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A Comprehensive Review - Indian Sign Language Recognition System

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Abstract: *Communication is a vital aspect of human interaction, yet individuals with hearing and speech impairments often face significant barriers when engaging with the general population. The Indian Sign Language (ISL) serves as a primary mode of communication for such individuals, but a lack of understanding among non-signers limits effective interaction. This project aims to develop an Indian Sign Language Recognition System that bridges this communication gap by translating hand gestures into corresponding text or speech in real time. The system utilizes computer vision and machine learning techniques to detect and interpret hand movements accurately. Image acquisition is performed using a camera, followed by preprocessing, feature extraction, and classification using a trained deep learning model. The proposed system enhances accessibility and inclusivity by enabling seamless two-way communication between hearing-impaired and non-impaired individuals. This work contributes toward the development of a more interactive and socially integrated environment for all.*

Keywords: Indian Sign Language, Gesture Recognition, Computer Vision, Deep Learning, Artificial Intelligence, CNN, Accessibility, Human-Computer Interaction

I. INTRODUCTION

Communication is a vital aspect of human life, enabling people to share ideas, thoughts, and emotions. For individuals with hearing or speech disabilities, however, expressing themselves clearly can be challenging. In India, Indian Sign Language (ISL) serves as the main communication medium for the deaf and mute community. Despite its importance, ISL is not widely understood by the general population, which often leads to difficulties in interaction and social inclusion. This communication gap affects daily activities, education, and employment opportunities for hearing-impaired individuals.

To reduce this gap, researchers have developed Indian Sign Language Recognition (ISLR) systems that can identify and interpret hand gestures into readable text or audible speech. Unlike hardware-based systems, this approach uses a purely software-driven framework, relying on computer vision, artificial intelligence, and deep learning algorithms to analyze visual data captured by a regular camera. The system processes images or video frames, extracts gesture-related features, and classifies them into specific signs.

Globally, sign language recognition has gained attention not only for accessibility but also for applications in education, healthcare, and human-computer interaction. ISL presents unique challenges due to variations in hand shapes, motion speed, and cultural gestures. Developing robust recognition systems requires addressing these challenges while maintaining real-time processing capabilities, especially on embedded devices like Raspberry Pi or low-power wearables. The typical ISLR workflow includes stages such as data acquisition, image preprocessing, feature extraction, classification, and output generation. Advanced models like Convolutional Neural Networks (CNNs) and Deep Neural Networks (DNNs) help in recognizing both static and dynamic gestures with improved precision. These models can adapt to variations in lighting, background, and hand orientation, making them suitable for real-time applications.

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The main goal of an ISLR system is to convert hand gestures into text and speech, enabling real-time interaction and bridging communication gaps. Such systems are useful in classrooms, hospitals, offices, and public service areas, making social, educational, and professional communication more accessible and inclusive. Advances in AI and deep learning have significantly improved the accuracy and speed of gesture recognition, making these systems more practical for everyday use.

Software-based ISLR systems are cost-effective, flexible, and easily deployable, since they do not require additional hardware components. They can be implemented on computers or mobile platforms, making them accessible for educational and communication purposes. However, issues such as limited ISL datasets, complex gesture variations, and environmental factors still pose challenges to achieving higher accuracy and stability.

In summary, Indian Sign Language Recognition Systems represent a significant advancement in promoting digital accessibility and inclusivity. By leveraging modern techniques in computer vision and deep learning, these systems provide an effective bridge between the hearing-impaired and the hearing community, fostering a more inclusive and connected society.

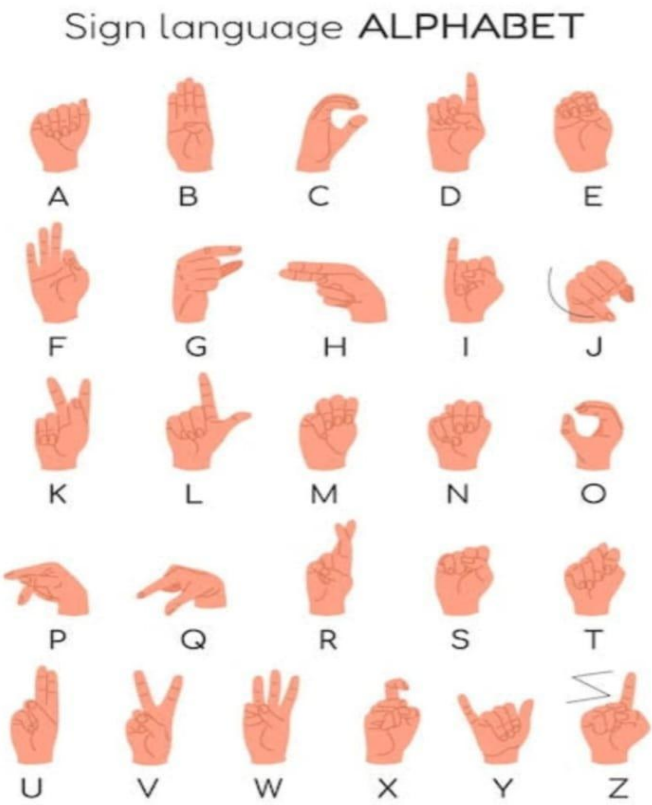

Fig 1; Sign Language

II. LITERATURE REVIEW

[12] Raj & Babu (2024) A Transformer-based framework was proposed for sentence-level ISL recognition. The model captured contextual dependencies between gestures, enabling recognition of continuous ISL sentences and demonstrating potential for more advanced communication systems.

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[10] Rathod et al. (2023) Lightweight CNN architectures were introduced for mobile and desktop applications. These models reduced computational requirements without sacrificing recognition accuracy, making ISLR systems more practical for real-world deployment.

[11] Sharma & Saini (2023) A CNN-attention hybrid model was developed to focus on the most relevant gesture features, enhancing recognition accuracy under different lighting conditions and for diverse signers.

[8] Patel & Shah (2022) A CNN-LSTM hybrid network was proposed for dynamic gesture recognition. CNN extracted spatial features while LSTM captured temporal sequences, enabling accurate recognition of continuous ISL gestures from video streams.

[9] Roy & Bhattacharya (2022) This research employed 3D CNNs to capture both spatial and temporal information from video frames. The approach improved real-time recognition performance and reduced latency, making it suitable for live ISL interpretation.

[6] Bhatnagar et al. (2021) The study utilized transfer learning with pre-trained CNN architectures such as VGG16 and InceptionV3. This approach improved generalization performance, even with smaller datasets, and allowed recognition under varying lighting conditions and hand orientations.

[7] Joshi & Mehta (2021) An optimized CNN model was developed to recognize both one-handed and two-handed gestures. The system handled complex gesture patterns effectively, addressing a limitation of earlier single-hand recognition approaches.

[5] Singh et al. (2020) A Convolutional Neural Network (CNN) was applied to recognize ISL alphabets. The model eliminated the need for manual feature extraction, achieving higher accuracy and reliability compared to conventional machine learning methods, marking a shift toward deep learning in ISLR.

[3] Kumar & Rani (2019) An SVM-based classifier was used to recognize static hand gestures from preprocessed images. This study demonstrated that machine learning could improve recognition accuracy over traditional image-processing methods, although it depended on manual feature extraction, which constrained scalability for dynamic gestures.

[4] Thomas & Nair (2019) This research employed a k-Nearest Neighbor (k-NN) algorithm for gesture classification based on extracted features. The approach offered faster computation but exhibited reduced accuracy for real-time or continuous gesture recognition scenarios.

[1] Chaudhary et al. (2018) This study developed a vision-based approach to recognize static Indian Sign Language (ISL) gestures using skin color segmentation and contour detection. The system performed well in controlled lighting conditions but showed limitations when applied to complex or changing backgrounds. It provided a foundational method for image-processing-based ISLR systems.

[2] Verma & Sharma (2018) The authors implemented a background subtraction and shape-based analysis technique for identifying ISL gestures. This method enhanced segmentation quality compared to basic color-based approaches, but it required uniform backgrounds and consistent hand positions, limiting real-world applicability.

III. THEORETICAL FRAMEWORK

Indian Sign Language (ISL) is a visual language used by deaf and mute individuals in India to express ideas through hand gestures, facial expressions, and body movements. Since most people do not understand ISL, communication between hearing-impaired individuals and others often becomes difficult. To reduce this communication gap, researchers have developed Indian Sign Language Recognition (ISLR) systems. These systems use computer vision and artificial intelligence to automatically recognize hand gestures and convert them into text or speech, promoting better communication and social inclusion.

In the beginning, gesture recognition systems were based on simple image processing methods such as color segmentation, contour detection, and shape analysis. These techniques could only detect static gestures and required controlled lighting and simple backgrounds. They often failed when the lighting changed or the background was complex. Later, machine learning algorithms like Support Vector Machine (SVM) and k-Nearest Neighbor (k-NN) were introduced. These algorithms analyzed specific image features to identify different gestures, improving accuracy and performance under varying conditions.

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The arrival of deep learning brought a major improvement to sign language recognition. Models such as Convolutional Neural Networks (CNNs) can automatically learn and extract important features from gesture images. Unlike older methods, CNNs can handle variations in lighting, angle, and hand position. Further advancements like CNN-LSTM and Transformer-based architectures now allow systems to recognize dynamic gestures, which include movement and time-based sequences, helping the system understand full words and sentences.

