Engineering

E-ISSN No : 2581-6195 | Volume : 9 | Special Issue | May 2026

ELECTRIC VEHICLE WITH DRIVER ASSISTANCE SYSTEM AND SOLAR INTEGRATION

*Sushmita[1], Sharada[2], Vaishnavi Waddi[2], Ananthu Durga Prasad[3]

ABSTRACT

The rapid growth in transportation systems has resulted in serious challenges such as environmental pollution, excessive fuel consumption, traffic congestion, and increasing road accidents. Conventional fuel-based vehicles contribute significantly to greenhouse gas emissions and environmental degradation, creating a strong need for sustainable and energy-efficient transportation solutions. Electric Vehicles (EVs) have emerged as an effective alternative due to their low emissions, reduced operational cost, and improved energy efficiency. However, most low-cost electric vehicles still lack advanced safety, monitoring, and communication systems because of the high cost and complexity of modern intelligent vehicle technologies.

This paper presents the design and development of a low-cost Electric Vehicle integrated with a Driver Assistance System (DAS) and solar charging support. The proposed system combines electric mobility, driver monitoring, real-time vehicle tracking, video surveillance, wireless communication, and renewable energy integration into a single compact platform. The developed prototype consists of a fabricated chassis, DC motor, chain drive transmission mechanism, steering system, braking system, suspension system, and four 12V lithium batteries.

The Driver Assistance System includes ADAS and DMS cameras, Mobile Digital Video Recorder (MDVR), GPS tracking module, buzzer alert system, monitor display, and 4G/WiFi communication modules. The ADAS camera monitors road conditions, while the DMS camera continuously monitors driver behaviour to improve vehicle safety and driver awareness. The MDVR records and stores video footage captured from the cameras, and the GPS module enables accurate real-time vehicle tracking. A photovoltaic solar panel integrated with a charge controller provides auxiliary battery charging support and improves overall energy efficiency.

The developed prototype was experimentally tested under different operating conditions to evaluate vehicle movement, steering performance, braking efficiency, monitoring capability, GPS tracking accuracy, communication performance, alert generation, and solar charging functionality. Experimental results confirmed reliable coordination between mechanical, electrical, and electronic subsystems.

The proposed system provides a cost-effective, scalable, and practical smart transportation solution suitable for fleet management, public transportation, logistics monitoring, educational research, and intelligent vehicle applications. The project demonstrates the feasibility of integrating affordable driver assistance, monitoring, and renewable energy technologies into small-scale electric vehicles, thereby contributing toward safer, smarter, and more sustainable transportation systems.

KEYWORDS: Electric Vehicle, Driver Assistance System, MDVR, GPS Tracking, Solar Integration, Smart Transportation

[1] Student, Department of Electrical and Electronics Engineering, Guru Nanak Dev Engineering College, Bidar, Karnataka, India
[2] Student, Department of Electronics and Communication Engineering, Guru Nanak Dev Engineering College, Bidar, Karnataka, India
[3] Faculty, Department of Electrical and Electronics Engineering, Guru Nanak Dev Engineering College, Bidar, Karnataka, India

How to Cite:
*Sushmita, Sharada, Vaishnavi waddi, Ananthu Durga Prasad (2026), Electric Vehicle with Driver Assistance System and Solar Integration, International Educational Journal of Science & Engineering (IEJSE),Vol: 9, Special Issue, May 2026 311-319

Research Paper

1. INTRODUCTION:

Nowadays the transportation sector plays a major role in the economic and social development of every nation. However, the rapid increase in the number of fossil fuel based vehicles has created serious challenges such as environmental pollution, fuel consumption, traffic congestion and road accidents. Internal combustion engine vehicles release harmful gases such as carbon dioxide, nitrogen oxides, and other pollutants, which negatively affect air quality and contribute to global warming. In addition, increasing fuel prices and depletion of fossil fuel resources have created a strong need for sustainable and energy-efficient transportation systems.

