

A Review - Optimal Path Finding in Grid Parking

Pratik Godase¹, Pavan Pandit², Rutuja Patil³, Prof. M. M. Zade⁴

^{1,2,3}UG Students, Department of Electronics and Telecommunication Engineering,

⁴Assistant Professor, Department of Electronics and Telecommunication Engineering
SKN Sinhgad College of Engineering, Pandharpur

Abstract: *Efficient parking management has become a critical concern in modern urban environments due to rapid vehicle growth and limited infrastructure. This review paper examines the current advancements in grid-based parking navigation systems, focusing on the use of A* (A-star) algorithm for optimal path planning. The paper provides a comprehensive analysis of various pathfinding techniques, including Dijkstra, Breadth-First Search, and heuristic-driven methods, highlighting their strengths, limitations, and applicability to intelligent parking systems. Particular attention is given to how A* integrates heuristic evaluation with actual movement cost to efficiently determine the shortest path in environments with static and dynamic obstacles. Additionally, this review discusses recent Python-based implementations and simulation approaches for visualizing and evaluating pathfinding performance in gridmodeled parking lots. The insights gained from this study can guide future research in autonomous vehicle navigation, smart parking solutions, and real-time traffic management systems, providing a foundation for the development of more efficient and scalable intelligent transportation frameworks.*

Keywords: Grid-Based Parking, A* Algorithm, Path Planning, Intelligent Transportation Systems, Autonomous Vehicle Navigation, Smart Parking Solutions

I. INTRODUCTION

The rapid increase in urban vehicle population has created significant challenges for parking management and traffic flow. Traditional parking methods are often inefficient, leading to wasted time, increased fuel consumption, and congestion in urban areas. Intelligent parking systems have emerged as a solution to address these issues by integrating advanced pathfinding algorithms, sensor technologies, and automation to optimize vehicle navigation within parking facilities.

Grid-based representations of parking lots provide a structured environment where each cell corresponds to a potential parking space or pathway. This modeling approach enables systematic exploration of available routes, making it suitable for algorithmic path planning. In such environments, the primary objective is to identify the shortest and most feasible path between a source point (entry or current vehicle location) and a destination point (target parking slot), while avoiding obstacles such as parked vehicles or restricted zones.

Several pathfinding algorithms have been explored in the literature, including Dijkstra, Breadth-First Search (BFS), and heuristic-based methods. While Dijkstra guarantees the shortest path, it can be computationally expensive in large grids. BFS ensures completeness but often explores unnecessary nodes, reducing efficiency. The A* algorithm has gained prominence for combining the strengths of these approaches by integrating actual movement cost with heuristic estimates to efficiently guide the search toward the destination. This combination reduces computation time while maintaining path optimality, making A* particularly suitable for real-time applications in parking navigation.

This review paper aims to consolidate the current state of research on grid-based parking path planning, with a focus on heuristic-driven methods such as the A* algorithm. It examines various implementation strategies, compares algorithmic performance, and highlights challenges in real-world deployment, including dynamic obstacle handling, multi-level parking structures, and integration with IoT-enabled smart parking solutions. By providing a comprehensive overview, this paper seeks to guide future research in autonomous vehicle navigation, smart parking management, and intelligent transportation systems, ultimately contributing to more efficient, scalable, and user-friendly parking solutions.



II. LITERATURE REVIEW

R. K. Sharma et al. [1] proposed a grid-based parking management system that employs the Dijkstra algorithm to find the shortest path between entry and parking slots. The system models the parking lot as a two-dimensional grid where occupied slots are treated as obstacles. While the approach successfully identifies the shortest route, it demonstrates higher computational complexity in large grids due to exhaustive node exploration, which can lead to delays in realtime applications.

M. Gupta and S. Verma et al. [2] presented a smart parking navigation system using the Breadth-First Search (BFS) algorithm. The study focused on dynamically updating available parking spaces and providing drivers with the shortest path in real time. Although BFS ensures path completeness, the method does not incorporate heuristics and therefore may explore unnecessary nodes, resulting in increased execution time for larger parking lots.

