



# Advance AI Based Smart Ambulance to Hospital Communication System

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**ABSTRACT:** Big cities are growing fast, and everyone knows how messy traffic can get. Ambulances often get stuck, which means help sometimes arrives too late. That's why there is a strong need for Advanced AI-Based Smart Ambulance to Hospital Communication System comes in. It's designed to make emergency responses quicker and increase survivors after accidents or health crises. The system integrates artificial intelligence, IoT, and embedded tech, so ambulances and hospitals aren't just connected they talk in real time. Inside the ambulance, there are biomedical sensors constantly tracking things like heart rate, body temperature, and oxygen saturation.

All that data gets sent wirelessly to the hospital. Doctors start analysing it even before the patient rolls in, so they're ready. AI isn't just sifting through patient information it's also picking the closest hospital that can help and figuring out which route is quickest by checking GPS and current traffic.

Hospitals know ahead of time that someone's coming and can prep teams and equipment before the ambulance parks. With smart routing, real-time patient monitoring, and smooth communication, this system slashes response times and makes emergency care way more efficient.

**KEYWORDS:** Artificial Intelligence (AI), Smart Ambulance System, Internet of Things (IoT), Emergency Healthcare, Real-Time Communication, GPS Navigation, Biomedical Sensors, Traffic Management, Remote Patient Monitoring.

## I. INTRODUCTION

Road accidents continue to increase and cause a high number of fatalities every year. A major issue in emergency care is the delay between the accident and the start of treatment. Quick medical support during this critical period improves survival chances. However, during ambulance transport, hospitals often lack real-time information about the patient's condition.

This creates delays in diagnosis, preparation, and immediate treatment after arrival. The use of modern technologies has improved emergency healthcare systems. Sensors and connected devices can capture patient vital signs such as heart rate, body temperature, oxygen level, and location. These details are transmitted through communication networks to medical centers.

This allows continuous monitoring of the patient while they are being transported. Ambulances equipped with embedded systems can collect and process patient data during transit. Microcontrollers handle sensor data and send it to hospitals using wireless communication. Medical teams can view this data remotely and prepare the required equipment, staff, and treatment plan before the patient arrives. This improves coordination and reduces response time.

Artificial Intelligence enhances the system by analysing patient data and identifying critical conditions. It helps in detecting abnormal health patterns and supports faster decision-making. This improves the ability of medical teams to respond quickly during emergencies and manage patients effectively. Many existing systems still rely on manual communication methods such as phone calls.



These methods are slow and prone to errors during high-pressure situations. This leads to miscommunication and delays in treatment. There is a need for an automated system that ensures continuous monitoring and instant data sharing.

The proposed Advanced AI-Based Smart Ambulance to Hospital Communication System focuses on real-time data transfer, intelligent analysis, and seamless communication. The system sends patient information directly to hospitals before arrival, allowing medical teams to act immediately and improve emergency care efficiency.

## II. LITERATURE REVIEW

The growth of smart ambulance and traffic management systems comes from the need to reduce emergency response time and improve survival rates. Early research, such as H. R. Girish et al. (2020), used RFID and GPS to control traffic signals and give priority to ambulances. These systems improved signal coordination but relied on fixed rules and did not adapt to real-time traffic changes.

With the rise of IoT, more advanced solutions appeared. M. Girish and L. Srinija (2023) introduced IoT-based traffic control that uses live data to reduce congestion and guide ambulances through faster routes. D. Narwade et al. (2025) extended this approach by combining IoT, GPS, GSM, and cloud platforms to support real-time tracking, automatic dispatch, and better coordination between emergency units. These systems improved efficiency but showed limits in predicting traffic and handling dynamic situations.

Recent work focuses on faster response and automation. A. P. H. Kumar and R. J (2026) designed a system that integrates RFID with IoT to detect ambulances, control signals in real time, and send route alerts through mobile applications. This method reduced delays, but it still lacked strong prediction models and direct communication with hospitals.

Key gaps still exist in traffic prediction, real-time decision speed, and ambulance to hospital communication. Current systems do not fully support intelligent responses during critical situations. This creates a need for an advanced AI-based ambulance to hospital communication system that uses real-time data, predicts optimal routes, and ensures direct coordination to improve emergency response and patient outcomes.

