Science: Fundamentals and Applications, John Wiley and Sons, Scopus, Web of Science, Library of Congress, 30 July 2022, Chapter 4,pp. 67-74. ISBN 9781119775614, E-ISBN 9781119776499. https://doi.org/10.1002/9781119776499.ch4 , DOI:10.1002/9781119776499.
43. Madhan, E. S., Kannan, K. S., Rani, P. S., Rani, J. V., & Anguraj, D. K. (2021). A distributed submerged object detection and classification enhancement with deep learning. Distrib. Parallel Databases, 1-17.
44. Kumar, V. S., & Naganathan, E. R. (2015). Segmentation of Hyperspectral image using JSEG based on unsupervised clustering algorithms. ICTACT Journal on Image and Video Processing, 6(2), 1152-1158.
45. Sakthivela, M., Balakrishnab, N., Kannanc, K. S., & Devabaland, P. (2021). An Analysis of Load Balancing Algorithm Using Software-Defined Network. Turkish Journal of Computer and Mathematics Education Vol, 12(9), 578-586.
46. Padmanaban, K., Kannan, K. S., Rajan, D. P., & Divya, P. (2021). A Novel Groundwater Resource Forecasting Technique for Cultivation Utilizing Wireless Sensor Network (WSN) and Machine Learning (ML) Model. Turkish Journal of Computer and Mathematics Education, 12(2), 2186-2192.
47. Kanna, D. K., Devabalan, D. P., Hariharasitaraman, S., & Deepa, P. (2018). Some Insights on Grid Computing-A Study Perspective. International Journal of Pure and Applied Mathematics, 118(8), 47-50.
48. G. Revathy, K. Bhavana Raj, Anil Kumar, Spurthi Adibatti, Priyanka Dahiya, T.M. Latha, Investigation of E-voting system using face recognition using convolutional neural network (CNN), Theoretical Computer Science, Volume 925, 2022, Pages 61-67, ISSN 0304-3975, https://doi.org/10.1016/j.tcs.2022.05.005.
49. . Y. W. Bhowte, A. Roy, K. B. Raj, M. Sharma, K. Devi and P. LathaSoundarraj, "Advanced Fraud Detection Using Machine Learning Techniques in Accounting and Finance Sector," 2024 Ninth International Conference on Science Technology Engineering and Mathematics (ICONSTEM), Chennai, India, 2024, pp. 1-6, doi: 10.1109/ICONSTEM60960.2024.10568756.
50. V. Chavan, K. Bhavana Raj, N. S, A. K. Bhunia, A. Dadhich and H. Pallathadka, "Integrated Portfolio Management Strategies: Harnessing IoT and Machine Learning for Enhanced Decision-Making," 2024 International Conference on Science Technology Engineering and Management (ICSTEM), Coimbatore, India, 2024, pp. 1-6, doi: 10.1109/ICSTEM61137.2024.10560711.
51. K. Bhavana Raj; Kamakshi Mehta; Someshwar Siddi; M.K. Sharma; Dilip K. Sharma; Sunil Adhav; José L.A. Gonzáles, "Optimizing Financial Transactions and Processes Through the Power of Distributed Systems," in Meta-Heuristic Algorithms for Advanced Distributed Systems, Wiley, 2024, pp.289-303, doi: 10.1002/9781394188093.ch17.