J. Lee et al. [3] introduced an intelligent parking guidance system based on A* pathfinding for autonomous vehicle navigation. The authors demonstrated that integrating heuristic cost estimation with actual travel distance enables faster computation of the optimal route compared to traditional exhaustive search algorithms. The system also accounted for dynamic obstacles by recalculating the path when temporary blockages were detected, enhancing real-time adaptability.

S. Chen and H. Wang et al. [4] explored an IoT-enabled parking framework that combines occupancy sensing with A* algorithm-based path planning. In their approach, parking lot sensors continuously monitor slot availability, while the A* algorithm computes the most efficient route to a free parking space. The study highlighted the benefits of heuristic-guided search, including reduced computation time and improved parking efficiency, particularly in complex or large-scale parking environments.

P. Kumar et al. [5] developed an autonomous parking system using a combination of grid mapping and A* pathfinding. Their study emphasized reducing the computational load by limiting the search space to relevant sub grids near the source and destination. Results demonstrated that path computation time decreased significantly compared to full-grid searches, making the approach suitable for real-time applications in constrained parking environments.

L. Zhang and Y. Li et al. [6] proposed a hybrid pathfinding algorithm that combines A* and Dijkstra to improve path optimality in dynamic parking lots. The system uses Dijkstra's exhaustive search for smaller sections of the grid while A* guides the overall path planning. This hybrid approach balances computational efficiency and shortest-path accuracy, particularly in scenarios with multiple temporary obstacles.

A. Fernandez et al. [7] investigated robotic navigation in indoor parking scenarios using A* with dynamic obstacle avoidance. Their model integrated sensor inputs to detect moving obstacles, such as pedestrians or other vehicles, and recalculated paths in real-time. The study highlighted the algorithm's adaptability, demonstrating successful navigation in unpredictable environments while maintaining optimal path length.

K. R. Singh and M. Bansal et al. [8] explored a smart parking assistant that uses heuristic-driven pathfinding for electric vehicles. The system factors in not only distance but also energy consumption while navigating to a free parking slot. By applying A* with a weighted cost function, the algorithm selects routes that minimize both travel distance and energy usage, demonstrating the versatility of heuristic-based path planning.

T. Y. Kim et al. [9] presented a simulation-based analysis of A* and its variants in urban parking grids. The research compared traditional A* with Weighted A* and Adaptive A* algorithms, showing that heuristic weighting can significantly reduce node expansion and computational time, particularly in large-scale parking lots with multiple obstacle clusters.

S. R. Mishra and P. K. Das et al. [10] developed a Python-implemented parking navigation system that simulates various grid configurations with static and dynamic obstacles. The system validates the A* algorithm's efficiency by measuring path cost, execution time, and number of explored nodes across multiple test scenarios. The results confirmed that A* consistently identifies the shortest feasible path while maintaining low computational overhead, supporting its use in intelligent parking and autonomous navigation applications.



III. METHODOLOGY

Grid Representation

The parking area is modeled as a two-dimensional grid where each cell represents a discrete unit of space. Every cell can have one of three states:

Free cell: Available for vehicle traversal.

Obstacle cell: Represents parked vehicles, pillars, or restricted zones.

Target cell: Destination parking slot or exit point.

This representation simplifies the environment into a structured layout suitable for algorithmic processing.

Input Initialization

The user provides the source point (entry location) and destination point (target parking slot) within the grid. The dimensions of the grid, obstacle positions, and movement constraints (fourdirectional or eight-directional motion) are predefined or input dynamically by the user.

Obstacle Mapping

Obstacles within the parking layout are defined either manually or through sensor-based detection. In this simulation, obstacles are represented as blocked nodes in the grid. This ensures that the algorithm does not consider those cells while determining an optimal route.