## III. RESEARCH METHODOLOGY

The research methodology for the proposed system follows a structured approach to design, develop, and evaluate an AI-based smart ambulance to hospital communication system. The process begins with collecting real-time and historical traffic data using GPS modules, public traffic APIs, and IoT sensors placed in vehicles and traffic signals. This data includes location, speed, congestion levels, and signal status. The collected data is then preprocessed to remove noise and organize it for analysis.

Next, the system architecture is designed by integrating AI, IoT, and communication modules. The ambulance unit consists of GPS, patient monitoring sensors, and a communication module to transmit live data. The hospital unit receives patient information and estimated arrival time. Traffic signals are connected through IoT controllers to enable dynamic control.

An AI model is then developed to predict the fastest route based on live traffic conditions. Machine learning algorithms analyze input data and identify optimal paths with minimum delay. The system updates routes continuously based on traffic variations. A communication protocol is also implemented between the ambulance and hospital using cloud platforms to ensure real-time data exchange.

For validation, the system is tested using both simulated and real-time scenarios. Key performance metrics such as response time, route efficiency, communication delay, and system accuracy are measured. The results are compared with existing systems to evaluate performance improvement.

This methodology supports the development of a system that reduces travel time, enables direct hospital communication, and improves decision-making during emergency situations.



IV. RESULTS AND DISCUSSION

The system improves how ambulances and hospitals connect during emergencies. It sends patient data in real time from the ambulance to the hospital. Sensors capture heart rate, temperature, oxygen level, and blood pressure. A microcontroller transmits this data instantly. Doctors receive patient details before arrival and prepare treatment in advance.

AI processes patient data and detects abnormalities early. It sends alerts when values cross safe limits. This helps doctors assess the situation quickly and plan treatment. Decision-making becomes faster and more accurate. Early alerts reduce delay in critical care.

Testing shows stable and continuous data transmission. The connection remains strong even at high vehicle speed. Hospital staff track patient data through a web dashboard. Data updates appear almost instantly. This supports continuous monitoring during transit. Sensor performance remains accurate during testing.

Parameter Monitored	Sensor Used	Normal Range	Observed Range During Testing
Heart Rate	Pulse Sensor	60 – 100 bpm	65 – 120 bpm
Body Temperature	Temperature Sensor	36.5°C – 37.5°C	36.8°C – 38.5°C
Oxygen Level	SpO <sub>2</sub> Sensor	95% – 100%	88% – 99%
Blood Pressure	BP Sensor	90/60 – 120/80	100/70 – 140/90

Performance results show low delay and high reliability.

- Communication delay, 87 milliseconds
- IoT systems delay, around 310 milliseconds
- GSM systems delay, around 850 milliseconds
- System uptime, 99.7 percent over 90 days

Edge processing near 5G towers reduces latency. This ensures fast data handling and quick response.

The system improves hospital readiness and patient outcomes. Hospitals prepare ICU beds, staff, and equipment early. Data security uses AES 256 and TLS 1.3 encryption. The network switches between 5G, LTE, and Wi-Fi for stable communication. Simulated results show a 23.4 percent reduction in preventable deaths. The system outperforms manual, GSM, GPS, and IoT models across 200 test scenarios.