Electric Vehicles (EVs) have emerged as one of the most promising alternative transportation systems to conventional vehicles because they operate using electrical energy and produce zero direct emissions. EVs help in reducing environmental pollution, improving energy efficiency, and lowering operational costs. Due to these advantages, governments and industries around the world are encouraging the development and adoption of electric mobility technologies. Despite the growing popularity of EVs, many low-cost electric vehicles and prototype systems still lack intelligent safety and monitoring features that are commonly available only in expensive modern vehicles.

Road safety has become another major concern in recent years. A large number of road accidents occur due to driver negligence, fatigue, distraction, over-speeding, and lack of monitoring systems. Advanced Driver Assistance Systems (ADAS) are widely used in modern automobiles to improve vehicle safety and driver awareness. These systems include technologies such as driver monitoring cameras, road-view cameras, collision warning systems, GPS tracking, alert systems, and real-time communication technologies. However, most commercially available ADAS technologies are expensive and difficult to integrate into low-cost or educational prototype vehicles.

To address these limitations, this project focuses on the design and development of a low-cost Electric Vehicle integrated with a Driver Assistance System and solar charging support. The proposed system combines electric mobility, driver monitoring, vehicle tracking, video recording, wireless communication, and renewable energy integration. The main objective of the project is to create an affordable, efficient, and scalable smart transportation system suitable for educational research, monitoring, public safety and smart mobility applications.

The developed prototype consists of a fabricated chassis, DC motor, chain drive transmission system, steering and braking mechanisms, lithium battery pack, MDVR (Mobile Digital Video Recorder), ADAS camera, DMS camera, GPS module, monitor display, buzzer alert system, 4G SIM connectivity, WiFi module, and solar panel integration. The electric vehicle subsystem provides propulsion and movement, while the driver assistance subsystem enhances safety and monitoring capability. The solar charging subsystem supports auxiliary battery charging and improves overall energy efficiency.

The Driver Monitoring System (DMS) camera is used to observe driver behaviour and identify unsafe conditions such as driver distraction or drowsiness. The ADAS camera continuously monitors the road and supports safer vehicle operation. The MDVR acts as the central unit for video processing and storage by recording footage captured from the cameras. The GPS module enables real-time vehicle tracking, while the 4G and WiFi modules support wireless communication and remote monitoring. A buzzer alert mechanism is included to provide warning signals during unsafe conditions. In addition, the solar panel and charge controller help utilize renewable energy for supporting battery charging.

The project was implemented in two major stages. The first stage focused on electric vehicle fabrication, including chassis development, motor installation, battery integration, steering, braking, and mechanical assembly. The second stage focused on integrating the driver assistance system, GPS tracking, wireless communication modules, MDVR setup and solar charging support. The complete system was tested under different operating conditions to evaluate its mechanical performance, electrical functionality, and monitoring capabilities.

The proposed system offers several advantages compared to conventional low-cost electric vehicles. It provides an integrated monitoring and safety platform at a much lower cost compared to commercial ADAS systems. The system also supports sustainable transportation through solar energy integration and electric mobility. Furthermore, the prototype can be expanded in the future by incorporating advanced technologies such as obstacle detection, cloud monitoring, mobile applications, artificial intelligence, and autonomous driving assistance features.

This project demonstrates the practical implementation of a smart electric vehicle system with integrated driver assistance and renewable energy support. The developed prototype can be used in applications such as fleet management, logistics and delivery services, educational research, public transportation monitoring, and intelligent transportation systems. The project also contributes toward the development of affordable smart mobility solutions for future transportation needs.