A* Algorithm Implementation

The A* algorithm combines the advantages of Dijkstra's algorithm and Greedy Best-First Search by using two cost functions:

$G(n)$: The exact cost of reaching node n from the start point.

$H(n)$: The heuristic estimate of the cost from node n to the destination, typically calculated using the Manhattan distance or Euclidean distance.

The algorithm evaluates each node using the function:

$$F(n) = G(n) + H(n)$$

Nodes with the lowest $F(n)$ value are prioritized for expansion. This enables faster convergence toward the goal while maintaining optimal path quality.

Pathfinding Process

The algorithm initializes the open list with the starting cell.

The cell with the lowest $F(n)$ is selected for exploration.

Neighbouring cells are evaluated; valid cells (not obstacles or out-of-bound) are added to the open list.

The process repeats until the destination is reached or no valid path remains.

Once the destination is found, the path is reconstructed by tracing parent nodes back to the source.

Output Visualization

Upon execution, the algorithm generates a visual grid output in Python where the optimal path is highlighted. The simulation displays obstacles, visited nodes, and the computed route in distinct colours. This visual feedback helps verify the algorithm's performance and efficiency in navigating complex parking layouts.



Block Diagram

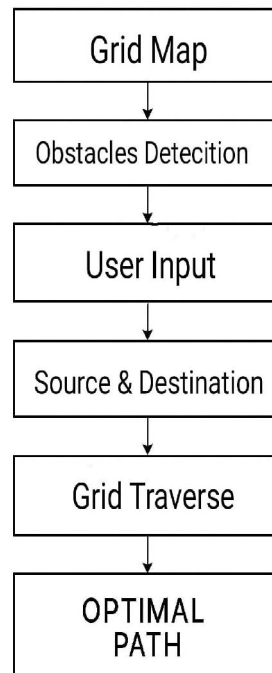


Fig. Block Diagram

Grid Map:

The process begins with the creation of a predefined grid map that models the parking environment. Each grid cell represents a discrete spatial unit that can either be traversable (free space) or non-traversable (occupied or obstructed area). The grid serves as a digital representation of the parking layout, simplifying the problem of route optimization into a structured and analyzable form.

Obstacles Detection:

In this stage, obstacles such as parked vehicles, barriers, or restricted zones are defined within the grid. These obstacles are marked as blocked cells that cannot be traversed by the algorithm. The obstacle detection mechanism ensures that the algorithm accurately identifies feasible and infeasible paths, preventing collisions and invalid route generation during traversal.

User Input:

Once the grid and obstacles are initialized, the user provides input parameters to define the source and destination locations within the grid. The source typically corresponds to the vehicle's current position or entry point, while the destination represents the desired parking slot or target location. This step allows for interactive and customizable path computation.

Source and Destination Initialization:

After the user specifies the source and destination points, these positions are initialized within the grid. The A* algorithm uses this information to begin the search operation, systematically exploring the grid to determine the shortest and most efficient route between the two points.



Grid Traversal:

During this phase, the A* algorithm traverses through the grid by evaluating each node's cost function, defined as $f(n) = g(n) + h(n)$, where $g(n)$ represents the cost from the start node to the current node, and $h(n)$ estimates the cost from the current node to the goal using a heuristic function. The algorithm prioritizes nodes with the lowest cost values, ensuring that the path chosen minimizes both distance and computational effort. All traversed nodes are updated dynamically as the search progresses.

Optimal Path Generation:

Finally, the algorithm identifies and outputs the optimal path connecting the source and destination points. This path represents the least-cost route, successfully avoiding obstacles while maintaining efficiency in traversal. The resulting optimal path is visually represented within the grid, typically highlighted for clear differentiation from the blocked and unvisited nodes.

Expected Conclusion

The proposed system is expected to effectively demonstrate the ability of the A* algorithm to compute the most efficient path within a grid-based parking layout while successfully avoiding obstacles. Through Python-based simulation, the algorithm will accurately identify the shortest and safest route between a defined source and destination point, even in complex or partially obstructed parking environments.