52. Grover, R., Raj, K. B., Tiwari, A., Sumant, M., & Naqvi, S. R. (2024). Statistical Quality Control in Manufacturing and Managing Processes for Continuous Improvement of Organisation. International Journal of Central Banking, 20(1).
53. J. R, S. H. Krishna, M. G.M, S. Mohammed, K. B. Raj and G. Manoharan, "Fuzzy Evaluation Method on the Financing Efficiency of Small and Medium-Sized Enterprises," 2023 International Conference on Artificial Intelligence and Knowledge Discovery in Concurrent Engineering (ICECONF), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ICECONF57129.2023.10083731.
54. Bommisetti, R. K., Raj, B. K., Subbalakshmi, A. V. V. S., Shehryar, M., & Hoang, S. D. (2022). Blockchain in Trust with Reputation Management for Financial Stock Market Using Distributed Ledger Technology and Bayesian Theory Based on Fault Tolerance Model. Global Business Review, 1-21. https://doi.org/10.1177/09721509221110371.
55. Babu, V. S., Amuthakkannan, R., Kumar, S. S., & Muruganandam, A. (2013). Optimal cutting parameters estimation to improve surface finish in turning operation in AISI 1045 using Taguchi's robust design. International Journal of Industrial and Systems Engineering, 15(1), 19-36.
56. Vijayalakshmi, K., Ramaraj, N., Amuthakkannan, R., & Kannan, S. M. (2007). A new algorithm in assembly for component-based software using dependency chart. International Journal of Information Systems and Change Management, 2(3), 261278.
57. Al Tobi, M. A. S., Ramachandran, K. P., Al-Araimi, S., Pacturan, R., Rajakannu, A., & Achuthan, C. (2022). Machinery faults diagnosis using support vector machine (SVM) and Naïve Bayes classifiers. Int. J. Engi. Trends Technol., 70(12), 26-34.
58. Amuthakkannan, R., Kannan, S. M., Vijayalakshmi, K., & Ramaraj, N. (2009). Reliability analysis of programmable mechatronics system using Bayesian approach. International Journal of Industrial and Systems Engineering, 4(3), 303-325.
59. Amuthakkannan, R., Vijayalakshmi, K., Al Araimi, S., & Ali Saud Al Tobi, M. (2023). A review to do fishermen boat automation with artificial intelligence for sustainable fishing experience ensuring safety, security, navigation and sharing information for Omani fishermen. Journal of Marine Science and Engineering, 11(3), 630.
60. Al Tobi, M. A. S., K p, R., Al-Araimi, S., Pacturan, R., Rajakannu, A., & Achuthan, G. (2022, July). Machinery Fault Diagnosis using Continuous Wavelet Transform and Artificial Intelligence based classification. In Proceedings of the 2022 3rd International Conference on Robotics Systems and Vehicle Technology (pp. 51-59). 99. Saravanan, V., Banerjee, N., Amuthakkannan, R., & Rajakumar, S. (2014). Effect of Heat Input on Tensile Properties of Friction Stir Welded AA6061-T6 and AA7075-T6 Dissimilar Aluminum Alloy Joints. Int. J. of Multidisciplinary and Scientific Emerging Research, 3(1).
61. Abdulkarem, W., Amuthakkannan, R., & Al-Raheem, K. F. (2014, March). Centrifugal pump impeller crack detection using vibration analysis. In 2nd International Conference on Research in Science, Engineering and Technology (pp. 206-211).

62. Amuthakkannan, R., Kannan, S. M., Selladurai, V., & Vijayalakshmi, K. (2008). Software quality measurement and improvement for real-time systems using quality tools and techniques: a case study. International Journal of Industrial and Systems Engineering, 3(2), 229-256.
63. Vijayalakshmi, K., Ramaraj, N., & Amuthakkannan, R. (2008). Improvement of component selection process using genetic algorithm for component-based software development. International Journal Management, 3(1), 63-80. of Information Systems and Change
64. Amuthakkannan, R. (2012). Parameters design and performance analysis of a softwarebased mechatronics system using Taguchi robust design–a case study. International Journal of Productivity and Quality Management, 10(1), 1-24.
65. Amuthakkannan, R., Kannan, S. M., Vijayalakshmi, K., & Ramaraj, N. (2009). Reliability analysis of programmable mechatronics system using Bayesian approach. International Journal of Industrial and Systems Engineering, 4(3), 303-325.
66. Saravanan, V., Banerjee, N., Amuthakkannan, R., & Rajakumar, S. (2015). Microstructure and mechanical properties of friction stir welded joints of dissimilar AA6061-T6 and AA7075-T6 aluminium alloys. Applied Mechanics and Materials, 787, 350-354.
67. Senthilkumar, M., Somasundaram, S., & Amuthakkannan, R. (2009). Power aware multiple QoS constraints routing protocol with mobility prediction for MANET. International Journal of Information Systems and Change Management, 4(2), 156-170.
68. Amuthakkannan, R., Kannan, S. M., Vijayalakshmi, K., & Jayabalan, V. (2007). Managing change and reliability of distributed software system. International Journal of Information Systems and Change Management, 2(1), 30-49.
69. . Amuthakkannan, R., Babu, C. K., & Kannan, S. M. (2010). An approach to the minimisation of makespan in the textile industry using ant colony optimisation. International Journal of Services and Operations Management, 7(2), 215230.
70. Jose, J., & Amuthakkannan, R. (2014). Design, Development and Analysis of FDM based Portable Rapid Prototyping Machine. International Journal of Latest Trends in Engineering and Technology (IJLTET), 4(4), 324-232.
71. Meenalochini, P., Karthick, R., & Sakthivel, E. (2023). An Efficient Control Strategy for an Extended Switched Coupled Inductor Quasi-Z-Source Inverter for 3Φ Grid Connected System. Journal of Circuits, Systems & Computers, 32(11).
72. Karthick, R., Senthilselvi, A., Meenalochini, P., & Senthil Pandi, S. (2023). An optimal partitioning and floor planning for VLSI circuit design based on a hybrid bio-inspired whale optimization and adaptive bird swarm optimization (WO-ABSO) algorithm. Journal of Circuits, Systems and Computers, 32(08), 2350273.
73. Reka, R., Karthick, R., Ram, R. S., & Singh, G. (2024). Multi head self-attention gated graph convolutional network based multi-attack intrusion detection in MANET. Computers & Security, 136, 103526. 24. Vijayalakshmi, S., Sivaraman, P. R., Karthick, R.,

& Ali, A. N. (2020, September). Implementation of a new Bi-Directional Switch multilevel Inverter for the reduction of harmonics. In IOP Conference Series: Materials Science and Engineering (Vol. 937, No. 1, p. 012026). IOP Publishing.