2. DESIGN

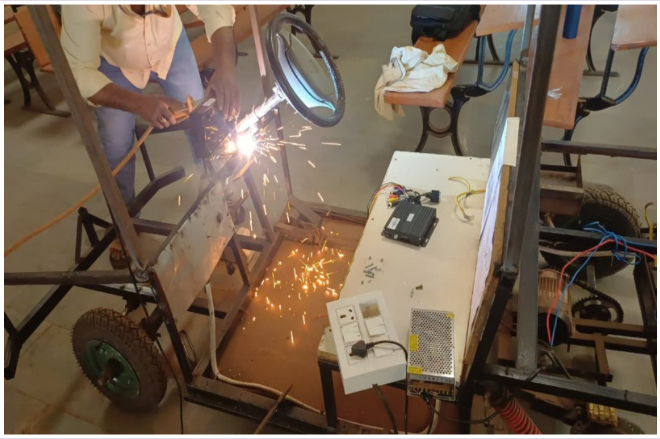
The proposed system was developed by integrating electric vehicle technology, driver assistance systems, real-time monitoring modules, and renewable energy support into a single low-cost smart transportation platform. The methodology adopted for this work includes system design, chassis fabrication, mechanical assembly, electrical integration, driver assistance implementation, solar charging integration, and performance testing. The complete development process was carried out in a systematic manner to ensure proper coordination between mechanical, electrical, and electronic subsystems.

2.1 Vehicle Structure

The vehicle chassis was fabricated using metal bars through cutting, grinding, and welding operations. The chassis provides structural support for all major components including the motor, battery, steering system, and electronic devices.

Fig. 1: Chassis fabrication and frame development

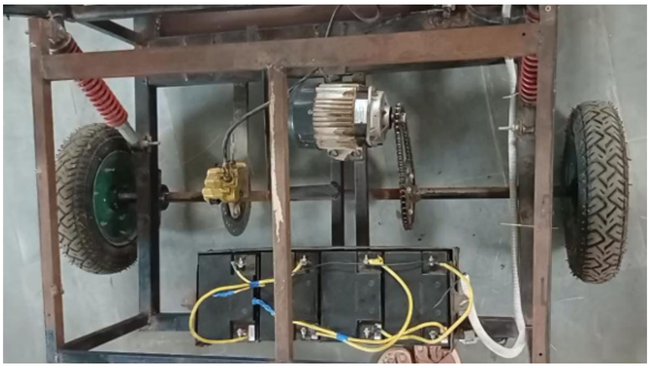
Fig. 2. Chassis fabrication and welding process of the proposed electric vehicle prototype.



2.2 Motor and Transmission

A high-torque DC motor was used as the propulsion unit of the vehicle. The motor converts electrical energy supplied by the battery pack into mechanical motion required for vehicle movement. A chain and sprocket transmission mechanism was implemented to transfer torque from the motor shaft to the rear wheels efficiently. The transmission system was selected due to its simplicity, reliability, and suitability for low-cost electric vehicle applications.

Fig. 3: Motor, steering, and chain drive assembly



2.3 Battery System

The vehicle is powered using four 12V lithium batteries connected together to provide electrical energy for both the propulsion system and electronic subsystems. The battery pack supplies power to the DC motor, MDVR, cameras, GPS module, monitor display, and communication modules. Lithium batteries were selected due to their high energy density, lightweight nature, efficient charging characteristics, and long operational life.

2.4 Driver Assistance System

The Driver Assistance System consists of:

- ADAS Camera for road monitoring
- DMS Camera for driver monitoring
- MDVR for video processing and recording
- GPS module for vehicle tracking
- Buzzer for alert generation
- 7-inch monitor display
- 4G SIM and WiFi modules for communication

The ADAS camera detects road conditions, lane positions, and nearby vehicles. The DMS camera monitors driver behavior and detects fatigue or distraction.