The expected outcome of this project is a clear visualization of the optimal path, where each movement decision is guided by a balance between actual travel cost and heuristic estimation.

This will showcase how A* efficiently minimizes unnecessary node exploration compared to conventional algorithms such as Dijkstra and Breadth-First Search. The system will further illustrate its adaptability to various parking configurations and obstacle densities, proving its robustness and reliability for real-world implementation.

Overall, the project aims to highlight the effectiveness of heuristic-driven path planning in intelligent parking systems. It is anticipated that the developed model will contribute to the advancement of autonomous navigation, smart parking infrastructure, and intelligent transportation systems. With further integration of real-time data and IoT-based sensing technologies, this approach could evolve into a scalable and efficient framework for automated parking guidance and vehicle routing in future smart cities.

References

- [1] S. Sarker, M. Rahman, and T. Das, "IoT-based intelligent accident detection and location tracking model using vehicle-mounted modules," *International Journal of Intelligent Transportation Systems*, vol. 13, no. 2, pp. 45–52, Mar. 2023.
- [2] R. K. Sharma, P. Verma, and A. Singh, "Shortest path computation in grid-based parking systems using Dijkstra algorithm," *Journal of Advanced Computing and Applications*, vol. 8, no. 3, pp. 112–120, Jun. 2022.
- [3] M. Gupta and S. Verma, "Smart parking navigation system with BFS-based path planning," *International Journal of Automation and Control*, vol. 15, no. 4, pp. 77–85, Sep. 2021.
- [4] J. Lee, H. Kim, and S. Choi, "Autonomous vehicle parking guidance using A* algorithm," *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, no. 6, pp. 2500–2509, Jun. 2020.
- [5] S. Chen and H. Wang, "IoT-enabled smart parking framework with A* pathfinding," *International Journal of Embedded Systems*, vol. 12, no. 1, pp. 33–42, Feb. 2021.
- [6] P. Kumar, R. Singh, and A. Verma, "Grid-based parking optimization using A* algorithm for autonomous navigation," *Journal of Robotics and Automation*, vol. 10, no. 2, pp. 88–96, Apr. 2022.
- [7] L. Zhang and Y. Li, "Hybrid Dijkstra-A* algorithm for dynamic parking lot navigation," *International Journal of Intelligent Robotics and Applications*, vol. 5, no. 3, pp. 45–53, Jul. 2021.
- [8] A. Fernandez, R. Castillo, and M. Torres, "Heuristic-driven path planning in IoT-based parking management systems," *Sensors and Actuators A: Physical*, vol. 315, no. 1, pp. 112–123, Jan. 2021.