An ISLR system generally follows several key steps: capturing the hand gesture using a camera, preprocessing the image to remove noise, extracting useful features, and classifying the gesture using trained models. Once recognized, the output is converted into text and optionally into audio using a text-to-speech system. This entire process combines multiple fields such as computer vision, machine learning, and deep learning to form a powerful framework for gesture recognition.

Overall, the theoretical foundation of ISLR shows how technology can bridge the gap between the hearing-impaired and the general public. By integrating artificial intelligence and language processing, these systems can translate gestures into understandable text or speech. This not only improves accessibility and communication but also encourages social inclusion and equal participation for people with hearing or speech disabilities.

Flow Chart:

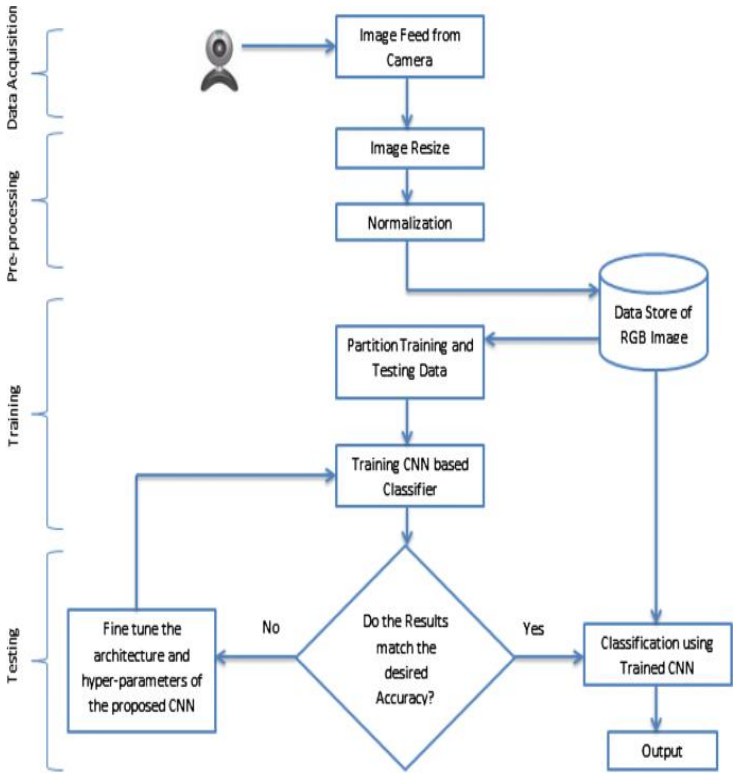

Fig.2 Flow Chart

The first step in the suggested image categorization system is data gathering, which involves taking pictures using a camera. These pictures serve as the main source of input for the processing steps that follow. Accurate feature extraction and trustworthy classification depend on high-quality image acquisition. The photos are pre-processed after acquisition in order to get them ready for the Convolutional Neural Network (CNN). In order to preserve consistency and increase computing efficiency, all photos must be resized to consistent dimensions at this point. Pixel values are also normalized, usually scaled from 0 to 1, which speeds up training and improves convergence by lowering input variability. For effective retrieval throughout the training and testing stages, the pre-processed photos are thereafter kept in a special database.

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The dataset is partitioned into training and testing subsets, where the training data is used to teach the CNN to recognize hierarchical patterns and features within the images, while the testing data evaluates the model's generalization on unseen samples. During the training phase, the CNN extracts features through multiple convolutional and pooling layers, and fully connected layers map these features to the corresponding target classes. The objective is to iteratively minimize the error between predicted outputs and actual labels, thereby improving the model's accuracy.

Once trained, the CNN model is evaluated using the testing dataset to verify its performance. If the desired accuracy threshold is not met, the network architecture and hyperparameters, including learning rate, number of layers, and batch size, are fine-tuned, and the training process is repeated. Upon achieving satisfactory accuracy, the trained CNN is deployed to classify new incoming images, assigning them to predefined categories. This structured pipeline ensures reliable and efficient image classification, enabling practical applications such as gesture recognition, object detection, and automated monitoring systems.

The flowchart represents a systematic approach for recognizing Indian Sign Language (ISL) gestures using a Convolutional Neural Network (CNN). The methodology is organized into four primary stages: Data Acquisition, Preprocessing, Training, and Testing.

Block Diagram:

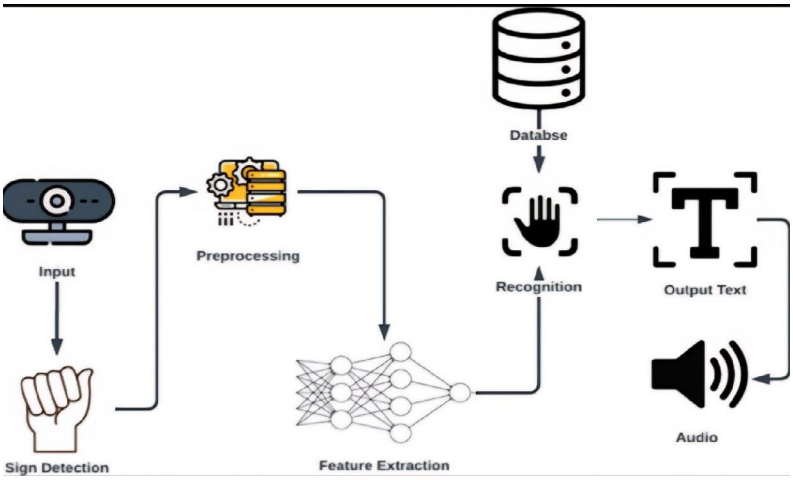

Fig: Block Diagram

The Indian Sign Language (ISL) Recognition System is designed to interpret hand gestures captured from real-time video and convert them into readable text and audible speech. This system integrates computer vision, machine learning, and signal processing concepts to achieve smooth human–machine communication for the hearing and speech-impaired community.The entire process can be divided into six major functional stages:

1. Input Stage (Video Acquisition)

The first stage of the system is the input module, where real-time video of the user's hand gestures is captured using a camera, such as a USB camera or a Raspberry Pi Camera Module. The camera continuously records the movements of the hand as the user performs sign gestures. Each gesture is then broken down into a sequence of image frames, which serve as the raw data for the next processing stages. For accurate capture, this stage requires good lighting and proper camera placement so that the hand is clearly visible and stands out from the background.

2. Gesture Detection / Region of Interest (ROI) Extraction

After capturing the video frames, the system identifies and isolates the region of interest, usually the hand or the upper body performing the gesture. This step removes unnecessary background pixels, allowing the system to focus only on the relevant gesture areas. Common techniques include skin color segmentation, which detects hand pixels based on color using models like HSV or YCbCr; background subtraction, which separates the moving hand from a static background

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by comparing frames; and AI-based hand landmark detection, using models such as MediaPipe Hands to identify 21 key points on the hand. The result of this stage is a cropped hand image or mask, which is then passed to the preprocessing stage for further processing.

3. Preprocessing Stage

In this phase, gesture images are preprocessed to enhance quality and consistency for model input. Common techniques include resizing, noise reduction, background removal, and pixel normalization to ensure reliable and efficient recognition.This step ensures that lighting variations, shadows, and skin tone differences do not affect gesture recognition accuracy.

4. Feature Extraction

After preprocessing, the next important step is feature extraction, where the system identifies the most important information from the gesture images. The aim is to convert complex visual data into a structured numerical format called a feature vector. The techniques used depend on the type of model. Traditional methods use algorithms like HOG (Histogram of Oriented Gradients), SIFT, or contour detection to analyze shapes and edges. Deep learning methods use Convolutional Neural Networks (CNNs) that automatically learn patterns such as finger positions, shapes, and orientations. For continuous gestures, hybrid models like CNN-LSTM are employed to capture both spatial features (hand position) and temporal features (motion over time). These extracted features are compact and descriptive, which helps make the recognition process faster and more accurate.

5. Gesture Recognition / Classification

In this stage, the extracted feature vector is sent to a trained machine learning or deep learning model, which classifies the gesture into one of the known categories. Common classifiers include Support Vector Machines (SVM) for recognizing static gestures, Artificial Neural Networks (ANN) for medium-sized datasets, CNN or CNN-LSTM models for real-time dynamic gestures, and Transformer-based models for continuous sentence-level gestures. The classifier compares the input feature vector with stored gesture patterns in a gesture database and selects the gesture with the highest match probability as the recognized output.

6. Output Generation (Text and Speech Conversion)

Once a gesture is successfully recognized, the system converts it into text and then into speech using Text-to-Speech (TTS) technology. The text output shows the recognized word, letter, or sentence on the screen, while the audio output reads it aloud. This allows effective communication between a sign language user and someone who does not know sign language. This stage makes the system interactive and useful for real-time communication in places like classrooms, hospitals, or public service counters.

V. CONCLUSION

The development of Indian Sign Language Recognition (ISLR) systems represents an important step toward improving communication between hearing-impaired individuals and the general public. By using computer vision and artificial intelligence, these systems can automatically recognize hand gestures and translate them into readable text or audible speech. The evolution from basic image processing to deep learning models such as CNNs, CNN-LSTMs, and Transformers has made gesture recognition more accurate, faster, and suitable for real-world applications.

