

AI Maze Escape Game Using Minmax Algorithm

A Comprehensive Review

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Abstract: *The project titled “AI Maze Escape Game Using Minimax Algorithm” aims to create a smart game where an AI agent independently moves through a maze to achieve its objective while steering clear of traps and obstacles. The system utilizes the Minimax algorithm, a traditional decision-making method employed in artificial intelligence and game theory, to assess potential moves and choose the most advantageous route by reducing possible losses and enhancing gains. The AI agent ensures strategic and efficient navigation by exploring the decision tree of possible states to anticipate the player’s or opponent’s future moves. This project illustrates the application of heuristic evaluation, depth search, and adversarial reasoning to real-time maze-solving and pathfinding challenges. This system improves the comprehension of AI game strategies and offers insights into how to implement intelligent agents that can make autonomous decisions in uncertain environments.*

Keywords: AI Maze Game, Minimax Algorithm, Game Theory, Pathfinding, Heuristic Search, Decision Tree, Artificial Intelligence, Optimal Path Selection, Adversarial Search, Intelligent Agent

I. INTRODUCTION

The AI Maze Escape Game Using Min-Max Algorithm is an engaging project that demonstrates how artificial intelligence can be applied to address intricate decision-making problems. This project involves creating a maze-like environment in which an intelligent agent must find its way from a designated starting point to a target, all the while steering clear of obstacles and potential dangers.

The Min-Max algorithm, a widely recognized AI technique utilized in game theory and adversarial search, is central to the project. Thanks to this algorithm, the agent can take into account all potential moves, foresee future results, and choose the course of action that optimizes success and minimizes risks. The agent pinpoints the best route at every juncture by investigating various possible scenarios, even in complex and shifting surroundings.

Heuristic evaluation functions play a crucial role in the project, as they assist the agent in estimating the value or cost of moves and directing it toward the most promising paths. This improves navigational efficiency and lessens the computational burden in complicated mazes.

The AI Maze Escape Game serves as a hands-on illustration of how to apply strategic decision-making algorithms in the context of real-time gaming. It underscores how well the Min-Max algorithm works in adversarial contexts and provides perspectives on pathfinding, problem-solving, and the design of intelligent agents. Moreover, the initiative holds considerable educational and research worth, aiding both learners and developers in grasping fundamental AI principles like adversarial search, optimal decision-making, and game-based simulations. It can be applied in robotics, autonomous navigation, and simulations based on games. It can be applied in fields such as robotics, autonomous navigation, and strategy-based games, making it a flexible resource for experimentation and education.

All in all, the project integrates AI strategy, algorithmic reasoning, and interactive gameplay to develop an engaging platform for the practical and visually appealing exploration of artificial intelligence concepts.



II. LITERATURE SURVEY

M.Derakhshan.et.al[1]

Derakhshan and Bateni investigated task optimization in cloud computing using MAX-MIN, MIN-MIN, and priority-based scheduling strategies. Their research showed how different task allocation methods impact system performance, resource utilization, and task completion times. They found that MAX-MIN works efficiently for larger tasks, whereas MIN-MIN is more suitable for smaller tasks. This study provides valuable insights for enhancing scheduling in dynamic cloud environments.

N.Alzaben.et.al[2]

Alzaben and Engels proposed an end-to-end routing method in SDN controllers using the Max-Flow Min-Cut algorithm. The study aimed to maximize network throughput and reduce congestion. Their algorithm dynamically selects routes based on maximum flow and minimum cut, offering a more reliable and efficient routing solution compared to conventional approaches.

N.Alzaben.et.al[3]

In this extension of their previous work, Alzaben and Engels evaluated the performance of the Max-Flow Min-Cut routing algorithm in more complex network topologies. They highlighted optimized path selection, lower latency, and enhanced network stability, demonstrating the algorithm's scalability for large-scale SDN deployments.

B.Barazandeh.et.al[4]

Barazandeh and colleagues addressed solving non-convex Min-Max games using adaptive momentum techniques. Their approach improved convergence speed and stability in adversarial optimization scenarios, which are common in AI and machine learning applications. The study offered practical insights into handling non-convex problems effectively.

D.A.Do.et.al[5]

Do and Doan analyzed gradient descent-ascent dynamics for nonconvex Min-Max optimization in the presence of delays. They derived theoretical convergence rates and studied the impact of delays on system stability, contributing to practical understanding of real-time Min-Max optimization in distributed systems.