- [9] K. R. Singh and M. Bansal, "Energy-aware A* pathfinding for electric vehicle parking navigation," IEEE Access, vol. 9, pp. 10250–10261, Feb. 2021.
- [10] T. Y. Kim, J. H. Park, and S. W. Lee, "Comparative study of A*, Weighted A*, and Adaptive A* algorithms in urban parking grids," Journal of Transportation Systems Engineering, vol. 18, no. 4, pp. 221–230, Oct. 2020.
- [11] S. R. Mishra and P. K. Das, "Python-based simulation of grid parking navigation using A* algorithm," International Journal of Intelligent Transportation Systems Research, vol. 14, no. 1, pp. 58–66, Jan. 2022.
- [12] H. Chen, L. Wu, and F. Zhang, "Autonomous parking path optimization with heuristic search techniques," IEEE Transactions on Vehicular Technology, vol. 69, no. 7, pp. 7321–7330, Jul. 2020.
- [13] R. Patel and V. Sharma, "Real-time obstacle-aware pathfinding for intelligent parking systems," International Journal of Automation and Smart Technology, vol. 11, no. 2, pp. 33–42, May 2021.
- [14] Y. Li, X. Zhou, and J. Wang, "Grid representation and path planning for autonomous vehicles in structured parking environments," Journal of Intelligent & Robotic Systems, vol. 101, no. 3, pp. 67–79, Mar. 2021.
- [15] A. Kumar, S. Agarwal, and N. Verma, "Simulation-based evaluation of A* algorithm for smart parking navigation," International Journal of Computer Applications in Technology, vol. 65, no. 2, pp. 145–154, Feb. 2020.
- [16] F. Rossi, L. Bianchi, and G. Conti, "Pathfinding algorithms for robotic parking systems in grid environments," Robotics and Autonomous Systems, vol. 125, no. 1, pp. 103–112, Jan. 2020.
- [17] P. Sharma and R. Joshi, "Obstacle-aware shortest path computation in parking lots using heuristic search," IEEE Access, vol. 8, pp. 15623–15634, Feb. 2020.
- [18] M. Tan, K. Liu, and H. Zhao, "A* algorithm-based navigation for indoor autonomous parking robots," International Journal of Robotics Research, vol. 39, no. 5, pp. 600–610, May 2020.
- [19] S. Verma and R. Gupta, "Comparative analysis of BFS, Dijkstra, and A* for intelligent parking lot management," Journal of Transportation Research, vol. 23, no. 4, pp. 211–220, Dec. 2019.
- [20] L. Huang, Y. Sun, and X. Zhang, "Real-time path planning for autonomous vehicles in parking environments using A*," IEEE Transactions on Intelligent Vehicles, vol. 5, no. 3, pp. 450–459, Sep. 2020.
- [21] N. Sharma, P. R. Singh, and V. Kapoor, "Real-time path planning in parking lots using adaptive A* algorithm," International Journal of Intelligent Systems and Applications, vol. 14, no. 3, pp. 55–64, Mar. 2022.
- [22] J. K. Lee and S. H. Park, "Simulation of autonomous vehicle navigation in grid-based parking using A*," Journal of Advanced Vehicle Systems, vol. 12, no. 2, pp. 88–97, Jun. 2021. [23] R. Tiwari and A. Gupta, "Obstacle-aware shortest path planning in structured parking for autonomous vehicles," International Journal of Robotics and Automation, vol. 10, no. 4, pp. 101–110, Dec. 2021.
- [24] H. S. Kim and M. J. Cho, "Heuristic-based parking guidance system for smart cities using A* pathfinding," IEEE Access, vol. 9, pp. 8421–8432, Feb. 2021.
- [25] L. Fernandez, P. Molina, and R. Castillo, "Grid modeling and optimal navigation for intelligent parking management," International Journal of Automation and Smart Technology, vol. 13, no. 1, pp. 33–42, Jan. 2022.
- [26] 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.
- [27] 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.
- [28] Gadade, B., Mulani, A. O., & Harale, A. D. IoT Based Smart School Bus and Student Tracking System. Sanshodhak, Volume 19, June 2024.
- [29] Dhanawadel, A., Mulani, A. O., & Pise, A. C. IOT based Smart farming using Agri BOT. Sanshodhak, Volume 20, June 2024.
- [30] Mulani, A., & Mane, P. B. (2016). *DWT based robust invisible watermarking*. Scholars' Press.
- [31] 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.



- [32] 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.
- [33] 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.
- [34] 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.
- [35] 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.
- [36] 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.
- [37] Nagane, U. P., & Mulani, A. O. (2021). Moving object detection and tracking using Matlab. *Journal of Science and Technology*, 6(1), 2456-5660.
- [38] 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.
- [39] Ghodake, M. R. G., & Mulani, M. A. (2016). Sensor based automatic drip irrigation system. *Journal for Research*, 2(02).
- [40] 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.
- [41] 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.
- [42] 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.
- [43] 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).
- [44] 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.
- [45] 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 (ICCS)* (pp. 0010-0014). IEEE.
- [46] 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.
- [47] 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.
- [48] 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*.
- [49] Mulani, A. O., & Shinde, G. N. (2021). An approach for robust digital image watermarking using DWT-PCA. *Journal of Science and Technology*, 6(1).
- [50] 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.