Although significant progress has been made, challenges such as varying gesture styles, lighting conditions, and high computational needs still remain. Future research should focus on building larger and more diverse datasets, optimizing algorithms for low-power devices, and improving real-time recognition of continuous gestures.

In conclusion, ISLR systems have the potential to create a more inclusive and accessible society. By enabling smooth and effective communication, they can help bridge the gap between the deaf community and others, promoting equal opportunities in education, healthcare, and everyday interactions. Continued innovation and research will ensure that these systems become reliable tools for inclusive communication in the future.

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FUTURE SCOPE

Indian Sign Language Recognition (ISLR) systems have improved a lot over time. They have moved from simple image-processing methods to advanced AI-based models that can understand both static (still) and dynamic (moving) hand gestures. Earlier systems relied heavily on manual feature extraction and traditional algorithms, which often struggled when hand positions, angles, or lighting conditions changed. The use of deep learning techniques like Convolutional Neural Networks (CNNs), CNN-LSTM models, and Transformer-based architectures has made these systems more accurate and capable of recognizing gestures in real-time. These improvements have made ISLR systems more practical and reliable for real-world use.

However, there are still challenges. Problems like inconsistent datasets, differences between how people sign, and varying environmental conditions make it hard for systems to work well for everyone. Advanced models also require a lot of computing power, which can make it difficult to use them on low-power devices like mobile phones or embedded systems. Recognizing sequences of gestures, such as complete sentences, is another difficult task, often needing additional data from video, motion sensors, or depth cameras.

Future research should aim to solve these problems. This includes creating large and standardized datasets that include many gestures, different people, and various conditions. Designing lightweight but accurate models will help run these systems in real-time on devices with limited resources. Using multimodal approaches—combining visual data with motion sensors or other inputs—can improve recognition of continuous gestures and complete sentences.

In conclusion, ISLR systems have the potential to greatly improve communication for the deaf and hard-of-hearing community. With the help of smart technologies, these systems can increase accessibility, inclusion, and social interaction in education, healthcare, and daily life. Continued work in improving models, building better datasets, and using multiple types of data will help these systems reach their full potential, bridging communication gaps and making society more inclusive.

REFERENCES

1. Chaudhary, A., Kumar, R., & Singh, P. (2018). A vision-based system for recognizing static Indian Sign Language gestures using skin color segmentation and contour detection. *International Journal of Computer Applications*, 182(32), 25–32.
2. Verma, S., & Sharma, K. (2018). Indian Sign Language gesture recognition through background subtraction and shape-based analysis. *Procedia Computer Science*, 132, 1255–1262.
3. Kumar, V., & Rani, A. (2019). Static hand gesture recognition in ISL using Support Vector Machine classification. *Journal of Intelligent & Fuzzy Systems*, 36(4), 3911–3920.
4. Thomas, J., & Nair, R. (2019). Real-time ISL gesture recognition employing k-Nearest Neighbor classification. *International Journal of Engineering & Technology*, 8(3), 120–127.
5. Singh, D., Mehta, R., & Gupta, A. (2020). Convolutional Neural Network-based recognition of ISL alphabets. *Journal of Visual Communication and Image Representation*, 71, 102823.
6. Bhatnagar, S., Sharma, P., & Verma, R. (2021). Transfer learning with pre-trained CNNs for Indian Sign Language recognition. *Expert Systems with Applications*, 173, 114658.
7. Joshi, M., & Mehta, S. (2021). An optimized CNN model for recognizing both one-handed and two-handed ISL gestures. *Multimedia Tools and Applications*, 80, 34321–34338.
8. Patel, N., & Shah, H. (2022). CNN-LSTM hybrid network for dynamic Indian Sign Language gesture recognition. *Neural Computing and Applications*, 34, 15745–15760.
9. Roy, S., & Bhattacharya, T. (2022). 3D CNN framework for real-time recognition of continuous ISL gestures. *Pattern Recognition Letters*, 160, 41–49.

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10. Rathod, P., Kulkarni, A., & Desai, R. (2023). Lightweight CNN architectures for practical ISL recognition on mobile and desktop platforms. *Journal of Ambient Intelligence and Humanized Computing*, 14, 2237–2250.
11. Sharma, A., & Saini, R. (2023). CNN-attention hybrid model to improve ISL gesture recognition under varied lighting and signer diversity. *Applied Soft Computing*, 138, 110455.
12. Raj, K., & Babu, S. (2024). Transformer-based model for sentence-level recognition of Indian Sign Language. *IEEE Transactions on Neural Networks and Learning Systems*, 35(1), 112–123.
13. Godase, M. V., Mulani, A., Ghodak, M. R., Birajadar, M. G., Takale, M. S., & Kolte, M. A MapReduce and Kalman Filter based Secure IIoT Environment in Hadoop. Sanshodhak, Volume 19, June 2024.
14. Mulani, A. O., & Mane, P. B. (2017). Watermarking and cryptography based image authentication on reconfigurable platform. *Bulletin of Electrical Engineering and Informatics*, *6*(2), 181-187.
15. Gadade, B., Mulani, A. O., & Harale, A. D. IoT Based Smart School Bus and Student Tracking System. Sanshodhak, Volume 19, June 2024.
16. Dhanawadel, A., Mulani, A. O., & Pise, A. C. IOT based Smart farming using Agri BOT. Sanshodhak, Volume 20, June 2024.
17. Mulani, A., & Mane, P. B. (2016). *DWT based robust invisible watermarking*. Scholars' Press.
18. R. G. Ghodke, G. B. Birajdar, A.O. Mulani, G.N. Shinde, R.B. Pawar, Design and Development of an Efficient and Cost-Effective surveillance Quadcopter using Arduino, Sanshodhak, Volume 20, June 2024.
19. R. G. Ghodke, G. B. Birajdar, A.O. Mulani, G.N. Shinde, R.B. Pawar, Design and Development of Wireless Controlled ROBOT using Bluetooth Technology, Sanshodhak, Volume 20, June 2024.
20. Swami, S. S., & Mulani, A. O. (2017, August). An efficient FPGA implementation of discrete wavelet transform for image compression. In *2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)* (pp. 3385-3389). IEEE.
21. Mane, P. B., & Mulani, A. O. (2018). High speed area efficient FPGA implementation of AES algorithm. *International Journal of Reconfigurable and Embedded Systems*, *7*(3), 157-165.
22. Mulani, A. O., & Mane, P. B. (2016). Area efficient high speed FPGA based invisible watermarking for image authentication. *Indian journal of Science and Technology*, *9*(39), 1-6.
23. Kashid, M. M., Karande, K. J., & Mulani, A. O. (2022, November). IoT-based environmental parameter monitoring using machine learning approach. In *Proceedings of the International Conference on Cognitive and Intelligent Computing: ICCIC 2021, Volume 1* (pp. 43-51). Singapore: Springer Nature Singapore.
24. Nagane, U. P., & Mulani, A. O. (2021). Moving object detection and tracking using Matlab. *Journal of Science and Technology*, *6*(1), 2456-5660.
25. Kulkarni, P. R., Mulani, A. O., & Mane, P. B. (2016). Robust invisible watermarking for image authentication. In *Emerging Trends in Electrical, Communications and Information Technologies: Proceedings of ICECIT-2015* (pp. 193-200). Singapore: Springer Singapore.
26. Ghodake, M. R. G., & Mulani, M. A. (2016). Sensor based automatic drip irrigation system. *Journal for Research*, *2*(02).
27. Mandwale, A. J., & Mulani, A. O. (2015, January). Different Approaches For Implementation of Viterbi decoder on reconfigurable platform. In *2015 International Conference on Pervasive Computing (ICPC)* (pp. 1-4). IEEE.
28. Jadhav, M. M., Chavan, G. H., & Mulani, A. O. (2021). Machine learning based autonomous fire combat turret. *Turkish Journal of Computer and Mathematics Education*, *12*(2), 2372-2381.
29. Shinde, G., & Mulani, A. (2019). A robust digital image watermarking using DWT-PCA. *International Journal of Innovations in Engineering Research and Technology*, *6*(4), 1-7.
30. Mane, D. P., & Mulani, A. O. (2019). High throughput and area efficient FPGA implementation of AES algorithm. *International Journal of Engineering and Advanced Technology*, *8*(4).
31. Mulani, A. O., & Mane, D. P. (2017). An Efficient implementation of DWT for image compression on reconfigurable platform. *International Journal of Control Theory and Applications*, *10*(15), 1-7.