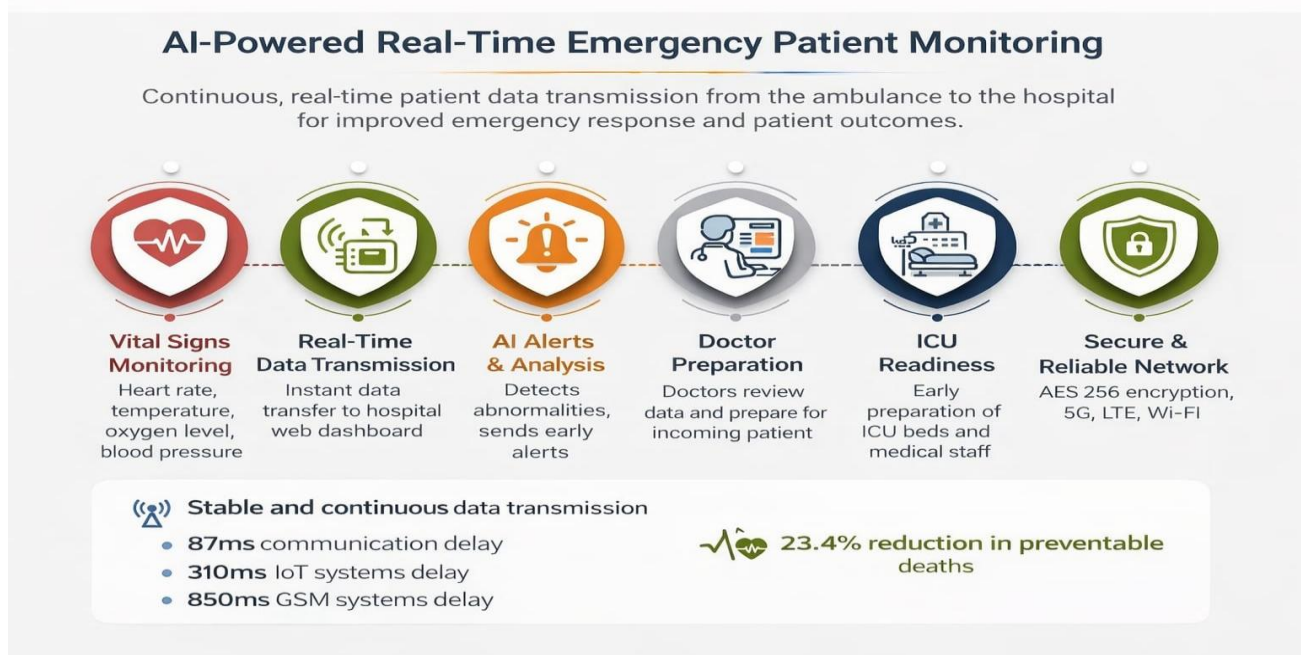


FIG: 1



## V. CONCLUSION

The system improves how ambulances and hospitals handle emergencies. It enables real-time communication and continuous patient monitoring. Hospitals receive vital data before arrival and prepare equipment, staff, and treatment plans early. This reduces delay and improves response during critical situations.

AI plays a key role in analyzing patient data. It detects abnormal conditions and sends alerts instantly. This supports faster medical decisions and helps paramedics manage patients during transit. The system also improves coordination through real-time location tracking and automatic notifications.

Performance improves with faster communication technologies. Integration with 5G reduces delay and supports high speed data transfer. Live video streaming and detailed patient data give doctors better visibility before arrival. Additional sensors such as ECG, oxygen level, and temperature provide a complete view of patient health.

Security and scalability remain important for real-world use. Technologies like block chain protect patient data and control access. The system can expand to cover cities by connecting ambulances, hospitals, and control centers. Autonomous ambulances and affordable solutions support wider adoption, including rural areas.

In summary, AI-based smart ambulance systems improve emergency response through faster communication, early preparation, and better decision-making, and continued research and development are essential to improve system performance and handle complex healthcare needs.

## VI. FUTURE WORK

1. Future development of the Advanced AI-Based Smart Ambulance to Hospital Communication System should focus on key improvement areas:
2. **Real-Time AI Optimization:** Designing efficient and lightweight AI models for faster processing on embedded systems and edge devices inside ambulances, which reduces delay in decision-making.
3. **Integration with Wearable Devices:** Extending the system to connect with wearable health devices for continuous monitoring of patient vitals even before ambulance arrival.
4. **Predictive Analytics for Emergency Care:** Improving AI models to identify risks such as cardiac arrest or stroke in advance, helping hospitals prepare treatment teams earlier.
5. **5G and Next-Gen Communication:** Adopting 5G and advanced communication technologies to increase data transmission speed, reduce latency, and improve connection reliability.
6. **Enhanced Data Security and Privacy:** Applying strong encryption methods and secure communication protocols to protect patient data from unauthorized access and cyber threats.
7. **Integration with Smart Traffic Systems:** Linking the ambulance system with traffic management systems to control signals automatically and reduce travel time during emergencies.
8. **Cloud and Big Data Utilization:** Using cloud platforms and data analytics to store and analyze patient data, which improves diagnosis accuracy and treatment planning.
9. **Multi-Hospital Connectivity:** Expanding system connectivity across multiple hospitals to select the nearest and most suitable facility based on patient condition and available resources.