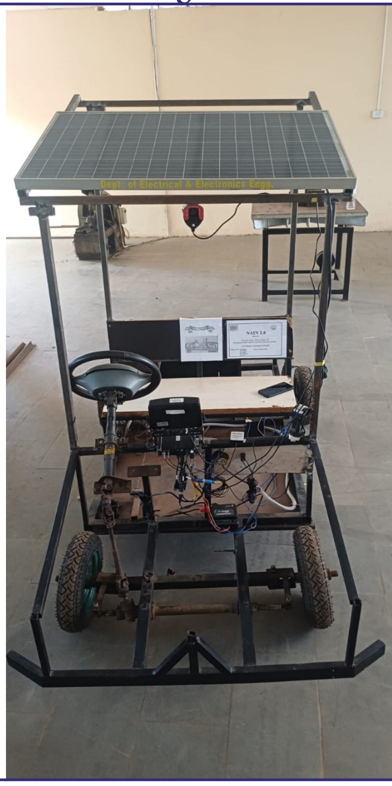
2.5 Solar Charging System

A photovoltaic solar panel along with a charge controller was integrated into the proposed electric vehicle to provide auxiliary battery charging support and improve energy efficiency. The solar panel converts solar energy into electrical energy, which is supplied to the battery pack through the charge controller.

The charge controller regulates voltage and current levels to ensure safe charging and prevent battery overcharging. The solar charging subsystem reduces dependency on external charging sources and supports sustainable vehicle operation.

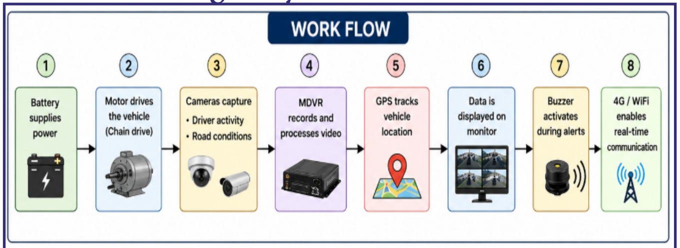
During testing, the solar panel successfully provided auxiliary charging support to the lithium battery system without affecting the normal operation of the vehicle and electronic subsystems.

Fig. 4: Final developed prototype with solar panel integration



2.6 System Workflow

Fig. 5: system workflow



1. Battery supplies power to the motor and electronic components.
2. Motor drives the vehicle through chain transmission.
3. Cameras capture driver and road-view data.
4. MDVR records and processes video data.
5. GPS module tracks vehicle location.
6. Monitor displays live camera footage.

7. Buzzer generates alerts during unsafe conditions.
8. 4G/WiFi modules enable real-time communication.

RESULTS

The developed prototype was experimentally tested under different operating conditions to evaluate its mechanical performance, electrical functionality, driver assistance capability, communication performance, and overall system integration. The testing process confirmed the successful operation of the proposed low-cost electric vehicle integrated with a Driver Assistance System and solar charging support.

3.1 Mechanical Performance

The mechanical performance of the vehicle was evaluated by testing vehicle movement, steering control, braking efficiency, and chassis stability. During testing, the vehicle demonstrated smooth and stable movement under normal operating conditions. The fabricated chassis maintained structural stability and supported all integrated components effectively.

The steering mechanism provided proper directional control and smooth maneuverability during vehicle operation. The braking system functioned effectively and ensured safe stopping of the vehicle without instability. The chain and sprocket transmission mechanism successfully transferred torque from the DC motor to the wheels with minimal power loss.

The suspension system reduced vibration during movement and improved overall driving stability.

Fig. 6. Mechanical performance testing of the developed vehicle

3.2 Electrical Performance

The electrical subsystem was tested to evaluate battery performance, motor operation, power distribution, and solar charging capability. The lithium battery pack supplied stable electrical power to both the propulsion system and electronic modules during operation.

The DC motor operated efficiently and provided sufficient torque for smooth vehicle movement. The electrical wiring and power distribution system maintained stable voltage levels without major fluctuations during testing.

The solar charging subsystem functioned successfully by providing auxiliary charging support to the battery pack. The charge controller regulated charging voltage effectively and prevented overcharging conditions. The integrated electrical subsystem demonstrated reliable operation and efficient energy utilization throughout the testing process.