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32. Deshpande, H. S., Karande, K. J., & Mulani, A. O. (2015, April). Area optimized implementation of AES algorithm on FPGA. In *2015 International Conference on Communications and Signal Processing (ICCSP)* (pp. 0010-0014). IEEE.
33. Deshpande, H. S., Karande, K. J., & Mulani, A. O. (2014, April). Efficient implementation of AES algorithm on FPGA. In *2014 International Conference on Communication and Signal Processing* (pp. 1895-1899). IEEE.
34. Kulkarni, P., & Mulani, A. O. (2015). Robust invisible digital image mamarking using discrete wavelet transform. *International Journal of Engineering Research & Technology (IJERT)*, *4*(01), 139-141.
35. Mulani, A. O., Jadhav, M. M., & Seth, M. (2022). Painless Non□invasive blood glucose concentration level estimation using PCA and machine learning. *The CRC Book entitled Artificial Intelligence, Internet of Things (IoT) and Smart Materials for Energy Applications*.
36. Mulani, A. O., & Shinde, G. N. (2021). An approach for robust digital image watermarking using DWT□ PCA. *Journal of Science and Technology*, *6*(1).
37. Mulani, A. O., & Mane, P. B. (2014, October). Area optimization of cryptographic algorithm on less dense reconfigurable platform. In *2014 International Conference on Smart Structures and Systems (ICSSS)* (pp. 86-89). IEEE.
38. Jadhav, H. M., Mulani, A., & Jadhav, M. M. (2022). Design and development of chatbot based on reinforcement learning. *Machine Learning Algorithms for Signal and Image Processing*, 219-229.
39. Mulani, A. O., & Mane, P. (2018). Secure and area efficient implementation of digital image watermarking on reconfigurable platform. *International Journal of Innovative Technology and Exploring Engineering*, *8*(2), 56-61.
40. Kalyankar, P. A., Mulani, A. O., Thigale, S. P., Chavhan, P. G., & Jadhav, M. M. (2022). Scalable face image retrieval using AESC technique. *Journal Of Algebraic Statistics*, *13*(3), 173-176.
41. Takale, S., & Mulani, A. (2022). DWT-PCA based video watermarking. Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN, 2799-1156.
42. Kamble, A., & Mulani, A. O. (2022). Google assistant based device control. *Int. J. of Aquatic Science*, *13*(1), 550-555.
43. Kondekar, R. P., & Mulani, A. O. (2017). Raspberry Pi based voice operated Robot. *International Journal of Recent Engineering Research and Development*, *2*(12), 69-76.
44. Ghodake, R. G., & Mulani, A. O. (2018). Microcontroller based automatic drip irrigation system. In *Techno-Societal 2016: Proceedings of the International Conference on Advanced Technologies for Societal Applications* (pp. 109-115). Springer International Publishing.
45. Mulani, A. O., Birajadar, G., Ivković, N., Salah, B., & Darlis, A. R. (2023). Deep learning based detection of dermatological diseases using convolutional neural networks and decision trees. *Traitement du Signal*, *40*(6), 2819.
46. Boxey, A., Jadhav, A., Gade, P., Ghanti, P., & Mulani, A. O. (2022). Face Recognition using Raspberry Pi. *Journal of Image Processing and Intelligent Remote Sensing (JIPIRS) ISSN*, 2815-0953.
47. Patale, J. P., Jagadale, A. B., Mulani, A. O., & Pise, A. (2023). A Systematic survey on Estimation of Electrical Vehicle. *Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN*, 2799-1156.
48. Gadade, B., & Mulani, A. (2022). Automatic System for Car Health Monitoring. *International Journal of Innovations in Engineering Research and Technology*, 57-62.
49. Shinde, M. R. S., & Mulani, A. O. (2015). Analysisof Biomedical Image Using Wavelet Transform. *International Journal of Innovations in Engineering Research and Technology*, *2*(7), 1-7.
50. Mandwale, A., & Mulani, A. O. (2014, December). Implementation of convolutional encoder & different approaches for viterbi decoder. In *IEEE International Conference on Communications, Signal Processing Computing and Information technologies*.
51. Mulani, A. O., Jadhav, M. M., & Seth, M. (2022). Painless machine learning approach to estimate blood glucose level with non-invasive devices. In *Artificial intelligence, internet of things (IoT) and smart materials for energy applications* (pp. 83-100). CRC Press.

52. Maske, Y., Jagadale, A. B., Mulani, A. O., & Pise, A. C. (2023). Development of BIOBOT system to assist COVID patient and caretakers. *European Journal of Molecular & Clinical Medicine*, *10*(01), 2023.
53. Utpat, V. B., Karande, D. K., & Mulani, D. A. Grading of Pomegranate Using Quality Analysis‖. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, *10*.
54. Takale, S., & Mulani, D. A. (2022). Video Watermarking System. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 10.
55. Mandwale, A., & Mulani, A. O. (2015, January). Different approaches for implementation of Viterbi decoder. In *IEEE international conference on pervasive computing (ICPC)*.
56. Maske, Y., Jagadale, M. A., Mulani, A. O., & Pise, A. (2021). Implementation of BIOBOT System for COVID Patient and Caretakers Assistant Using IOT. *International Journal of Information Technology and*, 30-43.
57. Mulani, A. O., & Mane, D. P. (2016). Fast and Efficient VLSI Implementation of DWT for Image Compression. *International Journal for Research in Applied Science & Engineering Technology*, *5*, 1397-1402.
58. Kambale, A. (2023). Home automation using google assistant. *UGC care approved journal*, *32*(1), 1071-1077.
59. Pathan, A. N., Shejal, S. A., Salgar, S. A., Harale, A. D., & Mulani, A. O. (2022). Hand gesture controlled robotic system. *Int. J. of Aquatic Science*, *13*(1), 487-493.
60. Korake, D. M., & Mulani, A. O. (2016). Design of Computer/Laptop Independent Data transfer system from one USB flash drive to another using ARM11 processor. *International Journal of Science, Engineering and Technology Research*.
61. Mandwale, A., & Mulani, A. O. (2016). Implementation of High Speed Viterbi Decoder using FPGA. *International Journal of Engineering Research & Technology, IJERT*.
62. Kolekar, S. D., Walekar, V. B., Patil, P. S., Mulani, A. O., & Harale, A. D. (2022). Password Based Door Lock System. *Int. J. of Aquatic Science*, *13*(1), 494-501.
63. Shinde, R., & Mulani, A. O. (2015). Analysis of Biomedical Image‖. International Journal on Recent & Innovative trend in technology (IJRITT).
64. Sawant, R. A., & Mulani, A. O. (2022). Automatic PCB Track Design Machine. *International Journal of Innovative Science and Research Technology*, *7*(9).
65. ABHANGRAO, M. R., JADHAV, M. S., GHODKE, M. P., & MULANI, A. (2017). Design And Implementation Of 8-bit Vedic Multiplier. *International Journal of Research Publications in Engineering and Technology (ISSN No: 2454-7875)*.
66. Gadade, B., Mulani, A. O., & Harale, A. D. (2024). Iot based smart school bus and student monitoring system. *Naturalista Campano*, *28*(1), 730-737.
67. Mulani, D. A. O. (2024). A Comprehensive Survey on Semi-Automatic Solar-Powered Pesticide Sprayers for Farming. *Journal of Energy Engineering and Thermodynamics (JEET) ISSN*, 2815-0945.
68. Salunkhe, D. S. S., & Mulani, D. A. O. (2024). Solar Mount Design Using High-Density Polyethylene. *NATURALISTA CAMPANO*, *28*(1).
69. Seth, M. (2022). Painless Machine learning approach to estimate blood glucose level of Non-Invasive device. *Artificial Intelligence, Internet of Things (IoT) and Smart Materials for Energy Applications*.
70. Kolhe, V. A., Pawar, S. Y., Gohery, S., Mulani, A. O., Sundari, M. S., Kiradoo, G., ... & Sunil, J. (2024). Computational and experimental analyses of pressure drop in curved tube structural sections of Coriolis mass flow metre for laminar flow region. *Ships and Offshore Structures*, *19*(11), 1974-1983.
71. Basawaraj Birajadar, G., Osman Mulani, A., Ibrahim Khalaf, O., Farhah, N., G Gawande, P., Kinage, K., & Abdullah Hamad, A. (2024). Epilepsy identification using hybrid CoPrO-DCNN classifier. *International Journal of Computing and Digital Systems*, *16*(1), 783-796.
72. Kedar, M. S., & Mulani, A. (2021). IoT Based Soil, Water and Air Quality Monitoring System for Pomegranate Farming. *Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN*, 2799-1156.
73. Godse, A. P. A.O. Mulani (2009). Embedded Systems (First Edition).
74. Pol, R. S., Bhalerao, M. V., & Mulani, A. O. A real time IoT based System Prediction and Monitoring of Landslides. International Journal of Food and Nutritional Sciences, Volume 11, Issue 7, 2022.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

75. Mulani, A. O., Sardey, M. P., Kinage, K., Salunkhe, S. S., Fegade, T., & Fegade, P. G. (2025). ML-powered Internet of Medical Things (MLIOMT) structure for heart disease prediction. *Journal of Pharmacology and Pharmacotherapeutics*, *16*(1), 38-45.

76. Aiwale, S., Kolte, M. T., Harpale, V., Bendre, V., Khurge, D., Bhandari, S., ... & Mulani, A. O. (2024). Non-invasive Anemia Detection and Prediagnosis. *Journal of Pharmacology and Pharmacotherapeutics*, *15*(4), 408-416.

77. Mulani, A. O., Bang, A. V., Birajadar, G. B., Deshmukh, A. B., Jadhav, H. M., & Liyakat, K. K. S. (2024). IoT Based Air, Water, and Soil Monitoring System for Pomegranate Farming. *Annals of Agri-Bio Research*, *29*(2), 71-86.