N.Alzaben.et.al[6]

Alzaben and Engels presented an end-to-end routing algorithm for SDN controllers based on Max-Flow Min-Cut principles. Their approach optimized multi-hop communication, reduced latency, and improved data reliability, providing practical solutions for network management in SDN environments.

Z.Wang.et.al[7]

Wang and colleagues focused on Max-Min energy efficiency optimization for NOMA-enabled backscatter communication systems. Their method enhanced energy utilization while maintaining high system throughput, offering an effective solution for sustainable and efficient wireless communication networks.

K.Yang.et.al[8]

Yang et al. implemented an RSS-based indoor localization system using a Min-Max algorithm combined with area partitioning. The approach improved localization accuracy and robustness, even in environments with signal interference, making it suitable for indoor navigation applications.

K.Zhu.et.al[9]

Zhu and co-authors developed a discretization-based integer programming approach for the Dubins Multiple Traveling Salesman Problem with a Min-Max objective. Their method achieved high path-planning accuracy while minimizing maximum travel distances, benefiting robotics, logistics, and automated routing systems.

B.Lee.et.al[10]

Lee and Shin studied Max-Min fairness precoder design for rate-splitting multiple access systems under imperfect channel knowledge. Their research examined strategies to maintain fairness and optimize data rates despite channel uncertainties, contributing to more reliable wireless communication systems.

S.Zhou.et.al[11]

Zhou and colleagues proposed a Max-Min throughput design for wireless body area networks using backscatter



communication. Their method maximized network efficiency while maintaining fairness among devices, addressing energy limitations and ensuring reliable communication in healthcare and wearable technologies.

J.Fang.et.al[12]

Fang and co-authors introduced a two-layer iterative algorithm for Max-Min rate optimization in IRS-assisted multiuser systems. Using improper Gaussian signaling, their approach enhanced spectral efficiency and optimized data rates across multiple users, improving overall network performance.

C.Wang.et.al[13]

Wang and colleagues developed an automatic heterogeneous MAX-MIN ant system with a pheromone reconstruction mechanism. Their method dynamically updated search paths, improving optimization performance in combinatorial problems and providing a robust solution for AI-based routing and optimization challenges.

Z.Wang.et.al[14]

Wang and co-authors improved indoor visible light positioning using particle swarm optimization integrated with a Min-Max algorithm. The approach increased localization accuracy and system stability, offering practical solutions for indoor navigation and smart building applications.

H.Yang.et.al[15]

Yang and colleagues designed RIS-aided constant-envelope beamforming for multiuser wireless power transfer using a Max-Min approach. Their study focused on ensuring energy fairness and efficient power delivery to multiple users, contributing to optimized and sustainable wireless power systems.

III. PROPOSED METHODOLOGY

The proposed system, “AI Maze Escape Game Using Minimax Algorithm,” aims to create an intelligent agent for solving mazes who can identify the optimal escape route through the application of game theory and artificial intelligence. The approach consists of multiple systematic phases, detailed below:

1. Problem Definition

This system is designed to allow an AI agent to navigate out of a maze, sidestepping obstacles and reducing the overall movement cost. The maze is regarded as a game setting in which the AI faces off against adversarial elements like traps, obstacles, or constraints on time.

2. Maze Environment Design

A maze grid is created using a 2D matrix in which:

- Each cell indicates a position (either free space, wall, goal, or trap).

- The initial point (S) and target point (G) are established.
- Obstacles are positioned randomly or by hand within the maze.

The AI agent uses the environment as its game board.

3. State Representation

A state is represented by each potential arrangement of the maze.

- The state space is determined by the AI's current position, target location, and obstacles.
- When the agent moves (up, down, left, right), transitions between states happen.

4. Application of Minimax Algorithm

To decide the best move at every stage, the Minimax algorithm is employed.

- The AI functions as the maximizing player (attempting to reduce the distance to the goal).
- The environment or trap serves as the minimizing player (making things harder or obstructing routes).
- A decision tree is created that illustrates all potential moves and their results.
- The AI selects the route that optimizes success and reduces loss through backtracking and heuristic evaluation



5. Heuristic Evaluation Function

An heuristic function (like Manhattan Distance or Euclidean Distance) approximates the proximity of the AI to the goal.

This function assists in assessing every node within the decision tree, thereby diminishing computational complexity and enhancing efficiency.