74. Jasper Gnana Chandran, J., Karthick, R., Rajagopal, R., & Meenalochini, P. (2023). Dualchannel capsule generative adversarial network optimized with golden eagle optimization for pediatric bone age assessment from hand X-ray image. International Journal of Pattern Recognition and Artificial Intelligence, 37(02), 2354001.
75. Sabarish, P., Karthick, R., Sindhu, A., & Sathiyanathan, N. (2021). Investigation on performance of solar photovoltaic fed hybrid semi impedance source converters. Materials Today: Proceedings, 45, 1597-1602.
76. Nagarani, N., Karthick, R., Sophia, M. S. C., & Binda, M. B. (2024). Self-attention based progressive generative adversarial network optimized with momentum search optimization algorithm for classification of brain tumor on MRI image. Biomedical Signal Processing and Control, 88, 105597.
77. Suresh, H. R., Vinitha, V., Girinath, N., & Karthick, R. (2021). Suppression of four wave mixing effect in DWDM system. Materials Today: Proceedings, 45, 2707-2712.
78. Sabarish, P., Raj, L. H. T., Ramprakash, G., & Karthick, R. (2020, September). An Energy Efficient Microwave Based Wireless Solar Power Transmission System. In IOP Conference Series: Materials Science and Engineering (Vol. 937, No. 1, p. 012013). IOP Publishing.
79. Roald, N. G. (2013). Estimation of vital signs from ambient-light non-contact photoplethysmography (Master's thesis, telekommunikasjon). Institutt for elektronikk og
80. Karthick, R., Prabaharan, A. M., & Selvaprasanth, P. (2019). Internet of things based high security border surveillance strategy. Asian Journal of Applied Science and Technology (AJAST) Volume, 3, 94-100.
81. Rajagopal, R. K. P. M. T. K. R., Karthick, R., Meenalochini, P., & Kalaichelvi, T. (2023). Deep Convolutional Spiking Neural Network optimized with Arithmetic optimization algorithm for lung disease detection using chest X-ray images. Biomedical Signal Processing and Control, 79, 104197.
82. Karthick, R., & Sundararajan, M. (2021). SPIDER-based out-of-order execution scheme for Ht-MPSOC. International Journal of Advanced Intelligence paradigms, 19(1), 28-41.
83. Karthick, R., & Meenalochini, P. (2020). Implementation of data cache block (DCB) in shared processor using field-programmable gate array (FPGA). Journal of the National Science Foundation of Sri Lanka, 48(4), 475.
84. Karthick, R., & Sundararajan, M. (2017). Design and implementation of low power testing using advanced razor based processor. International Journal of Applied Engineering Research, 12(17), 6384-6390.

85. Karthick, R., & Sundararajan, M. (2018). A novel 3-D-IC test architecture-a review. International Journal of Engineering and Technology (UAE), 7(1), 582-586.
86. Karthick, R., Senthilselvi, A., Meenalochini, P., & Senthil Pandi, S. (2022). Design and analysis of linear phase finite impulse response filter using water strider optimization algorithm in FPGA. Circuits, Systems, and Signal Processing, 41(9), 5254-5282.
87. Karthick, R. R. M. A. M. V. K. R., Ramkumar, R., Akram, M., & Kumar, M. V. (2021). Overcome the challenges in bio-medical instruments using IOT–A review. Materials Today: Proceedings, 45, 1614-1619.
88. Karthick, R., & Sundararajan, M. (2017). PSO based out-of-order (ooo) execution scheme for HT-MPSOC. Journal of Advanced Research in Dynamical and Control Systems, 9(6), 1969-1986.
89. Karthick, R., & Sundararajan, M. (2017). A Reconfigurable Method for TimeCorrelatedMimo Channels with a Decision Feedback Receiver. International Journal of Applied Engineering Research, 12(15), 5234-5241.
90. Bhuvana Suganth, D., & Manjunath, R. (2017). Fault tolerance communication in mobile distributed networks. In Proceedings of the International Conference on Data Engineering and Communication Technology: ICDECT 2016, Volume 1 (pp. 77-87). Springer Singapore.
91. Varsha, A., & Karnika, S. (2024, January). Smart Waste Segregation System. In 2024 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE) (pp. 1-4). IEEE.
92. Jaichandran, R., Bharathi, P. S., Meenakshi, B., Anushya, A., & Devi, V. B. (2021). The Defense Against Jamming Attack in Cognitive Radio Networks: Energy Efficiency Management Perspective. Microprocessors and Microsystems, 82, 103816.
93. Suganthi, D. B., Manjuath, R., & Aravindan, A. (2016, May). Reliable security policy in mobile distributed network. In 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT) (pp. 1782-1786). IEEE.
94. Vidhyalakshmi, M. K., Thaiyalnayaki, S., Suganthi, D. B., Porselvi, R., & Kumuthapriya, K. (2024). Automated micro aneurysm classification using deep convolutional spike neural networks. Wireless Networks, 1-11.
95. Suganthi, D. B., Indumathy, D., Panimozhi, K., Kavitha, P., Punitha, A., & Saravanan, S. Edge Computing Technology for Secure IoT. In Secure Communication in Internet of Things (pp. 192-203). CRC Press.
96. Adithe, S. S., Suganthi, S., Maheswari, B. U., & Selvi, M. (2021, November). Networking reliability approach for energy analysis in wireless sensor nodes with edge computing techniques. In 2021 Fifth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) (pp. 1428-1433). IEEE.