78. Kulkarni, T. M., & Mulani, A. O. (2024). Face Mask Detection on Real Time Images and Videos using Deep Learning. *International Journal of Electrical Machine Analysis and Design (IJEMAD)*, *2*(1).

79. Thigale, S. P., Jadhav, H. M., Mulani, A. O., Birajadar, G. B., Nagrale, M., & Sardey, M. P. (2024). Internet of things and robotics in transforming healthcare services. *Afr J Biol Sci (S Afr)*, *6*(6), 1567-1575.

80. Pol, D. R. S. (2021). Cloud Based Memory Efficient Biometric Attendance System Using Face Recognition. *Stochastic Modeling & Applications*, *25*(2).

81. Nagtilak, M. A. G., Ulegaddi, M. S. N., Adat, M. A. S., & Mulani, A. O. (2021). Breast Cancer Prediction using Machine Learning.

82. Rahul, G. G., & Mulani, A. O. (2016). Microcontroller Based Drip Irrigation System.

83. Kulkarni, T. M., & Mulani, A. O. Deep Learning Based Face-Mask Detection: An Approach to Reduce Pandemic Spreads in Human Healthcare. African Journal of Biological Sciences, 6(6), 2024.

84. Mulani, A., & Mane, P. B. (2016). *DWT based robust invisible watermarking*. Scholars' Press.

85. Dr. Vaishali Satish Jadhav, Dr. Shweta Sadanand Salunkhe, Dr. Geeta Salunkhe, Pranali Rajesh Yawle, Dr. Rahul S. Pol, Dr. Altaf Osman Mulani, Dr. Manish Rana, Iot Based Health Monitoring System for Human, Afr. J. Biomed. Res. Vol. 27 (September 2024).

86. Dr. Vaishali Satish Jadhav, Geeta D. Salunke, Kalyani Ramesh Chaudhari, Dr. Altaf Osman Mulani, Dr. Sampada Padmakar Thigale, Dr. Rahul S. Pol, Dr. Manish Rana, Deep Learning-Based Face Mask Recognition in Real-Time Photos and Videos, Afr. J. Biomed. Res. Vol. 27 (September 2024).

87. Altaf Osman Mulani, Electric Vehicle Parameters Estimation Using Web Portal, Recent Trends in Electronics & Communication Systems, Volume 10, Issue 3, 2023.

88. Aryan Ganesh Nagtilak, Sneha Nitin Ulegaddi, Mahesh Mane, Altaf O. Mulani, Automatic Solar Powered Pesticide Sprayer for Farming, International Journal of Microwave Engineering and Technology, Volume 9 No. 2, 2023.

89. Annasaheb S. Dandage, Vitthal R. Rupnar, Tejas A Pise, and A. O. Mulani, Real-Time Language Translation Application Using Tkinter. International Journal of Digital Communication and Analog Signals. 2025; 11(01): -p.

90. AnnaSaheb S Dandage, Vitthal R. Rupnar, Tejas A Pise, and A. O. Mulani, IoT-Powered Weather Monitoring and Irrigation Automation: Transforming Modern Farming Practices. . 2025; 11(01): -p.

91. Mulani, A.O., Kulkarni, T.M. (2025). Face Mask Detection System Using Deep Learning: A Comprehensive Survey. In: Singh, S., Arya, K.V., Rodriguez, C.R., Mulani, A.O. (eds) Emerging Trends in Artificial Intelligence, Data Science and Signal Processing. AIDSP 2023. Communications in Computer and Information Science, vol 2439. Springer, Cham. https://doi.org/10.1007/978-3-031-88759-8_3.

92. Karve, S., Gangonda, S., Birajadar, G., Godase, V., Ghodake, R., Mulani, A.O. (2025). Optimized Neural Network for Prediction of Neurological Disorders. In: Singh, S., Arya, K.V., Rodriguez, C.R., Mulani, A.O. (eds) Emerging Trends in Artificial Intelligence, Data Science and Signal Processing. AIDSP 2023. Communications in Computer and Information Science, vol 2440. Springer, Cham. https://doi.org/10.1007/978-3-031-88762-8_18.

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International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

93. Saurabh Singh, Karm Veer Arya, Ciro Rodriguez Rodriguez, and Altaf Osman Mulani, Emerging Trends in Artificial Intelligence, Data Science and Signal Processing, Communications in Computer and Information Science (CCIS), volume 2440.

94. Saurabh Singh, Karm Veer Arya, Ciro Rodriguez Rodriguez, and Altaf Osman Mulani, Emerging Trends in Artificial Intelligence, Data Science and Signal Processing, Communications in Computer and Information Science (CCIS), volume 2439.

95. Godase, V., Mulani, A., Pawar, A., & Sahani, K. (2025). A Comprehensive Review on PIR Sensor-Based Light Automation Systems. International Journal of Image Processing and Smart Sensors, 1(1), 22-29.

96. Godase, V., Mulani, A., Takale, S., & Ghodake, R. (2025). Comprehensive Review on Automated Field Irrigation using Soil Image Analysis and IoT. Journal of Advance Electrical Engineering and Devices, 3(1), 46-55.

97. Altaf Osman Mulani, Deshmukh M., Jadhav V., Chaudhari K., Mathew A.A., Shweta Salunkhe. Transforming Drug Therapy with Deep Learning: The Future of Personalized Medicine. Drug Research. 2025 Aug 29.

98. Altaf O. Mulani, Vaibhav V. Godase, Swapnil R. Takale, Rahul G. Ghodake (2025), Image Authentication Using Cryptography and Watermarking, International Journal of Image Processing and Smart Sensors, Vol. 1, Issue 2, pp 27-34.

99. Altaf O. Mulani, Vaibhav V. Godase, Swapnil R. Takale, Rahul G. Ghodake (2025), Advancements in Artificial Intelligence: Transforming Industries and Society, International Journal of Artificial Intelligence of Things (AIoT) in Communication Industry, Vol. 1, Issue 2, pp 1-5.

100. Altaf O. Mulani, Vaibhav V. Godase, Swapnil R. Takale, Rahul G. Ghodake (2025), AI-Powered Predictive Analytics in Healthcare: Revolutionizing Disease Diagnosis and Treatment, Journal of Advance Electrical Engineering and Devices, Vol. 3, Issue 2, pp 27-34.

101. Godase, V., Mulani, A., Takale, S., & Ghodake, R. (2025). A Holistic Review of Automatic Drip Irrigation Systems: Foundations and Emerging Trends. *Available at SSRN 5247778*.

102. V. Godase, R. Ghodake, S. Takale, and A. Mulani, ―Design and Optimization of Reconfigurable Microwave Filters Using AI Techniques, International Journal of RF and Microwave Communication Technologies, vol. 2, no. 2, pp.26–41, Aug. 2025.

103. V. Godase, A. Mulani, R. Ghodake, S. Takale, "Automated Water Distribution Management and Leakage Mitigation Using PLC Systems," Journal of Control and Instrumentation Engineering, vol.11, no. 3, pp. 1-8, Aug. 2025.

104. V. Godase, A. Mulani, R. Ghodake, S. Takale, "PLC-Assisted Smart Water Distribution with Rapid Leakage Detection and Isolation," Journal of Control Systems and Converters, vol. 1, no. 3, pp. 1-13, Aug. 2025.

105. V. V. Godase, S. R. Takale, R. G. Ghodake, and A. Mulani, "Attention Mechanisms in Semantic Segmentation of Remote Sensing Images," Journal of Advancement in Electronics Signal Processing, vol. 2, no. 2, pp. 45–58, Aug. 2025.

106. D. Waghmare, A. Mulani, S. R. Takale, V. Godase, and A. Mulani, "A Comprehensive Review on Automatic Fruit Sorting and Grading Techniques with Emphasis on Weight-based Classification," Research & Review: Electronics and Communication Engineering, vol. 2, no. 3, pp. 1-10, Oct. 2025.

107. Karande, K. J., & Talbar, S. N. (2014). Independent component analysis of edge information for face recognition. Springer India.

108. Karande, K. J., & Talbar, S. N. (2008). Face recognition under variation of pose and illumination using independent component analysis. ICGST-GVIP, ISSN.

109. Gaikwad, D. S., & Karande, K. J. (2016). Image processing approach for grading and identification of diseases on pomegranate fruit: An overview. International Journal of Computer Science and Information Technologies, 7, 519-522.