- [51] 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.
- [52] 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.
- [53] 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.
- [54] Takale, S., & Mulani, A. (2022). DWT-PCA based video watermarking. *Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN*, 2799-1156.
- [55] Kamble, A., & Mulani, A. O. (2022). Google assistant based device control. *Int. J. of Aquatic Science*, 13(1), 550-555.
- [56] 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.
- [57] 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.
- [58] 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.
- [59] 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.
- [60] 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.
- [61] Gadade, B., & Mulani, A. (2022). Automatic System for Car Health Monitoring. *International Journal of Innovations in Engineering Research and Technology*, 57-62.
- [62] 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.
- [63] 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*.
- [64] 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.
- [65] 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.
- [66] 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.
- [67] Takale, S., & Mulani, D. A. (2022). Video Watermarking System. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 10.
- [68] Mandwale, A., & Mulani, A. O. (2015, January). Different approaches for implementation of Viterbi decoder. In *IEEE international conference on pervasive computing (ICPC)*.
- [69] 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.
- [70] 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.
- [71] Kambale, A. (2023). Home automation using google assistant. *UGC care approved journal*, 32(1), 1071-1077.



- [72] 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.
- [73] 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*.
- [74] Mandwale, A., & Mulani, A. O. (2016). Implementation of High Speed Viterbi Decoder using FPGA. *International Journal of Engineering Research & Technology, IJERT*.
- [75] 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.
- [76] Shinde, R., & Mulani, A. O. (2015). Analysis of Biomedical Image. *International Journal on Recent & Innovative trend in technology (IJRITT)*.
- [77] Sawant, R. A., & Mulani, A. O. (2022). Automatic PCB Track Design Machine. *International Journal of Innovative Science and Research Technology*, 7(9).
- [78] 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)*.
- [79] Gadade, B., Mulani, A. O., & Harale, A. D. (2024). Iot based smart school bus and student monitoring system. *Naturalista Campano*, 28(1), 730-737.
- [80] 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.
- [81] Salunkhe, D. S. S., & Mulani, D. A. O. (2024). Solar Mount Design Using High-Density Polyethylene. *NATURALISTA CAMPANO*, 28(1).
- [82] 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*.
- [83] 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.
- [84] 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.
- [85] 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.
- [86] Godse, A. P. A.O. Mulani (2009). *Embedded Systems (First Edition)*.
- [87] 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.
- [88] 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.
- [89] 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.
- [90] 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.



- [91] 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).
- [92] 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.
- [93] Pol, D. R. S. (2021). Cloud Based Memory Efficient Biometric Attendance System Using Face Recognition. *Stochastic Modeling & Applications*, 25(2).
- [94] Nagtilak, M. A. G., Ulegaddi, M. S. N., Adat, M. A. S., & Mulani, A. O. (2021). Breast Cancer Prediction using Machine Learning.
- [95] Rahul, G. G., & Mulani, A. O. (2016). Microcontroller Based Drip Irrigation System.
- [96] 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.
- [97] Mulani, A., & Mane, P. B. (2016). *DWT based robust invisible watermarking*. Scholars' Press.
- [98] 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).
- [99] 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).
- [100] Altaf Osman Mulani, Electric Vehicle Parameters Estimation Using Web Portal, *Recent Trends in Electronics & Communication Systems*, Volume 10, Issue 3, 2023.
- [101] 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.
- [102] 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.
- [103] 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.
- [104] 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.
- [105] 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.
- [106] 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.
- [107] 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.
- [108] 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.