97. Sheela, A., Karunkuzhali, D., Bhuvana Suganthi, D., Anushya, A., & Ramprabu, G. (2020). Data imputation in wireless sensor networks using regression models. International Journal of Advanced Trends in Computer Science and Engineering, 9(5), 8661-8665.
98. Suganthi, D. B., Vidhyalakshmi, M. K., Punitha, A., Raghupathi, S., & Subhapradha, M. (2023). A Review on Transdisciplinary Approach and Challenges on Wearable Technology.
99. Suganthi, D. B., Shivaramaiah, M., Punitha, A., Vidhyalakshmi, M. K., & Thaiyalnayaki, S. (2023, January). Design of 64-bit Floating-Point Arithmetic and Logical Complex Operation for High-Speed Processing. In 2023 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE) (pp. 928-931). IEEE.
100. Vidhyalakshmi, M. K., Jagadeesh, K., Dharmaraj, B. S., Sankar N, P., & Kumar, R. G. (2024). Indian Sign Language Recognition using transfer learning with Efficient Net. Smart Science, 12(2), 269-280.
101. Singh, V., Sharma, M. P., Jayapriya, K., Kumar, B. K., Chander, M. A. R. N., & Kumar, B. R. (2023). Service quality, customer satisfaction and customer loyalty: A comprehensive literature review. Journal of Survey in Fisheries Sciences, 10(4S), 3457-3464.
102. Chatterjee, R., Singh, A., & Singh, V. (2022). Ethical and Sustainable Perceptions on Cloud Kitchen Business-A Study of Consumers and Stakeholders during the Covid-19 Pandemic. International Journal of Hospitality and Tourism Systems, 15(COVID-19 Issue), 76.
103. Mishra, R., Sharma, M. P., Seth, K., & Singh, V. (2023). A study on consumers' travel purchase intention through travel apps. Prabandhan: Indian Journal of Management, 16(7), 25-42.
104. Singh, V., & Tharakan, Y. G. (2020). Marketing Trends in Food Tourism to Attract International Tourists in Delhi Hotels. Studies in Indian Place Names (UGC Care Journal) ISSN, 2394-3114.
105. Mishra, R., & Singh, V. (2022). A study on destination loyalty of tourists at the UNESCO world heritage site: A case study of old Goa in India.
106. Sakhuja Sharma, A. (2022). An Empirical Study To Assimilate The Perceptual Gaps Among The Hospitality Stakeholders Regarding The Academic Learning Processes Followed By The Private Hotel Management Colleges In Karnataka. Webology (ISSN: 1735-188X), 19(2).
107. CARE, A. U. A STUDY OF FOOD PROTECTION AND SANITATION AWARENESS AND PRACTICES BY HOTEL MANAGEMENT STUDENTS IN DELHI NCR.
108. Sundram, S., Kushwaha, A., Mylapalli, S., Latwal, G. S., Singh, V., & Jaswal, R. INVESTIGATING THE RELATIONSHIP BETWEEN ATTACHMENT STYLE AND MANNER OF MOBILE PHONE USAGE AMONG STUDENTS.

109. Kumari, M. J. P. Community Perception of Initiatives Promoting Community-Based Tourism.
110. Singh, C. V., & Sharma, H. The Impact and Challenges of Hospitality Sector Post Covid19. Perspectives, Patterns and Practices, 207.
111. Sharma, H., & Singh, C. V. Operational Considerations for Hotel Industry Post COVID19. Perspectives, Patterns and Practices, 183.
112. Thakur, S., Kulshrestha, R., & Singh, C. V. Perspectives, Patterns and Practices.