110. Kawathekar, P. P., & Karande, K. J. (2014, July). Severity analysis of Osteoarthritis of knee joint from X-ray images: A Literature review. In 2014 International Conference on Signal propagation and computer technology (ICSPCT 2014) (pp. 648-652). IEEE.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

111. Daithankar, M. V., Karande, K. J., & Harale, A. D. (2014, April). Analysis of skin color models for face detection. In 2014 International Conference on Communication and Signal Processing (pp. 533-537). IEEE.
112. Karande, J. K., Talbar, N. S., & Inamdar, S. S. (2012, May). Face recognition using oriented Laplacian of Gaussian (OLOG) and independent component analysis (ICA). In 2012 Second International Conference on Digital Information and Communication Technology and it's Applications (DICTAP) (pp. 99-103). IEEE.
113.
114. Shubham Salunkhe, Pruthviraj Zambare, Sakshi Shinde, S. K. Godase. (2024). API Development for Cloud Parameter Curation International. *Journal of Electrical and Communication Engineering Technology*, *2*(1). https://doi.org/10.37591/ijecet
115. Badave, A., Pawale, A., Andhale, T., Godase, S. K., & STM JOURNALS. (2024). Smart home safety using fire and gas detection system. *Recent Trends in Fluid Mechanics*, *1*, 35–43. https://journals.stmjournals.com/rtfm
116. Asabe, H., Asabe, R., Lengare, O., & Godase, S. (2025). IOT- BASED STORAGE SYSTEM FOR MANAGING VOLATILE MEDICAL RESOURCES IN HEALTHCARE FACILITIES. *INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)*, *05*(03), 2427–2433. https://www.ijprems.com
117. Karche, S. N., Mulani, A. O., Department of Electronics, SKN Sinhgad College of Engineering, Korti, & University of Solapur, Maharashtra, India. (2018). AESC Technique for Scalable Face Image Retrieval. *International Journal of Innovative Research in Computer and Communication Engineering*, *6*(4), 3404–3405.
118. https://doi.org/10.15680/IJIRCCE.2018.0604036
119. Bankar, A. S., Harale, A. D., & Karande, K. J. (2021). Gestures Controlled Home Automation using Deep Learning: A Review. *International Journal of Current Engineering and Technology*, *11*(06), 617–621. https://doi.org/10.14741/ijcet/v.11.6.4
120. Mali, A. S., Ghadge, S. K., Adat, A. S., & Karande, S. V. (2024). Intelligent Medication Management System. *IJSRD - International Journal for Scientific Research & Development*, *Vol. 12*(Issue 3).
121. Water Level Control, Monitoring and Altering System by using GSM in Irrigation Based on Season. (2019). In *International Research Journal of Engineering and Technology (IRJET)* (Vol. 06, Issue 04, p. 1035) [Journal-article]. https://www.irjet.net
122. Modi, S., Misal, V., Kulkarni, S., & Mali A.S. (2025). Hydroponic Farming Monitoring System - Automated system to monitor and control nutrient and pH levels. In *Journal of Microcontroller Engineering and Applications* (Vol. 12, Issue 3, pp. 11–16). https://doi.org/10.37591/JoMEA
123. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "VGHN: variations aware geometric moments and histogram features normalization for robust uncontrolled face recognition", *International Journal of Information Technology*, https://doi.org/10.1007/s41870-021-00703-0.
124. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition using MFCC & DTW Features", *International Journal of Engineering Research And Applications (IJERA) pp. 118-122, ISSN: 2248-9622.*
125. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Recognition of Marathi Numerals Using MFCC and DTW Features", *Book Title: Recent Trends on Image Processing and Pattern Recognition, RTIP2R 2018, CCIS 1037, pp. 1–11, © Springer Nature Singapore Pte Ltd. 2019 https://doi.org/10.1007/978-981-13-9187-3_17.*
126. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Analysis of Face Recognition Algorithms for Uncontrolled Environments", *Book Title: Computing, Communication and Signal Processing, pp. 919–926, © Springer Nature Singapore Pte Ltd. 2018.*
127. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Recognition of Marathi Numerals using MFCC and DTW Features", 2nd International Conference on Recent Trends in Image Processing and Pattern Recognition (RTIP2R 2018), 21th -22th Dec., 2018, organized by Solapur University, Solapur in collaboration with University of South Dakota (USA) and Universidade de Evora (Portugal), India.

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ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

128. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "A Comprehensive Survey of Face Databases for Constrained and Unconstrained Environments", 2nd IEEE Global Conference on Wireless Computing & Networking (GCWCN-2018), 23th-24th Nov., 2018, organized by STES's Sinhgad Institute of Technology, Lonavala, India.

129. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "An Extensive Survey of Prominent Researches in Face Recognition under different Conditions", 4th International Conference on Computing, Communication, Control And Automation (ICCUBEA-2018), 16th to 18th Aug. 2018 organized by Pimpri Chinchwad College of Engineering (PCCOE), Pune, India.

130. Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, "Analysis of Face Recognition Algorithms for Uncontrolled Environments", 3rd International Conference on Computing, Communication and Signal Processing (ICCASP 2018), 26th-27th Jan.2018, organized by Dr. BATU, Lonere, India.

131. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", International Conference on Recent Trends, Feb 2012, IOK COE, Pune.

132. S. S. Gangonda, "Bidirectional Visitor Counter with automatic Door Lock System", National Conference on Computer, Communication and Information Technology (NCCCIT-2018), 30th and 31st March 2018 organized by Department of Electronics and Telecommunication Engineering, SKN SCOE, Korti, Pandharpur.

133. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition using MFCC & DTW Features", ePGCON 2012, 23rd and 24th April 2012 organized by Commins COE for Woman, Pune.

134. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", National Conference on Emerging Trends in Engineering and Technology (VNCET'12), 30th March 2012 organized by Vidyavardhini's College of Engineering and Technology, Vasai Road, Thane.

135. Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", ePGCON 2011, 26th April 2011 organized by MAEER's MIT, Kothrud, Pune-38.

136. Siddheshwar Gangonda, "Medical Image Processing", Aavishkar-2K7, 17th and 18th March 2007 organized by Department of Electronics and Telecommunication Engineering, SVERI's COE, Pandharpur.

137. Siddheshwar Gangonda, "Image enhancement & Denoising", VISION 2k7, 28th Feb-2nd March 2007 organized by M.T.E. Society's Walchand College of Engineering, Sangli.

138. Siddheshwar Gangonda, "Electromagnetic interference & compatibility" KSHITIJ 2k6, 23rd and 24th Sept. 2006 organized by Department of Mechanical Engineering, SVERI's COE, Pandharpur.

139. A. Pise and K. Karande, "A genetic Algorithm-Driven Energy-Efficient routing strategy for optimizing performance in VANETs," Engineering Technology and Applied Science Research, vol. 15, no. 5, 2025, [Online]. Available: https://etasr.com/index.php/ETASR/article/view/12744

140. A. C. Pise, K. J. Karande, "Investigating Energy-Efficient Optimal Routing Protocols for VANETs: A Comprehensive Study", ICT for Intelligent Systems, Lecture Notes in Networks and Systems 1109, Proceedings of ICTIS 2024 Volume 3, Lecture Notes in Networks and Systems, Springer, Singapore, ISSN 2367-3370, PP 407-417, 29 October 2024 https://doi.org/10.1007/978-981-97-6675-8_33.

141. A. C. Pise, et. al., "Smart Vehicle: A Systematic Review", International Journal - The Ciência & Engenharia - Science & Engineering Journal ISSN: 0103-944XVolume 11 Issue 1, 2023pp: 992–998, 2023.

142. A. C. Pise, et. al., "Smart Vehicle: A Systematic Review", International Journal of Research Publication and Reviews, ISSN 2582-7421, Vol 4, no 10, pp 2728-2731 October 2023.

143. A. C. Pise, et. al., "Development of BIOBOT System to Assist COVID Patient and Caretakers", European Journal of Molecular and Clinical Medicine ; 10(1):3472-3480, 2023.

144. A. C. Pise, et. al., "IoT Based Landmine Detection Robot", International Journal of Research in Science & EngineeringISSN: 2394-8299Vol: 03, No. 04, June-July 2023.

145. A. C. Pise, et. al., "A Systematic survey on Estimation of Electrical Vehicle", Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN: 2799-1156, Volume 3, Issue 01, Pages 1-6, December 2023.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