6. Implementation and Simulation

- The system can be implemented in Python or C++ and includes graphical visualization (e.g., Pygame or Tkinter).
- The maze, the AI agent, and its movement are depicted in real-time.
- The agent uses the Minimax strategy to evaluate moves continuously until it either reaches the goal or there are no valid paths left.

7. Testing and Evaluation

- To evaluate the AI performance, mazes with varying complexities are examined.
- Assessment metrics comprise path length, duration to achieve target, and count of explored nodes.
- The algorithm's ability to make decisions is evaluated in comparison to random or heuristic-based methods.

IV. CONCLUSION

The project titled "AI Maze Escape Game Using Minimax Algorithm" culminates in the successful design and implementation of a smart maze-solving system based on artificial intelligence and game theory principles. The system shows how an AI agent can independently move through a maze and make strategic choices using the Minimax algorithm. The project effectively demonstrates predictive reasoning and optimal decision-making by simulating an adversarial situation in which the agent must minimize losses and maximize rewards. With the help of the Minimax algorithm, the agent can assess potential future states and choose the most effective action to achieve its goal. The AI can estimate the distance to the goal and reduce unnecessary exploration through heuristic evaluation, thus enhancing speed and accuracy.

The project emphasizes that a navigation process can become more intelligent and adaptive when decision trees and heuristic functions are combined. Through thorough testing of various maze structures, it was demonstrated that the AI can operate effectively even in intricate and changing settings.

This work offers a practical illustration of how theoretical AI concepts can be applied to solve real-world problems. According to the simulation results, the AI reliably discovers the optimal route while using minimal computation time. In addition, the use of games in the implementation renders the process of learning AI algorithms both interactive and interesting. It also highlights how crucial search optimization and strategic planning are in the context of artificial intelligence. It improves comprehension of AI systems' thought processes and behaviors by combining visualization with algorithmic reasoning. The concept of escaping the maze effectively illustrates Minimax's promise in uncertain and adversarial contexts.

This demonstrates that Minimax is not confined to conventional two-player games; it can also be tailored for navigation and decision-making tasks. The project adds to the expanding domain of intelligent agents that can operate independently in complex situations. It motivates the examination of hybrid methods such as Alpha-Beta pruning and reinforcement learning to enhance performance. The system establishes a robust basis for investigations into AI-based game design and robotic pathfinding. The project successfully meets its objective of developing a smart, efficient, and strategic maze escape system utilizing the Minimax algorithm. It demonstrates that decision-based AI models can successfully replicate human logical reasoning when addressing structured problems. Therefore, the project represents a novel use of artificial intelligence for both problem-solving and the development of intelligent games.