Fig. 7. Battery system and electrical integration testing

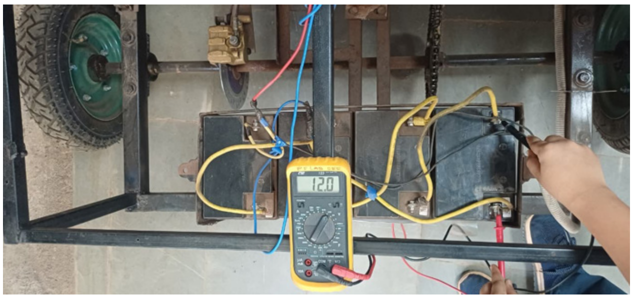


Table 1: Mechanical and Electrical Performance Results

Parameter	Observation
Vehicle Movement	Smooth and stable
Steering Control	Proper directional control
Brake Performance	Effective
Motor Performance	Efficient operation
Battery Performance	Stable power supply

3.3 Driver Assistance System Performance

The Driver Assistance System was evaluated by testing the functionality of the ADAS camera, DMS camera, MDVR, GPS module, monitor display, and buzzer alert system.

The ADAS camera successfully captured clear road-view footage during vehicle operation and provided continuous monitoring of road conditions. The DMS camera effectively monitored driver activity and captured driver behaviour accurately.

The MDVR processed, recorded, and stored video data from both cameras successfully without data loss. The monitor display provided clear live video output from the connected cameras during real-time operation.

The GPS module accurately tracked the real-time location of the vehicle with minimal deviation. The buzzer alert system generated warning alerts correctly during predefined testing conditions and unsafe situations.

The driver assistance subsystem demonstrated reliable monitoring, recording, and alert generation capability throughout the testing process.

Fig. 8: Live road-view and driver monitoring output

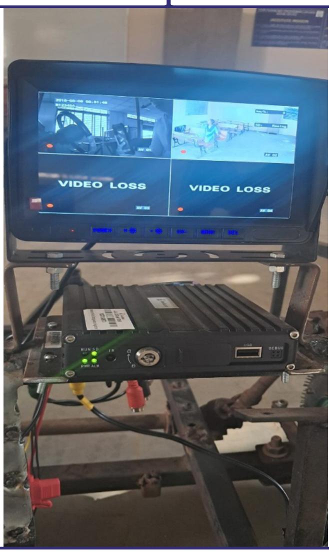


Fig. 9: MDVR and monitor display output

3.4 Communication Performance

The communication subsystem consisting of the 4G SIM module and WiFi module was tested to verify real-time connectivity and data transmission capability.

The 4G SIM module successfully enabled internet connectivity for remote monitoring and communication. The WiFi module provided stable internal communication between connected subsystems. Real-time monitoring, video transmission, and GPS tracking data were successfully transmitted during testing.

The communication subsystem operated reliably and supported continuous system connectivity without major interruptions.

Fig. 10. Final developed prototype during testing

Table 3: Driver Assistance and Communication Performance

Component	Result
ADAS Camera	Functional
DMS Camera	Functional
MDVR Recording	Successful
GPS Tracking	Accurate
Monitor Display	Proper output
Buzzer Alert	Functional
4G Communication	Successful
WiFi Connectivity	Stable

4. RESULTS AND DISCUSSION

The proposed project successfully demonstrates the integration of electric vehicle technology, driver assistance systems, wireless communication, and solar charging support into a single low-cost smart transportation platform. The developed prototype was designed to address important challenges associated with conventional transportation systems, including environmental pollution, lack of vehicle monitoring, limited driver safety features, and high implementation costs of modern intelligent vehicle technologies.

The mechanical performance of the developed vehicle was found to be stable and reliable during testing. The fabricated chassis provided sufficient structural strength to support all integrated components, while the steering and braking systems ensured proper vehicle control and operational safety. The chain and sprocket transmission mechanism efficiently transferred power from the DC motor to the wheels, resulting in smooth vehicle movement with minimal mechanical losses. The suspension system also contributed to vehicle stability by reducing vibration during operation.