146. A. C. Pise, et. al., "Python Algorithm to Estimate Range of Electrical Vehicle", Web of Science, Vol 21, No 1 (2022) December 2022
147. A. C. Pise, et. al., "Implementation of BIOBOT System for COVID Patient and Caretakers Assistant using IOT", International Journal of Information technology and Computer Engineering. 30-43. 10.55529/ijitc.21.30.43, (2022).
148. A. C. Pise, et. al., "An IoT Based Real Time Monitoring of Agricultural and Micro irrigation system", International journal of scientific research in Engineering and management (IJSREM), VOLUME: 06 ISSUE: 04 | APRIL – 2022, ISSN:2582-3930.
149. A. C. Pise, Dr. K. J. Karande, "An Exploratory study of Cluster Based Routing Protocol in VANET: A Review", International Journal of Advanced Research in Engineering and Technology(IJARET), 12,10, 2021, 17-30, Manuscript ID :00000-94375 Source ID : 00000006, Journal_uploads/ IJARET/VOLUME_12_ISSUE_10/IJARET_12_10_002.pdf
150. A. C. Pise, et. al., "Android based Portable Health Support System," A Peer Referred & Indexed International Journal of Research,Vol.8,issue.4 , April 2019.
151. A. C. Pise, et. al., "Facial Expression Recognition Using Image Processing," International Journal of VLSI Design, Microelectronics and Embedded System,Vol.3,issue.2 , July 2018.
152. A. C. Pise, et. al., "Detection of Cast Iron Composition by Cooling Curve Analysis using Thermocouple Temperature Sensor," UGC Approved International Journal of Academic Science (IJRECE),Vol.6, Issue.3 , July-September 2018.
153. A. C. Pise, et. al., "Android Based Portable Health Support", System International Journal of Engineering Sciences & Research Technology (IJESRT 2017) Vol.6, Issue 8, pp 85-88 5th Aug 2017
154. A. C. Pise, et. al., "Adaptive Noise Cancellation in Speech Signal", International Journal of Innovative Engg and Technology, 2017
155. A. C. Pise, et. al., "Lung Cancer Detection System by using Baysian Classifier", ISSN 2454-7875, IJRPET, published online in conference special issue VESCOMM-2016, February 2016
156. A. C. Pise, et. al.,"Review on Agricultural Plant Diseases Detection by Image Processing", ISSN 2278-62IX, IJLTET, Vol 7, Issue 1 May 2016
157. A. C. Pise, et. al. "Segmentation of Retinal Images for Glaucoma Detection", International Journal of Engineering Research and Technology (06, June-2015).
158. A. C. Pise, et. al. "Color Local Texture Features Based Face Recognition", International Journal of Innovations in Engineering and Technology(IJIET) , Dec. 2014
159. A. C. Pise, et. al. "Single Chip Solution For Multimode Robotic Control", International Journal of Engineering Research and Technology (IJERT-2014), Vol. 3, Issue 12, Dec. 2014.
160. Anjali C. Pise et. al., "Remote monitoring of Greenhouse parameters using zigbee Wireless Sensor Network", International Journal of Engineering Research & Technology ISSN 2278-0181 (online) Vol. 3, Issue 2, and pp: (2412-2414), Feb. 2014.
161. A. C. Pise, K. J. Karande, "Cluster Head Selection Based on ACO In Vehicular Ad-hoc Networks", Machine Learning for Environmental Monitoring in Wireless Sensor Networks
162. A. C. Pise, K. J. Karande, "Architecture, Characteristics, Applications and Challenges in Vehicular Ad Hoc Networks" Presented in 27th IEEE International Symposium on Wireless Personal Multimedia Communications (WPMC 2024) "Secure 6G – AI Nexus: Where Technology Meets Humanity" Accepted for book chapter to be published in international Scopus index book by River publisher.
163. A. C. Pise, Dr. K. J. Karande, "K-mean Energy Efficient Optimal Cluster Based Routing Protocol in Vehicular Ad Hoc Networks", International Conference on Innovations in Artificial Intelligence and Machine Learning (ICAIML-2022), August 20th and 21st 2022 Springer database Conference.
164. A. C. Pise, Mr. D. Nale, "Web-Based Application for Result Analysis", ", International Conference on Innovations in Artificial Intelligence and Machine Learning (ICAIML-2022), August 20th and 21st 2022 Springer database Conference.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

165. A. C. Pise, et. al., "Detection of Cast Iron Composition by Cooling Curve Analysis using Thermocouple Temperature Sensor," 2nd International Conference on Engineering Technology, Science and Management Innovation (ICETSMI – 2018), 2nd September 2018.

166. A. C. Pise, et. al., "Facial Expression Recognition Using Facial Features," IEEE International Conference on Communication and Electronics Systems (ICCES 2018), October 2018.

167. A. C. Pise, et. al., "Estimating Parameters of Cast Iron Composition using Cooling Curve Analysis," IEEE International Conference on Communication and Electronics Systems (ICCES 2018), Coimbatore, October 2018.

168. A. C. Pise, et. al., "Android based portable Health Support System," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.

169. A. C. Pise, et. al., "Baysian Classifier & FCM Segmentation for Lung Cancer Detection in early stage," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.

170. A. C. Pise, et. al., "Cast Iron Composition Measurement by Coding Curve Analysis," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.

171. A. C. Pise, et. al., "War field Intelligence Defence Flaging Vehicle," International Conference on Innovations in Engineering and Technology (CIET 2016), SKN Sinhgad College of Engineering, 30-31 Dec 2016.

172. A. C. Pise, et. al. "Disease Detection of Pomegranate Plant", IEEE sponsored International Conference on Computation of Power, Energy, Information and Communication, 22- 23 Apr. 2015.

173. A. C. Pise, P. Bankar. "Face Recognition by using GABOR and LBP", IEEE International Conference on Communication and Signal Processing, ICCSP, 2-4 Apr. 2015

174. A. C. Pise, et. al. "Single Chip Solution For Multimode Robotic Control", Ist IEEE International Conferene on Computing Communication and Automation, 26-27 Feb2015.

175. Anjali C. Pise, Vaishali S. Katti, "Efficient Design for Monitoring of Greenhouse Parameters using Zigbee Wireless Sensor Network", fifth SARC international conference IRF,IEEE forum ISBN 978-93-84209-21-6,pp 24-26, 25th May 2014

176. A. C. Pise, P. Bankar, "Face Recognition using Color Local Texture Features", International Conference on Electronics and Telecommunication, Electrical and Computer Engineering, Apr.2014.

177. A. C. Pise, et.al. "Monitoring parameters of Greenhouse using Zigbee Wireless Sensor Network", 1st International Conference on Electronics and Telecommunication, Electrical and Computer Engineering, 5-6 Apr.2014.

178. A. C. Pise, et. al. "Compensation schemes and performance Analysis of IQ Imbalances in Direct Conversion Receivers", International Conference at GHPCOE, Gujarat, (Online Proceeding is Available), 2009.

179. A. C. Pise, K. J. Karande, "Energy-Efficient Optimal Routing Protocols in VANETs", 66th Annual IETE Convention, AIC -2023 September16-17, 2023, under the Theme: The Role of 5G In Enabling Digital Transformation for Rural Upliftment.

180. A. C. Pise, et. al. "Automatic Bottle Filling Machine using Raspberry Pi", National Conference on computer ;Communication & information Technology (NCCIT-2018) dated 30th & 31st March 2018.

181. A. C. Pise, et. al. "Design & Implementation of ALU using VHDL", National Conference on computer ;Communication & information Technology (NCCIT-2018) dated 30th & 31st March 2018.

182. A. C. Pise, et. al. "Mechanism and Control of Autonomus four rotor Quad copter", National Conference on Computer, Electrical and Electronics Engineering, 23- 24 Apr. 2016.

183. A. C. Pise, et. al. "Segmentation of Optic Disk and Optic Cup from retinal Images", ICEECMPE – Chennai, June 2015

184. A. C. Pise, et. al. "Diseases Detection of Pomegranate Plant", IEEE Sponsored International conference on Computation of Power, Energy , April 2015.

IJARSCT
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ISSN: 2581-9429
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Impact Factor: 7.67

185. A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct-Conversion Receivers", Conference at SCOE, Pune 2010.

186. A. C. Pise, et. al. "I/Q Imbalance compensation Techniques in Direct Conversion Receiver ", Advancing Trends in Engineering and Management Technologies, ATEMT-2009, Conference at Shri Ramdeobaba Kamla Nehru Engineering College, Nagpur, 20-21 November 2009

187. A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct Conversion Receiver", Conference at PICT, Pune 2008.

188. A. C. Pise, et. al. "I/Q Imbalance compensation Techniques in Direct Conversion Receiver ", Conference at DYCOE, Pune 2008.

189. A. C. Pise, et. al. "DUCHA: A New Dual channel MAC protocol for Multihop Ad-Hoc Networks", Conference at SVCP, Pune 2007.

190. Godase, V., Pawar, P., Nagane, S., & Kumbhar, S. (2024). Automatic railway horn system using node MCU. Journal of Control & Instrumentation, 15(1).

191. Godase, V., & Godase, J. (2024). Diet prediction and feature importance of gut microbiome using machine learning. Evolution in Electrical and Electronic Engineering, 5(2), 214-219.

192. Jamadade, V. K., Ghodke, M. G., Katakdhond, S. S., & Godase, V. A Comprehensive Review on Scalable Arduino Radar Platform for Real-time Object Detection and Mapping.

193. Godase, V. (2025). A comprehensive study of revolutionizing EV charging with solar-powered wireless solutions. Advance Research in Power Electronics and Devices e-ISSN, 3048-7145.

194. Godase, V. (2025, April). Advanced Neural Network Models for Optimal Energy Management in Microgrids with Integrated Electric Vehicles. In Proceedings of the International Conference on Trends in Material Science and Inventive Materials (ICTMIM-2025) DVD Part Number: CFP250J1-DVD.

195. Dange, R., Attar, E., Ghodake, P., & Godase, V. (2023). Smart agriculture automation using ESP8266 NodeMCU. J. Electron. Comput. Netw. Appl. Math, (35), 1-9.

196. Godase, V. (2025). Optimized Algorithm for Face Recognition using Deepface and Multi-task Cascaded Convolutional Network (MTCNN). Optimum Science Journal.

197. Mane, V. G. A. L. K., & Gangonda, K. D. S. Pipeline Survey Robot.

198. Godase, V. (2025). Navigating the digital battlefield: An in-depth analysis of cyber-attacks and cybercrime. International Journal of Data Science, Bioinformatics and Cyber Security, 1(1), 16-27.

199. Godase, V., & Jagadale, A. (2019). Three element control using PLC, PID & SCADA interface. International Journal for Scientific Research & Development, 7(2), 1105-1109.

200. Godase, V. (2025). Edge AI for Smart Surveillance: Real-time Human Activity Recognition on Low-power Devices. International Journal of AI and Machine Learning Innovations in Electronics and Communication Technology, 1(1), 29-46.