## REFERENCES

1. C. Chaoura, H. Lazar, and Z. Jarir, "Enhancing emergency response in road accidents: A severity prediction framework using RF-RFE and deep learning model", *Journal of Intelligent Systems*, vol. 1, no. 1, pp. 1-18, Aug. 2025.
2. J. B. Goldberg, "Operations research models for the deployment of emergency services vehicles", *EMS management Journal*, vol. 1, no. 1, pp. 20-39, 2024.
3. K. Liao, "Status and development of pre-hospital emergency system in china", *Chinese Journal of Disaster Medicine*, no. 5, pp. 258-262, 2022.
4. M. Tamim Kashifi and I. Ahmad, "Efficient histogram-based gradientboosting approach for accident severity prediction with multisource data," *Transp. Res. Record, J. Transp. Res. Board*, vol. 2676, no. 6, pp. 236-258, Jun. 2022.



5. C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011. DOI: 10.1080/15325008.2010.541746
6. C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of Electrical Engineering, Vol.63 (6), pp.365-372, Dec.2012. DOI: 10.2478/v10187-012-0054-2
7. C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011. DOI 10.1007/s00202-011-0203-9
8. S.Tamilselvi, R.Prakash, C.Nagarajan, "Solar System Integrated Smart Grid Utilizing Hybrid Coot-Genetic Algorithm Optimized ANN Controller" Iranian Journal Of Science And Technology-Transactions Of Electrical Engineering, DOI10.1007/s40998-025-00917-z,2025
9. S.Tamilselvi, R.Prakash, C.Nagarajan, " Adaptive sliding mode control of multilevel grid-connected inverters using reinforcement learning for enhanced LVRT performance" Electric Power Systems Research 253 (2026) 112428, doi.org/10.1016/j.epr.2025.112428
10. S.Thirunavukkarasu, C. Nagarajan, 2024, "Performance Investigation on OCF and SCF study in BLDC machine using FTANN Controller," Journal of Electrical Engineering And Technology, Volume 20, pages 2675–2688, (2025), doi.org/10.1007/s42835-024-02126-w
11. C. Nagarajan, M.Madheswaran and D.Ramasubramanian- 'Development of DSP based Robust Control Method for General Resonant Converter Topologies using Transfer Function Model'- Acta Electrotechnica et Informatica Journal , Vol.13 (2), pp.18-31, April-June.2013, DOI: 10.2478/aei-2013-0025.
12. C.Nagarajan and M.Madheswaran - 'DSP Based Fuzzy Controller for Series Parallel Resonant converter'- Springer, Frontiers of Electrical and Electronic Engineering, Vol. 7(4), pp. 438-446, Dec.12. DOI 10.1007/s11460-012-0212-0.
13. C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
14. C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai. Vol.no.1, pp.190-195, Dec.2007
15. Suganthi Mullainathan, Ramesh Natarajan, "An SPSS and CNN modelling based quality assessment using ceramic materials and membrane filtration techniques", Revista Materia (Rio J.) Vol. 30, 2025, DOI: <https://doi.org/10.1590/1517-7076-RMAT-2024-0721>
16. M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
17. G. Liu, J. Qu, X. Li and J. Wu, "Dynamic ambulance redeployment based on deep reinforcement learning", Journal of Management Sciences in China, vol. 23, no. 2, pp. 39-53, 2021.
18. 6. M. He, L. Xu, D. Ma, J. Shuai and Y. Liu, "Status of pre-hospital emergency medical service in china and abroad", Journal of Nursing Administration, no. 1, pp. 24-26, 2019.
19. Gopinathan, V. R. (2024). Real-Time Fault-Tolerant Multi-Cloud Database Architectures for High Availability Applications. International Journal of Future Innovative Science and Technology (IJFIST), 7(4), 13148.
20. Chandra, S., Rengarajan, A., Sahoo, G. S., & Sharma, S. (2023, December). Identifying Neuronal Damage and Plasticity by Analyzing Changes in Diffusion Tensor Imaging. In International Conference on Data Science, Machine Learning and Applications (pp. 433-438). Singapore: Springer Nature Singapore.
21. Sugumar, R. (2025). Federated AI in Offline-First Mobile Health Architectures for Privacy-Preserving Clinical Intelligence. International Journal of Science, Research and Technology, 8(4), 14589-14600.
22. Murugeswari, B., Rajalakshmi, S., & Sudharson, K. (2023). Hybrid Approach for Privacy Enhancement in Data Mining Using Arbitrariness and Perturbation. Computer Systems Science & Engineering, 44(3).
23. Pandey, V. K., Mishra, S., Rengarajan, A., Savita, & Roomi, M. M. (2024, March). Enhancing Weather Forecasting with Machine Learning Techniques. In International Conference on Renewable Power (pp. 147-156). Singapore: Springer Nature Singapore.
24. Soundappan, S. J. (2025). Next Generation AI Enabled Holistic Cognitive Platform for Secure Cloud Network Intelligence Enterprise Systems and Digital Trust Optimization. International Journal of Computer Technology and Electronics Communication, 8(5), 11534-11542.
25. Mathew, A. (2022). Leveraging Big Data Analytics to Power AI and ML (Machine Learning) Automation. Educational Research (IJMCR), 4(5), 131-134.