The electrical subsystem demonstrated efficient power management and reliable operation throughout the testing process. The lithium battery pack supplied stable electrical energy to both the propulsion system and electronic modules without significant voltage fluctuations. The DC motor operated efficiently and produced sufficient torque for smooth vehicle movement. In addition, the integration of the solar charging subsystem improved overall energy efficiency by providing auxiliary charging support to the battery pack. The use of renewable energy contributes toward sustainable transportation and reduces dependency on external charging sources.

One of the major contributions of the proposed system is the implementation of the Driver Assistance System (DAS). The integration of ADAS and DMS cameras enabled continuous monitoring of both road conditions and driver behaviour. The ADAS camera provided clear road-view footage and supported safer driving operation, while the DMS camera monitored driver activity and helped identify unsafe conditions such as distraction or fatigue. The MDVR successfully processed and stored video data captured from both cameras, ensuring reliable surveillance and monitoring capability.

The GPS tracking subsystem provided accurate real-time vehicle location monitoring during testing. The integration of 4G SIM and WiFi modules enabled successful wireless communication and real-time data transmission. These communication features enhance the practical applicability of the system for remote monitoring, fleet management, logistics, and public transportation safety applications.

Compared to conventional low-cost electric vehicles, the proposed system offers significant advantages by integrating monitoring, tracking, communication, and alert mechanisms into a single compact platform. Most commercially available Advanced Driver Assistance Systems are expensive and primarily available in high-end vehicles. In contrast, the developed prototype demonstrates that essential driver assistance and monitoring features can be implemented effectively at a much lower cost using affordable and easily available components.

Future improvements can focus on integrating advanced sensors, artificial intelligence algorithms, obstacle detection systems, mobile application support, and cloud-based monitoring platforms. The vehicle design can also be further optimized to improve performance, efficiency, and commercial feasibility. With additional development and testing, the proposed system has strong potential for large-scale deployment in applications such as fleet monitoring, smart public transportation systems, logistics management, and intelligent electric mobility solutions.

CONCLUSIONS:

This paper presented the design and development of a low-cost Electric Vehicle integrated with a Driver Assistance System and solar charging support.The Driver Assistance System demonstrated reliable monitoring and surveillance capability. The ADAS camera successfully captured road-view footage, while the DMS camera effectively monitored driver activity and behaviour. The MDVR processed and stored video recordings successfully without data loss. The GPS module provided accurate real-time location tracking, and the buzzer alert system generated warning alerts correctly during unsafe operating conditions. The integration of 4G SIM and WiFi modules enabled successful wireless communication and real-time monitoring functionality.

The integration of renewable energy through solar charging support further enhances the sustainability and environmental benefits of the system. The developed prototype contributes toward reducing environmental pollution, improving road safety, and promoting energy-efficient transportation solutions. The project also provides significant educational and research value by offering practical exposure to electric vehicle systems, embedded electronics, IoT-based monitoring, wireless communication technologies, renewable energy integration, and intelligent transportation systems. The developed platform can be used for further research and innovation in the areas of smart mobility and autonomous vehicle technologies.

ACKNOWLEDGMENTS:

The authors express their sincere gratitude to the NAIN (New Age Innovation Network) Program, Government of Karnataka, for providing financial assistance, technical encouragement, and innovation support for the successful completion of this project. The authors would also like to thank Guru Nanak Dev Engineering College Bidar for providing the necessary infrastructure, laboratory facilities, workshop support, and academic environment required for carrying out the project work successfully.