201. Godase, V., Modi, S., Misal, V., & Kulkarni, S. (2025). LoRaEdge-ESP32 synergy: Revolutionizing farm weather data collection with low-power, long-range IoT. Advance Research in Analog and Digital Communications, 2(2), 1-11.

202. Godase, V. (2025). Comparative study of ladder logic and structured text programming for PLC. Available at SSRN 5383802.

203. Godase, V., Modi, S., Misal, V., & Kulkarni, S. Real-time object detection for autonomous drone navigation using YOLOv8,‖. Advance Research in Communication Engineering and its Innovations, 2(2), 17-27.

204. Godase, V. (2025). Smart energy management in manufacturing plants using PLC and SCADA. Advance Research in Power Electronics and Devices, 2(2), 14-24.

205. Godase, V. (2025). IoT-MCU Integrated Framework for Field Pond Surveillance and Water Resource Optimization. International Journal of Emerging IoT Technologies in Smart Electronics and Communication, 1(1), 9-19.

206. Godase, V. (2025). Graphene-Based Nano-Antennas for Terahertz Communication. International Journal of Digital Electronics and Microprocessor Technology, 1(2), 1-14.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, October 2025
Impact Factor: 7.67

207. Godase, V., Khiste, R., & Palimkar, V. (2025). AI-Optimized Reconfigurable Antennas for 6G Communication Systems. Journal of RF and Microwave Communication Technologies, 2(3), 1-12.

208. Bhaganagare, S., Chavan, S., Gavali, S., & Godase, V. V. (2025). Voice-Controlled Home Automation with ESP32: A Systematic Review of IoT-Based Solutions. Journal of Microprocessor and Microcontroller Research, 2(3), 1-13.

209. Jamadade, V. K., Ghodke, M. G., Katakdhond, S. S., & Godase, V. A Comprehensive Review on Scalable Arduino Radar Platform for Real-time Object Detection and Mapping.

210. Godase, V. (2025). Cross-Domain Comparative Analysis of Microwave Imaging Systems for Medical Diagnostics and Industrial Testing. Journal of Microwave Engineering & Technologies, 12(2), 39-48p.

211. V. K. Jamadade, M. G. Ghodke, S. S. Katakdhond, and V. Godase, ―A Review on Real-time Substation Feeder Power Line Monitoring and Auditing Systems," International Journal of Emerging IoT Technologies in Smart Electronics and Communication, vol. 1, no. 2, pp. 1-16, Sep. 2025.

212. V. V. Godase, "VLSI-Integrated Energy Harvesting Architectures for Battery-Free IoT Edge Systems,"Journal of Electronics Design and Technology, vol. 2, no. 3, pp. 1-12, Sep. 2025.

213. A. Salunkhe et al., "A Review on Real-Time RFID-Based Smart Attendance Systems for Efficient Record Management," Advance Research in Analog and Digital Communications, vol. 2, no. 2, pp.32-46, Aug. 2025.

214. Vaibhav, V. G. (2025). A Neuromorphic-Inspired, Low-Power VLSI Architecture for Edge AI in IoT Sensor Nodes. *Journal of Microelectronics and Solid State Devices*, *12*(2), 41-47p.

215. Nagane, M.S., Pawar, M.P., & Godase, P.V. (2022). Cinematica Sentiment Analysis. *Journal of Image Processing and Intelligent Remote Sensing*.

216. Godase, V.V. (2025). Tools of Research. SSRN Electronic Journal.

217. Godase, V. (n.d.). EDUCATION AS EMPOWERMENT: THE KEY TO WOMEN'S SOCIO ECONOMIC DEVELOPMENT. Women Empowerment and Development, 174–179.

218. Godase, V. (n.d.). COMPREHENSIVE REVIEW ON EXPLAINABLE AI TO ADDRESSES THE BLACK BOX CHALLENGE AND ITS ROLE IN TRUSTWORTHY SYSTEMS. In Sinhgad College of Engineering, Artificial Intelligence Education and Innovation (pp. 127–132).

219. Godase, V. (n.d.-b). REVOLUTIONIZING HEALTHCARE DELIVERY WITH AI-POWERED DIAGNOSTICS: A COMPREHENSIVE REVIEW. In SKN Sinhgad College of Engineering, SKN Sinhgad College of Engineering (pp. 58–61).

220. Dhope, V. (2024). SMART PLANT MONITORING SYSTEM. In International Journal of Creative Research Thoughts (IJCRT). https://www.ijcrt.org

221. M. M. Zade,Sushant D.Kambale,Shweta A.Mane,Prathamesh M. Jadhav.(2025) "IOT Based early fire detection in Jungles". RIGJA&AR Volume 2 Issue 1,ISSN:2998-4459. DOI:https://doi.org/10.5281/zendo.15056435

222. M. M. Zade, Bramhadev B. Rupanar, Vrushal S. Shilawant , Akansha R. Pawar(2025) "IOT Flood Monitoring & Alerting System using Rasberry Pi-Pico "International Journal of Research Publication & Reviews , Volume 6 ,Issue 3,ISSN:2582-7421.DOI:https://ijrpr.com/uploads/V6ISSUE3/IJRPR40251.pdf

223. M.M.Zade(2022) "Touchless Fingerprint Recognition System"(Paper-ID 907)(2022) International Conference on "Advanced Technologies for Societal Applications: Techno-Societal 2022 https://link.springer.com/book/10.1007/978-3-031-34644-6?page=6

224. Mr.M.M.Zade published the paper on "Automation of Color Object Sorting Conveyor Belt", in International Journal of Scientific Research in Engineering & Management (IJSREM),ISSN:2582-3930 Volume 06 ,Issue 11th November 2022.

225. Mr.M.M.Zade published the paper on "Cloud Based Patient Health Record Tracking web Developement",in International Journal of Advanced Research in Science, Communication & Technology(IJARSCT),ISSN NO:2581-9429 Volume 02 ,Issue 03,DOI 1048175/IJARSCT-3705,IF 6.252, May 2022.

226. Mr. Mahesh M Zade, "Performance analysis of PSNR Vs. Impulse Noise for the enhancement of Image using SMF", Journal of Applied Science & Computations (JASC UGC Approved), Volume VI, Issue II, Feb.2019

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ISSN: 2581-9429
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Impact Factor: 7.67

227. Mr. Mahesh M Zade, "Classification of Power Quality Disturbances Using SVM & their Efficiency Comparison", Journal of Applied Science & Computations (JASC UGC Approved), Volume VI, Issue II, Feb.2019

228. Mr. Mahesh M Zade, "Dynamic Clustering of Wireless Sensor Network Using Modified AODV", Journal of Applied Science & Computations (JASC UGC Approved), Volume VI, Issue II, Feb.2019

229. Mr. Mahesh M Zade, "Performance analysis of PSNR Vs. Impulse Noise for the enhancement of Image using SMF", National Conference on Mathematical Modeling and Computational Intelligence 2K19 (MMCI-2k19), in association with JASC, at S. B. Patil College of Engineering, Indapur, Feb.2019

230. Mr. Mahesh M Zade, "Classification of Power Quality Disturbances Using SVM & their Efficiency Comparison", National Conference on Mathematical Modeling and Computational Intelligence 2K19 (MMCI-2k19), in association with JASC, at S. B. Patil College of Engineering, Indapur Feb.2019

231. Mr. Mahesh M Zade, "Dynamic Clustering of Wireless Sensor Network Using Modified AODV", National Conference on Mathematical Modeling and Computational Intelligence 2K19 (MMCI-2k19), in association with JASC, at S. B. Patil College of Engineering, Indapur Feb.2019

232. Mr. Mahesh M Zade & Mr.S.M.Karve,"Performance Analysis of Median Filter for Enhancement of Highly Corrupted Images", National Conference on Advanced Trends in Engineering, Association with IRJMS, Karmyogi Engineering College, Shelave, Pandharpur, March 2016.

233. Mr. Mahesh M Zade & Mr.S.M.Karve,"Implementation of Reed Solomen Encoder & Decoder Using FPGA",National Conference on Advanced Trends in Engineering, Association with IRJMS, Karmyogi Engineering College, Shelave, Pandharpur, March 2016.

234. Mr. Mahesh M Zade & Dr.S.M.Mukane,"Performance of Switching Median Filter for Enhancement of Image", National Conference on Mechatronics at Sinhgad Institute of Technology and Science, Narhe, Pune, Feb. 2016.

235. Mr. Mahesh M Zade & Dr.S.M.Mukane,"Enhancement of Image with the help of Switching Median Filter", National Conference on Emerging Trends in Electronics & Telecommunication Engineering, SVERI's College of Engineering Pandharpur, NCET 2013.

236. Mr.Mahesh M Zade & Dr.S.M.Mukane,"Enhancement of Image with the help of Switching Median Filter", International Journal of Computer Application (IJCA) SVERI's College of Engineering, Pandharpur, Dec.2013.

237. A O. Mulani, V. Godase, S. Takale, and R. Ghodake, "Secure Image Authentication using AES and DWT Watermarking on Reconfigurable Platform," International Journal of Embedded System and VLSI Design, vol. 1, no. 2, pp. 14-20, Oct. 2025.