REFERENCES

- 1) M. Derakhshan and Z. Bateni, "Optimization of tasks in cloud computing based on MAX-MIN, MIN-MIN and priority," 2018 4th International Conference on Web Research (ICWR), Tehran, Iran, 2018, pp. 45-50, doi: 10.1109/ICWR.2018.8387236.
- 2) N. Alzaben and D. W. Engels, "End-to-End Routing in SDN Controllers Using Max-Flow Min-Cut Route Selection Algorithm," 2021 23rd International Conference on Advanced Communication Technology (ICACT), PyeongChang, Korea (South), 2021, pp. 461-467, doi: 10.23919/ICACT51234.2021.9371006.
- 3) N. Alzaben and D. W. Engels, "End-to-End Routing in SDN Controllers Using Max-Flow Min-Cut Route Selection Algorithm," 2022 24th International Conference on Advanced Communication Technology (ICACT), PyeongChang Kwangwoon_Do, Korea, Republic of, 2022, pp. 461-467, doi: 10.23919/ICACT53585.2022.9728920.
- 4) B. Barazandeh, D. A. Tarzanagh and G. Michailidis, "Solving a Class of Non-Convex Min-Max Games Using Adaptive Momentum Methods," ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Toronto, ON, Canada, 2021, pp. 3625-3629, doi: 10.1109/ICASSP39728.2021.9414476.
- 5) D. A. Do and T. T. Doan, "Convergence Rates of Gradient Descent-Ascent Dynamics Under Delays in Solving Nonconvex Min-Max Optimization," 2024 European Control Conference (ECC), Stockholm, Sweden, 2024, pp. 2748-2753, doi: 10.23919/ECC64448.2024.10590762.
- 6) N. Alzaben and D. W. Engels, "End-to-End Routing Algorithm Based on Max-Flow Min-Cut in SDN Controllers," 2022 24th International Conference on Advanced Communication Technology (ICACT), PyeongChang Kwangwoon_Do, Korea, Republic of, 2022, pp. 1405-1413, doi: 10.23919/ICACT53585.2022.9728780.
- 7) Z. Wang, W. Ding, Y. Hu, Z. Fan, X. Wan and X. Wei, "Max-min Energy Efficiency Optimization of NOMA Enabled Backscatter Communication Systems," 2022 14th International Conference on Communication Software and Networks (ICCSN), Chongqing, China, 2022, pp. 28-33, doi: 10.1109/ICCSN55126.2022.9817591.
- 8) K. Yang, Z. Liang, R. Liu and W. Li, "RSS-Based Indoor Localization Using Min-Max Algorithm With Area Partition Strategy," in IEEE Access, vol. 9, pp. 125561-125568, 2021, doi: 10.1109/ACCESS.2021.3111650.
- 9) K. Zhu, H. Dai, H. Gao and X. Zhou, "High Accuracy Discretization-based Integer Programming for the Dubins Multiple Traveling Salesman Problem with Min-max Objective," 2022 5th International Conference on Robotics, Control and Automation Engineering (RCAE), Changchun, China, 2022, pp. 242-248, doi: 10.1109/RCAE56054.2022.9995954.
- 10) B. Lee and W. Shin, "Max-Min Fairness Precoder Design for Rate-Splitting Multiple Access: Impact of Imperfect Channel Knowledge," in IEEE Transactions on Vehicular Technology, vol. 72, no. 1, pp. 1355-1359, Jan. 2023, doi: 10.1109/TVT.2022.3206808.
- 11) S. Zhou, B. Ning, J. Li, Y. Dong, H. Peng and S. Li, "Max-Min Throughput Design for Wireless Body Area Network with Backscatter Communication," 2024 10th International Conference on Computer and Communications (ICCC), Chengdu, China, 2024, pp. 1776-1782, doi: 10.1109/ICCC62609.2024.10942168.
- 12) J. Fang, C. Zhang, Q. Wu, Y. Zeng and Q. Shi, "A Two-Layer Iterative Algorithm for Max-Min Rate Optimization in IRS Assisted Multiuser Systems With Improper Gaussian Signaling," in IEEE Transactions on Communications, vol. 72, no. 12, pp. 7596-7610, Dec. 2024, doi: 10.1109/TCOMM.2024.3422170.
- 13) C. Wang, W. Li and Y. Huang, "An Automatic Heterogenous-Based MAX-MIN Ant System with Pheromone Reconstruction Mechanism," 2021 17th International Conference on Computational Intelligence and Security (CIS), Chengdu, China, 2021, pp. 252-256, doi: 10.1109/CIS54983.2021.00060.
- 14) Z. Wang, Z. Liang, X. Li and H. Li, "Indoor Visible Light Positioning Based on Improved Particle Swarm Optimization Method With Min-Max Algorithm," in IEEE Access, vol. 10, pp. 130068-130077, 2022, doi: 10.1109/ACCESS.2022.3228543.



- 15) H. Yang, C. Cai, X. Yuan and Y. Liang, "RIS-aided constant-envelope beamforming for multiuser wireless power transfer: A max-min approach," in *China Communications*, vol. 18, no. 3, pp. 80-90, March 2021, doi: 10.23919/JCC.2021.03.007.
- 16) 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.
- 17) 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.
- 18) Gadade, B., Mulani, A. O., & Harale, A. D. IoT Based Smart School Bus and Student Tracking System. *Sanshodhak*, Volume 19, June 2024.
- 19) Dhanawadel, A., Mulani, A. O., & Pise, A. C. IOT based Smart farming using Agri BOT. *Sanshodhak*, Volume 20, June 2024.
- 20) Mulani, A., & Mane, P. B. (2016). *DWT based robust invisible watermarking*. Scholars' Press.
- 21) 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.
- 22) 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.
- 23) 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.
- 24) 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.
- 25) 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.
- 26) 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.
- 27) Nagane, U. P., & Mulani, A. O. (2021). Moving object detection and tracking using Matlab. *Journal of Science and Technology*, 6(1), 2456-5660.
- 28) 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.
- 29) Ghodake, M. R. G., & Mulani, M. A. (2016). Sensor based automatic drip irrigation system. *Journal for Research*, 2(02).
- 30) 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.
- 31) 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.
- 32) 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.
- 33) 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).
- 34) 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.
- 35) 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.