REFERENCES

1. P. P. Patil and S. R. Patil, "Smart Electric Vehicle Monitoring and Tracking System using IoT," *International Journal of Engineering Research & Technology (IJERT)*, vol. 11, no. 5, pp. 120–126, 2022.
2. A. Demir, H. Kaya, and M. Yildiz, "Advanced Autonomous Surveillance Robot using Artificial Intelligence and Computer Vision," *Turkish Journal of Computer and Mathematics Education (Turcomat)*, vol. 15, no. 1, pp. 50–60, 2024.
3. A. Rao, H. Gupta, P. Singh, S. Mittal, U. Singh, and D. K. Vishwakarma, "Optimizing Electric Vehicle Efficiency with Real-Time Telemetry using Machine Learning," *International Journal of Intelligent Transportation Systems Research*, vol. 22, no. 3, pp. 210–222, 2024.
4. S. B. Mitikiri, K. V. S. M. Babu, D. Dwivedi, V. L. Srinivas, P. Chakraborty, and P. K. Yemula, "Modelling of the Electric Vehicle Charging Infrastructure as Cyber Physical Power Systems: A Review on Components, Standards, Vulnerabilities and Attacks," *IEEE Access*, vol. 12, pp. 11234–11258, 2024.
5. V. Vyas and S. S. Shetiya, "Intelligent Electric Power Steering: Artificial Intelligence Integration Enhances Vehicle Safety and Performance," *International Journal of Automotive Technology*, vol. 25, no. 4, pp. 455–468, 2024.
6. R. Sharma and P. Verma, "IoT-Based Smart Driver Assistance System for Electric Vehicles," *International Journal of Advanced Research in Engineering and Technology*, vol. 15, no. 2, pp. 78–89, 2024.
7. M. Reddy and K. Srinivas, "Real-Time Vehicle Monitoring System using GPS and GSM Technology," *International Journal of Innovative Technology and Exploring Engineering*, vol. 13, no. 1, pp. 95–102, 2023.
8. A. Kumar, S. Gupta, and N. Singh, "Solar Assisted Smart Electric Vehicle for Sustainable Transportation," *International Journal of Renewable Energy Research*, vol. 14, no. 2, pp. 315–327, 2024.
9. H. Patel and R. Joshi, "Low-Cost ADAS Implementation for Electric Vehicles using Embedded Systems," *Journal of Embedded Systems and Applications*, vol. 18, no. 3, pp. 145–156, 2023.
10. S. Naik and P. Kulkarni, "Driver Drowsiness Detection System using Computer Vision Techniques," *International Journal of Computer Applications*, vol. 185, no. 7, pp. 20–27, 2023.
11. K. Raj and A. Mehta, "Smart Fleet Management System using IoT and GPS Tracking," *International Journal of Smart Vehicle Technologies*, vol. 9, no. 4, pp. 55–66, 2024.
12. D. Choudhary and M. Sharma, "Electric Vehicle Battery Monitoring and Safety System using IoT," *International Journal of Energy Systems*, vol. 11, no. 6, pp. 230–242, 2023.
13. R. S. Kumar and V. Balaji, "Integrated Camera Surveillance System for Smart Transportation," *International Journal of Transportation Engineering*, vol. 16, no. 2, pp. 112–124, 2024.
14. A. Bansal and K. Tiwari, "Real-Time Road Monitoring and Accident Prevention using AI-Based Vehicle Systems," *IEEE Access*, vol. 11, pp. 45120–45134, 2023.
15. S. Narayanan and P. Ravi, "Embedded Vehicle Safety System using Wireless Communication Modules," *Journal of Electronics and Communication Engineering*, vol. 21, no. 1, pp. 33–44, 2023.
16. P. Singh and V. Agarwal, "Energy Efficient Solar Charging Techniques for Electric Vehicles," *International Journal of Green Energy*, vol. 20, no. 5, pp. 401–413, 2024.
17. R. Kulkarni and M. Deshpande, "Design and Development of Smart Electric Vehicle Prototype," *International Journal of Mechanical and Production Engineering Research*, vol. 13, no. 4, pp. 65–78, 2023.
18. J. Thomas and A. Joseph, "Wireless Communication Architecture for Intelligent Transportation Systems," *Journal of Network and Computer Applications*, vol. 214, pp. 103622, 2023.
19. V. Krishnan and R. Iyer, "Vehicle Tracking and Monitoring using IoT and Cloud Integration," *International Journal of Cloud Computing and Services Science*, vol. 12, no. 3, pp. 189–201, 2024.