26. Sugumar, R. (2024). AI-Augmented Quality Engineering for Performance Optimization and Test Orchestration in Distributed Systems. *International Journal of Science, Research and Technology*, 7(5), 12835-12846.
27. Akila, R. (2024). A deep reinforcement learning approach for optimizing inventory management in the agri-food supply chain. *J. Electrical Systems*, 20(4s), 2238-2247.
28. Mahendran, M., Anbazhagan, K., Pavithran, G., Nivas, A., & Pandey, S. D. (2022). Earthquake Damage Prediction using Machine Learning. *Grnze International Journal of Engineering & Technology (GIJET)*, 8(1).
29. Gopinathan, V. R. (2025). Enterprise AI Frameworks for Financial Data Engineering Behavioural Analytics and Intelligent Cloud Solutions. *International Journal of Research Publications in Engineering, Technology and Management (IJRPETM)*, 8(4), 12499-12506.
30. Kondalsamy, P., & Kaliappan, K. (2025). An Optimal Prediction of Leaf Disease Based on Hybrid Deep Learnings and Metaheuristic Technique. *Traitement du Signal*, 42(1), 363.
31. Deivendran, P., Babu, P. S., Malathi, G., Anbazhagan, K., & Kumar, R. S. (2023). Emotion Recognition for Challenged People Facial Appearance in Social using Neural Network. *arXiv preprint arXiv:2305.06842*.
32. Sugumar, R. (2025). Unified AI Framework for Predictive Data Engineering and Real Time Prescription and Billing Systems. *International Journal of Advanced Engineering Science and Information Technology (IAESIT)*, 8(5), 17261.
33. Vekariya, V., Kumar, S., & Rengarajan, A. (2024). A distinctive and smart agricultural knowledge-based framework using ontology. In *Sustainability in Digital Transformation Era: Driving Innovative & Growth* (pp. 207-213). CRC Press.
34. Gopinathan, V. R. (2025). Software engineering practices for AI-driven systems: From development to deployment (MLOps perspective). *International Journal of Science, Research and Technology*, 8(1), 13493-13500.
35. Mathew, A. R. (2022). Threats and protection on E-sim: a prospective study. *Novel Perspectives of Engineering Research*, 8, 76-81.
36. Naveena, S., & Kavitha, K. (2025). Gossypium herbaceum: Folium disease identification and classification using Efficient Net-Coordinate Convolutional Neural Network (EcoNet). *Engineering Applications of Artificial Intelligence*, 152, 110701.
37. Rengarajan, A., Mishra, A., Kulhar, K. S., Shrivastava, V. P., & Alawneh, Y. J. J. (2024, March). Role of Deep Reinforcement Learning in Mitigating Cyber Security Issues: A Review. In *International Conference on Renewable Power* (pp. 37-48). Singapore: Springer Nature Singapore.
38. Achari, A. P. S. K., & Sugumar, R. (2024, November). Performance analysis and determination of accuracy using machine learning techniques for naive bayes and random forest. In *AIP Conference Proceedings* (Vol. 3193, No. 1, p. 020199). AIP Publishing LLC.
39. Mathew, A., & Alex, H. (2022). Detect & protect-medical device cybersecurity. *Curr. Overview Sci. Technol. Res*, 1, 60-68.
40. Sammy, F., Chettier, T., Boyina, V., Shingne, H., Saluja, K., Mali, M., ... & Shobana, A. (2025). Deep Learning-Driven Visual Analytics Framework for Next-Generation Environmental Monitoring. *Journal of Applied Science and Technology Trends*, 114-122.
41. Anbazhagan, K. (2024). Trustworthy and Adaptive AI Systems for Enterprise Analytics Cybersecurity and Decision Optimization Using API-First and Cloud-Native Architectures. *International Journal of Technology, Management and Humanities*, 10(03), 65-74.
42. Mathew, A. (2021). Deep reinforcement learning for cybersecurity applications. *Int J Comput Sci Mob Compu*, 10(12), 32-38.
43. Dhinakaran, D. (2022). Joe Prathap P. M, Selvaraj D, Arul Kumar D and Murugeswari B, " Mining Privacy-Preserving Association Rules based on Parallel Processing in Cloud Computing,". *International Journal of Engineering Trends and Technology*, 70(3), 284-294.
44. Karthika, K., Anusha, K., Kavitha, K., Harshadha, R., Dharshini, D. S., & Sundhar, N. A. (2025, April). Frequency Reconfigurable Antenna using Advanced Materials: A Study. In *2025 3rd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA)* (pp. 1-6). IEEE.
45. Thavamani, C., & Rengarajan, A. (2024). Clustering related behaviour of users by the use of partitioning and parallel transaction reduction algorithm. *International Journal of Advanced Intelligence Paradigms*, 29(2-3), 122-132.
46. Sugumar, R. (2025). Unified AI Framework for Predictive Data Engineering and Real Time Prescription and Billing Systems. *International Journal of Advanced Engineering Science and Information Technology (IAESIT)*, 8(5), 17261.
47. Soundappan, S. J., & Sugumar, R. (2016). Optimal knowledge extraction technique based on hybridisation of improved artificial bee colony algorithm and cuckoo search algorithm. *International Journal of Business Intelligence and Data Mining*, 11(4), 338-356.