- 36) 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.
- 37) Kulkarni, P., & Mulani, A. O. (2015). Robust invisible digital image watermarking using discrete wavelet transform. *International Journal of Engineering Research & Technology (IJERT)*, 4(01), 139-141.
- 38) 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*.
- 39) Mulani, A. O., & Shinde, G. N. (2021). An approach for robust digital image watermarking using DWT-PCA. *Journal of Science and Technology*, 6(1).
- 40) 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.
- 41) 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.
- 42) 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.
- 43) 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.
- 44) Takale, S., & Mulani, A. (2022). DWT-PCA based video watermarking. *Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN*, 2799-1156.
- 45) Kamble, A., & Mulani, A. O. (2022). Google assistant based device control. *Int. J. of Aquatic Science*, 13(1), 550-555.
- 46) 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.
- 47) 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.
- 48) 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.
- 49) 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.
- 50) 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.
- 51) Gadade, B., & Mulani, A. (2022). Automatic System for Car Health Monitoring. *International Journal of Innovations in Engineering Research and Technology*, 57-62.
- 52) Shinde, M. R. S., & Mulani, A. O. (2015). Analysis of Biomedical Image Using Wavelet Transform. *International Journal of Innovations in Engineering Research and Technology*, 2(7), 1-7.
- 53) 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*.
- 54) 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.



- 55) 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.
- 56) 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.
- 57) Takale, S., & Mulani, D. A. (2022). Video Watermarking System. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 10.
- 58) Mandwale, A., & Mulani, A. O. (2015, January). Different approaches for implementation of Viterbi decoder. In *IEEE international conference on pervasive computing (ICPC)*.
- 59) 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.
- 60) 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.
- 61) Kambale, A. (2023). Home automation using google assistant. *UGC care approved journal*, 32(1), 1071-1077.
- 62) 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.
- 63) 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*.
- 64) Mandwale, A., & Mulani, A. O. (2016). Implementation of High Speed Viterbi Decoder using FPGA. *International Journal of Engineering Research & Technology, IJERT*.
- 65) 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.
- 66) Shinde, R., & Mulani, A. O. (2015). Analysis of Biomedical Image. *International Journal on Recent & Innovative trend in technology (IJRITT)*.
- 67) Sawant, R. A., & Mulani, A. O. (2022). Automatic PCB Track Design Machine. *International Journal of Innovative Science and Research Technology*, 7(9).
- 68) 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)*.
- 69) Gadade, B., Mulani, A. O., & Harale, A. D. (2024). Iot based smart school bus and student monitoring system. *Naturalista Campano*, 28(1), 730-737.
- 70) 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.
- 71) Salunkhe, D. S. S., & Mulani, D. A. O. (2024). Solar Mount Design Using High-Density Polyethylene. *NATURALISTA CAMPANO*, 28(1).
- 72) 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*.
- 73) 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.
- 74) 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.
- 75) 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.



- 76) Godse, A. P. A.O. Mulani (2009). *Embedded Systems (First Edition)*.
- 77) 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.
- 78) 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.
- 79) 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.
- 80) 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.
- 81) 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).
- 82) 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.
- 83) Pol, D. R. S. (2021). Cloud Based Memory Efficient Biometric Attendance System Using Face Recognition. *Stochastic Modeling & Applications*, 25(2).
- 84) Nagtilak, M. A. G., Ulegaddi, M. S. N., Adat, M. A. S., & Mulani, A. O. (2021). Breast Cancer Prediction using Machine Learning.
- 85) Rahul, G. G., & Mulani, A. O. (2016). Microcontroller Based Drip Irrigation System.
- 86) 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.
- 87) Mulani, A., & Mane, P. B. (2016). *DWT based robust invisible watermarking*. Scholars' Press.
- 88) 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).
- 89) 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).
- 90) Altaf Osman Mulani, Electric Vehicle Parameters Estimation Using Web Portal, *Recent Trends in Electronics & Communication Systems*, Volume 10, Issue 3, 2023.
- 91) 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.
- 92) 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.
- 93) 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.
- 94) 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.
- 95) 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.
- 96) 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.
 - 97) 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.
 - 98) 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.
 - 99) 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.
 - 100) 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.
 - 101) 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.
 - 102) 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.
 - 103) 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.
 - 104) 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*.
 - 105) 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.
 - 106) 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.
 - 107) 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.
 - 108) 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.
 - 109) 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.
 - 110) Karande, K. J., & Talbar, S. N. (2014). Independent component analysis of edge information for face recognition. Springer India.
 - 111) Karande, K. J., & Talbar, S. N. (2008). Face recognition under variation of pose and illumination using independent component analysis. *ICGST-GVIP*, ISSN.
 - 112) 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.