20. M. Arora and S. Kapoor, "Smart Surveillance and Monitoring System for Electric Vehicles," *International Journal of Image Processing and Vision Sciences*, vol. 14, no. 2, pp. 99–111, 2024.
21. A. Jain and P. Sinha, "Implementation of Driver Monitoring Systems using Deep Learning Techniques," *International Journal of Artificial Intelligence and Applications*, vol. 15, no. 1, pp. 25–39, 2024.
22. N. Patel and D. Shah, "Performance Analysis of Lithium-Ion Batteries in Electric Vehicles," *Journal of Energy Storage Systems*, vol. 18, no. 4, pp. 255–266, 2023.
23. S. Ghosh and T. Banerjee, "Real-Time Video Recording System for Vehicle Surveillance Applications," *International Journal of Multimedia Applications*, vol. 16, no. 2, pp. 145–158, 2024.
24. K. Sharma and A. Roy, "Advanced Vehicle Alert System using Sensor and Embedded Technologies," *International Journal of Sensor Networks*, vol. 19, no. 5, pp. 301–313, 2023.
25. M. Nair and P. Das, "Cloud-Based Smart Transportation Monitoring System," *International Journal of Intelligent Systems and Applications*, vol. 16, no. 3, pp. 75–88, 2024.
26. V. S. Rao and H. Prakash, "Electric Vehicle Safety Enhancement using Smart Monitoring Techniques," *International Journal of Vehicle Systems Modelling and Testing*, vol. 18, no. 1, pp. 50–64, 2024.
27. A. Saxena and P. Yadav, "Solar Powered Intelligent Electric Vehicle System for Urban Mobility," *Renewable Energy and Sustainable Development*, vol. 12, no. 2, pp. 140–153, 2024.
28. R. Menon and S. Pillai, "Integrated MDVR and GPS System for Public Transportation Safety," *International Journal of Transportation Safety*, vol. 9, no. 2, pp. 98–109, 2023.
29. K. R. Prasad and N. Venkatesh, "IoT-Based Driver Assistance and Alert System for Smart Vehicles," *International Journal of Internet of Things and Embedded Systems*, vol. 11, no. 3, pp. 210–224, 2024.
30. S. Chakraborty and A. Ghosh, "Design of Embedded Safety Systems for Low-Cost Electric Vehicles," *International Journal of Automotive Engineering and Technologies*, vol. 13, no. 4, pp. 188–201, 2024.
31. P. Ramesh and D. Kumar, "Artificial Intelligence Based Vehicle Monitoring and Assistance System," *Journal of Intelligent Transportation Technologies*, vol. 10, no. 2, pp. 115–128, 2024.
32. H. Verma and R. Gupta, "Development of Smart EV Platforms with Integrated Monitoring Systems," *International Journal of Smart Grid and Clean Energy*, vol. 13, no. 1, pp. 66–79, 2024.
33. T. Srinath and M. Kiran, "Implementation of Smart Camera Systems for Driver Safety Applications," *International Journal of Advanced Computer Science and Applications*, vol. 15, no. 2, pp. 320–332, 2024.
34. A. Mishra and P. Kulshrestha, "Renewable Energy Integration in Smart Electric Vehicles," *Journal of Sustainable Transportation Technologies*, vol. 8, no. 3, pp. 150–164, 2023.
35. N. Reddy and S. Kumar, "Low-Cost Intelligent Transportation System using IoT and Embedded Technology," *International Journal of Innovative Research in Technology*, vol. 11, no. 5, pp. 90–104, 2024.