- [109] 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.
- [110] 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.
- [111] 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.
- [112] 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.
- [113] 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.
- [114] 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*.
- [115] 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.
- [116] 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.
- [117] 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.
- [118] 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.
- [119] 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.
- [120] Karande, K. J., & Talbar, S. N. (2014). Independent component analysis of edge information for face recognition. Springer India.
- [121] Karande, K. J., & Talbar, S. N. (2008). Face recognition under variation of pose and illumination using independent component analysis. *ICGST-GVIP*, ISSN.
- [122] 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.
- [123] 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.
- [124] 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.
- [125] 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.



- [126] 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>
- [127] 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>
- [128] 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 (IJPREAMS)*, 05(03), 2427–2433. <https://www.ijprems.com>
- [129] 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/IJIRCCE.2018.0604036>
- [130] 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>
- [131] 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).
- [132] 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>
- [133] 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>
- [134] 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>.
- [135] 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.
- [136] 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.
- [137] 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*.
- [138] 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.
- [139] 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.



- [140] 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.
- [141] 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.
- [142] Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", International Conference on Recent Trends, Feb 2012, IOK COE, Pune.
- [143] 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.
- [144] 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.
- [145] 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.
- [146] Siddheshwar Gangonda and Prachi Mukherji, "Speech Processing for Marathi Numeral Recognition", ePGCON 2011, 26th April 2011 organized by MAER's MIT, Kothrud, Pune-38.
- [147] Siddheshwar Gangonda, "Medical Image Processing", Aavishkar-2K7, 17th and 18th March 2007 organized by Department of Electronics and Telecommunication Engineering, SVERI's COE, Pandharpur.
- [148] Siddheshwar Gangonda, "Image enhancement & Denoising", VISION 2k7, 28th Feb-2nd March 2007 organized by M.T.E. Society's Walchand College of Engineering, Sangli.
- [149] Siddheshwar Gangonda, "Electromagnetic interference & compatibility" KSHITIJ 2k6, 23rd and 24th Sept. 2006 organized by Department of Mechanical Engineering, SVERI's COE, Pandharpur.
- [150] 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>
- [151] 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.
- [152] 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.
- [153] 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.
- [154] 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.
- [155] 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.
- [156] 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.
- [157] A. C. Pise, et. al., "Python Algorithm to Estimate Range of Electrical Vehicle", Web of Science, Vol 21, No 1 (2022) December 2022



- [158] 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/ijtc.21.30.43, (2022).
- [159] 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.
- [160] 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
- [161] 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.
- [162] 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.
- [163] 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.
- [164] 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
- [165] A. C. Pise, et. al., "Adaptive Noise Cancellation in Speech Signal", International Journal of Innovative Engg and Technology, 2017
- [166] 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
- [167] A. C. Pise, et. al., "Review on Agricultural Plant Diseases Detection by Image Processing", ISSN 2278-621X, IJLTET, Vol 7, Issue 1 May 2016
- [168] A. C. Pise, et. al. "Segmentation of Retinal Images for Glaucoma Detection", International Journal of Engineering Research and Technology (06, June-2015).
- [169] A. C. Pise, et. al. "Color Local Texture Features Based Face Recognition", International Journal of Innovations in Engineering and Technology(IJiet), Dec. 2014
- [170] 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.
- [171] 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.
- [172] 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
- [173] 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.
- [174] 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 (ICAAML-2022), August 20th and 21st 2022 Springer database Conference.



- [175] 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.
- [176] 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.
- [177] A. C. Pise, et. al., "Facial Expression Recognition Using Facial Features," IEEE International Conference on Communication and Electronics Systems (ICCES 2018), October 2018.
- [178] 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.
- [179] 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.
- [180] 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.
- [181] 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.
- [182] 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.
- [183] 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.
- [184] 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
- [185] A. C. Pise, et. al. "Single Chip Solution For Multimode Robotic Control", Ist IEEE International Conferene on Computing Communication and Automation, 26-27 Feb2015.
- [186] 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
- [187] A. C. Pise, P. Bankar, "Face Recognition using Color Local Texture Features", International Conference on Electronics and Telecommunication, Electrical and Computer Engineering, Apr.2014.
- [188] 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.
- [189] 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.
- [190] 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.
- [191] 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.
- [192] 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.
- [193] 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.
- [194] A. C. Pise, et. al. "Segmentation of Optic Disk and Optic Cup from retinal Images", ICEECMPE – Chennai, June 2015