- 113) 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.
- 114) 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.
- 115) 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.
- 116) 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>
- 117) 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>
- 118) 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>
- 119) 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. <https://doi.org/10.15680/IJRCCE.2018.0604036>
- 120) 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>
- 121) 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).
- 122) 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>
- 123) 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>
- 124) 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>.
- 125) 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.
- 126) Siddheshwar S. Gangonda, Prashant P. Patavardhan, Kailash J. Karande, “Recognition of Marathi Numerals Using MFCC and DTW Features”, *Book Title: Recent Trends in 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.
- 127) 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*.
- 128) 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.
- 129) 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.
 - 130) 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.
 - 131) 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.
 - 132) Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", International Conference on Recent Trends, Feb 2012, IOK COE, Pune.
 - 133) 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.
 - 134) Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition using MFCC & DTW Features", ePGCON 2012, 23rd and 24th April 2012 organized by Commis COE for Woman, Pune.
 - 135) 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.
 - 136) Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", ePGCON 2011, 26th April 2011 organized by MAEER's MIT, Kothrud, Pune-38.
 - 137) Siddheshwar Gangonda, "Medical Image Processing", Aavishkar-2K7, 17th and 18th March 2007 organized by Department of Electronics and Telecommunication Engineering, SVERI's COE, Pandharpur.
 - 138) Siddheshwar Gangonda, "Image enhancement & Denoising", VISION 2k7, 28th Feb-2nd March 2007 organized by M.T.E. Society's Walchand College of Engineering, Sangli.
 - 139) Siddheshwar Gangonda, "Electromagnetic interference & compatibility" KSHITIJ 2k6, 23rd and 24th Sept. 2006 organized by Department of Mechanical Engineering, SVERI's COE, Pandharpur.
 - 140) 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>
 - 141) 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.
 - 142) A. C. Pise, et. al., "Smart Vehicle: A Systematic Review", International Journal - The Ciência & Engenharia - Science & Engineering Journal ISSN: 0103-944X Volume 11 Issue 1, 2023pp: 992-998, 2023.
 - 143) 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.
 - 144) 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.
 - 145) A. C. Pise, et. al., "IoT Based Landmine Detection Robot", International Journal of Research in Science & Engineering ISSN: 2394-8299 Vol: 03, No. 04, June-July 2023.



- 146) 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.
- 147) A. C. Pise, et. al., "Python Algorithm to Estimate Range of Electrical Vehicle", Web of Science, Vol 21, No 1 (2022) December 2022
- 148) 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).
- 149) 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.
- 150) 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
- 151) 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.
- 152) 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.
- 153) 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.
- 154) 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
- 155) A. C. Pise, et. al., "Adaptive Noise Cancellation in Speech Signal", International Journal of Innovative Engg and Technology, 2017
- 156) 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
- 157) A. C. Pise, et. al., "Review on Agricultural Plant Diseases Detection by Image Processing", ISSN 2278-621X, IJLTET, Vol 7, Issue 1 May 2016
- 158) A. C. Pise, et. al. "Segmentation of Retinal Images for Glaucoma Detection", International Journal of Engineering Research and Technology (06, June-2015).
- 159) A. C. Pise, et. al. "Color Local Texture Features Based Face Recognition", International Journal of Innovations in Engineering and Technology(IJIT) , Dec. 2014
- 160) 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.
- 161) 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.
- 162) 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
- 163) 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.
- 164) 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.