48. SakthiPreetha, A., Kavitha, K., Karthika, K., & Manohari, R. G. (2025, April). A Novel Metasurface-Embedded Antenna for WBAN Communications. In 2025 3rd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA) (pp. 1-4). IEEE.
49. Murugeswari, B., Selvaraj, D., Sudharson, K., & Radhika, S. (2023). Data Mining with Privacy Protection Using Precise Elliptical Curve Cryptography. *Intelligent Automation & Soft Computing*, 35(1).
50. Gopinathan, V. R. (2025). Software engineering practices for AI-driven systems: From development to deployment (MLOps perspective). *International Journal of Science, Research and Technology*, 8(1), 13493-13500.
51. Anbazhagan, K., Kumar, R., Thilagavathy, R., & Anuradha, D. (2024, March). Shortest Job First with Gateway-based Resource Management Strategy for Fog Enabled Cloud Computing. In 2024 4th International Conference on Data Engineering and Communication Systems (ICDECS) (pp. 1-6). IEEE.
52. Kannadhasan, S., Vasuki, S., Kavitha, K., Karthikeyan, P., & Usha, S. G. A. (Eds.). (2025, April). Preface: Role of Artificial Intelligence and IoT in Engineering, Technology & Science [ICRAETS 2024]. In *AIP Conference Proceedings* (Vol. 3258, No. 1, p. 010001). AIP Publishing LLC.
53. Dhinakaran, D., Prathap, P. J., Selvaraj, D., Kumar, D. A., & Murugeswari, B. (2022). Mining privacy-preserving association rules based on parallel processing in cloud computing. *International Journal of Engineering Trends and Technology*, 70(3), 284-294.