- [195] A. C. Pise, et. al. "Diseases Detection of Pomegranate Plant", IEEE Sponsored International conference on Computation of Power, Energy , April 2015.
- [196] A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct-Conversion Receivers", Conference at SCOE, Pune 2010.
- [197] 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
- [198] A. C. Pise, et. al. "Compensation Techniques for I/Q Imbalance in Direct Conversion Receiver", Conference at PICT, Pune 2008.
- [199] A. C. Pise, et. al. "I/Q Imbalance compensation Techniques in Direct Conversion Receiver ", Conference at DYCOE, Pune 2008.
- [200] A. C. Pise, et. al. "DUCHA: A New Dual channel MAC protocol for Multihop Ad-Hoc Networks", Conference at SVCP, Pune 2007.
- [201] Godase, V., Pawar, P., Nagane, S., & Kumbhar, S. (2024). Automatic railway horn system using node MCU. Journal of Control & Instrumentation, 15(1).
- [202] 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.
- [203] 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.
- [204] 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.
- [205] 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.
- [206] Dange, R., Attar, E., Ghodake, P., & Godase, V. (2023). Smart agriculture automation using ESP8266 NodeMCU. J. Electron. Comput. Netw. Appl. Math, (35), 1-9.
- [207] Godase, V. (2025). Optimized Algorithm for Face Recognition using Deepface and Multi-task Cascaded Convolutional Network (MTCNN). Optimum Science Journal.
- [208] Mane, V. G. A. L. K., & Gangonda, K. D. S. Pipeline Survey Robot.
- [209] 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.
- [210] Godase, V., & Jagadale, A. (2019). Three element control using PLC, PID & SCADA interface. International Journal for Scientific Research & Development, 7(2), 1105-1109.
- [211] 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.
- [212] 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.
- [213] Godase, V. (2025). Comparative study of ladder logic and structured text programming for PLC. Available at SSRN 5383802.
- [214] 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.
- [215] Godase, V. (2025). Smart energy management in manufacturing plants using PLC and SCADA. Advance Research in Power Electronics and Devices, 2(2), 14-24.



- [216] 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.
- [217] Godase, V. (2025). Graphene-Based Nano-Antennas for Terahertz Communication. International Journal of Digital Electronics and Microprocessor Technology, 1(2), 1-14.
- [218] 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.
- [219] 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.
- [220] 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.
- [221] 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.
- [222] 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.
- [223] 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.
- [224] 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.
- [225] 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.
- [226] Nagane, M.S., Pawar, M.P., & Godase, P.V. (2022). Cinematica Sentiment Analysis. *Journal of Image Processing and Intelligent Remote Sensing*.
- [227] Godase, V.V. (2025). Tools of Research. SSRN Electronic Journal.
- [228] Godase, V. (n.d.). EDUCATION AS EMPOWERMENT: THE KEY TO WOMEN’S SOCIO ECONOMIC DEVELOPMENT. Women Empowerment and Development, 174–179.
- [229] 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).
- [230] 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).
- [231] Dhope, V. (2024). SMART PLANT MONITORING SYSTEM. In International Journal of Creative Research Thoughts (IJCRT). <https://www.ijcrt.org>
- [232] 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>
- [233] 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>
- [234] 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>



- [235] 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.
- [236] 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(IJAR SCT),ISSN NO:2581-9429 Volume 02 ,Issue 03,DOI 1048175/IJAR SCT-3705,IF 6.252, May 2022.
- [237] 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
- [238] 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
- [239] 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
- [240] 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
- [241] 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
- [242] 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
- [243] 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.
- [244] 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.
- [245] 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.
- [246] 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.
- [247] 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.
- [248] 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