- 165) 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.
- 166) 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.
- 167) A. C. Pise, et. al., "Facial Expression Recognition Using Facial Features," IEEE International Conference on Communication and Electronics Systems (ICCES 2018), October 2018.
- 168) 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.
- 169) 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.
- 170) 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.
- 171) 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.
- 172) 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.
- 173) 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.
- 174) 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
- 175) A. C. Pise, et. al. "Single Chip Solution For Multimode Robotic Control", Ist IEEE International Conferene on Computing Communication and Automation, 26-27 Feb2015.
- 176) 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
- 177) A. C. Pise, P. Bankar, "Face Recognition using Color Local Texture Features", International Conference on Electronics and Telecommunication, Electrical and Computer Engineering, Apr.2014.
- 178) 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.
- 179) 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.
- 180) 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.
- 181) 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.
- 182) 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.
- 183) 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.
- 184) A. C. Pise, et. al. "Segmentation of Optic Disk and Optic Cup from retinal Images", ICEECMPE – Chennai, June 2015



- 185) A. C. Pise, et. al. "Diseases Detection of Pomegranate Plant", IEEE Sponsored International conference on Computation of Power, Energy , April 2015.
- 186) A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct-Conversion Receivers", Conference at SCOE, Pune 2010.
- 187) 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
- 188) A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct Conversion Receiver", Conference at PICT, Pune 2008.
- 189) A. C. Pise, et. al. "I/Q Imbalance compensation Techniques in Direct Conversion Receiver", Conference at DYCOE, Pune 2008.
- 190) A. C. Pise, et. al. "DUCHA: A New Dual channel MAC protocol for Multihop Ad-Hoc Networks", Conference at SVCP, Pune 2007.
- 191) Godase, V., Pawar, P., Nagane, S., & Kumbhar, S. (2024). Automatic railway horn system using node MCU. Journal of Control & Instrumentation, 15(1).
- 192) 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.
- 193) 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.
- 194) 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.
- 195) 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.
- 196) Dange, R., Attar, E., Ghodake, P., & Godase, V. (2023). Smart agriculture automation using ESP8266 NodeMCU. J. Electron. Comput. Netw. Appl. Math, (35), 1-9.
- 197) Godase, V. (2025). Optimized Algorithm for Face Recognition using Deepface and Multi-task Cascaded Convolutional Network (MTCNN). Optimum Science Journal.
- 198) Mane, V. G. A. L. K., & Gangonda, K. D. S. Pipeline Survey Robot.
- 199) 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.
- 200) Godase, V., & Jagadale, A. (2019). Three element control using PLC, PID & SCADA interface. International Journal for Scientific Research & Development, 7(2), 1105-1109.
- 201) 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.
- 202) 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.
- 203) Godase, V. (2025). Comparative study of ladder logic and structured text programming for PLC. Available at SSRN 5383802.
- 204) 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.
- 205) Godase, V. (2025). Smart energy management in manufacturing plants using PLC and SCADA. Advance Research in Power Electronics and Devices, 2(2), 14-24.
- 206) 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.



- 207) Godase, V. (2025). Graphene-Based Nano-Antennas for Terahertz Communication. *International Journal of Digital Electronics and Microprocessor Technology*, 1(2), 1-14.
- 208) 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.
- 209) 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.
- 210) 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.
- 211) 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.
- 212) 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.
- 213) 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.
- 214) 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.
- 215) 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.
- 216) Nagane, M.S., Pawar, M.P., & Godase, P.V. (2022). Cinematica Sentiment Analysis. *Journal of Image Processing and Intelligent Remote Sensing*.
- 217) Godase, V.V. (2025). Tools of Research. SSRN Electronic Journal.
- 218) Godase, V. (n.d.). EDUCATION AS EMPOWERMENT: THE KEY TO WOMEN’S SOCIO ECONOMIC DEVELOPMENT. *Women Empowerment and Development*, 174–179.
- 219) 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).
- 220) 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).
- 221) Dhope, V. (2024). SMART PLANT MONITORING SYSTEM. In *International Journal of Creative Research Thoughts (IJCRT)*. <https://www.ijert.org>
- 222) 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/zenodo.15056435>
- 223) M. M. Zade, Bramhadev B. Rupanar, Vrushal S. Shilawant, Akansha R. Pawar (2025) “IOT Flood Monitoring & Alerting System using Raspberry Pi-Pico ” *International Journal of Research Publication & Reviews*, Volume 6, Issue 3, ISSN:2582-7421. DOI: <https://ijrpr.com/uploads/V6ISSUE3/IJRPR40251.pdf>
- 224) 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>
- 225) 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.
- 226) 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.



- 227) 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
- 228) 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
- 229) 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
- 230) 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
- 231) 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
- 232) 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
- 233) 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.
- 234) 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.
- 235) 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.
- 236) 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.
- 237) 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.
- 238) 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

