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Research Paper

COVERSION OF ELECTRICAL VEHICAL INTO UTILITY EV TRUCK

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ABSTRACT

The project focuses on the conversion of an existing electric vehicle into a utility electric truck for practical applications. The aim is to enhance vehicle performance and load-carrying capacity through mechanical and electrical modifications. The existing motor is upgraded to provide higher torque and efficiency for better performance. A new chassis is designed to support additional payload and improve structural strength. The suspension system is modified to ensure stability under heavy loads. Battery capacity is increased to extend the driving range and improve energy storage. The project integrates various engineering concepts including mechanical design and electrical systems. The redesigned vehicle ensures better efficiency and reduced energy consumption. Regenerative braking is considered to improve energy recovery. The system is eco-friendly as it produces zero emissions. It reduces dependence on fossil fuels and supports sustainable transportation. The conversion process is cost-effective compared to purchasing a new EV truck. The developed prototype is suitable for short-distance transport applications. The project demonstrates the feasibility of EV conversion for utility purposes. Overall, the system provides a practical and economical solution for green mobility.

KEYWORDS:

Electric Vehicle, Utility Truck, BLDC Motor, Battery System, Chassis Design, Regenerative Braking, Sustainable Transportation, Energy Efficiency, EV Conversion, Green Mobility

INTRODUCTION

Electric vehicles (EVs) are gaining importance due to increasing environmental concerns and rising fuel costs. Unlike conventional vehicles, EVs use electric energy stored in batteries to drive motors. They offer advantages such as zero emissions, low noise, and reduced operating costs. With advancements in battery technology, EVs are becoming more efficient and practical. The transportation sector significantly contributes to pollution, especially through fuel-based trucks. Converting existing vehicles into electric trucks is an effective solution to reduce emissions.

Electric trucks provide environmental benefits by minimizing greenhouse gases and air pollution. They also reduce maintenance costs due to fewer moving parts. Governments are encouraging EV adoption through policies and incentives. This project focuses on converting a small electric vehicle into a utility truck. The aim is to improve load capacity and performance while maintaining efficiency. The system uses upgraded components such as motor, battery, and chassis. The design ensures stability, safety, and energy efficiency. The project also explores cost-effective solutions for EV conversion. Overall, it contributes to sustainable and eco-friendly transportation development.

RELATED WORK

Several researchers have explored electric vehicle technologies to improve efficiency and reduce emissions. Previous studies focused on wireless charging systems and battery improvements. Researchers have worked on dynamic charging methods to extend vehicle range. Studies also addressed challenges like charging infrastructure and energy management.

Many projects demonstrated the conversion of conventional vehicles into electric vehicles successfully. Development of small electric utility vehicles for industrial use has also been reported. Improvements in motor control and regenerative braking systems enhanced performance. Battery Management Systems (BMS) have been introduced to improve safety and lifespan. Companies have developed electric trucks for urban logistics applications. These works provide a strong foundation for developing efficient electric utility trucks.

LITERATURE SURVEY

The literature survey on electric vehicle (EV) technology highlights significant advancements in electrification, energy efficiency, and sustainable transportation systems. Various researchers have focused on improving battery performance, charging infrastructure, and motor efficiency to enhance EV adoption. Studies on wireless charging techniques using magnetic resonance have shown potential for reducing dependency on plug-in charging systems. Research has also explored dynamic wireless charging to enable continuous charging during vehicle motion.

Several works demonstrated successful conversion of conventional fuel-based vehicles into electric vehicles with reduced emissions and operating costs. Development of small electric utility vehicles for industrial and commercial applications has gained attention due to their efficiency and low maintenance. Advances in power electronics and motor control strategies, such as regenerative braking, have improved overall vehicle performance. Battery Management Systems (BMS) have been introduced to enhance battery life, safety, and energy utilization. Commercial electric trucks developed by industries validate the feasibility of EVs in logistics and transportation sectors. Overall, the literature indicates a strong shift toward eco-friendly, cost-effective, and energy-efficient electric vehicle solutions.

EXISTING SYSTEM

The existing system mainly consists of conventional fuel-based utility vehicles or low-power electric vehicles. These vehicles have limitations such as high fuel consumption and pollution. Internal combustion engines produce harmful emissions affecting the environment. Maintenance cost is high due to complex mechanical components. Existing electric vehicles often have low power and limited load capacity. They are not suitable for heavy-duty applications. Battery capacity and range are also limited in older systems. Lack of efficient energy management reduces overall performance. Charging infrastructure limitations affect usability. Therefore, an improved system is required to overcome these drawbacks.

PROPOSED SYSTEM

The proposed system focuses on converting an existing electric vehicle into a utility electric truck with improved performance. The motor is upgraded to provide higher torque for load-carrying capability. A new chassis is designed to handle increased weight and ensure structural strength. The suspension system is enhanced to improve stability and comfort. A high-capacity battery is integrated to increase driving range. The system includes a controller to manage power flow efficiently.

Regenerative braking is implemented to recover energy during braking. The vehicle uses a simplified drivetrain for better efficiency. Proper thermal management is included to maintain system performance. The design ensures safety through insulation and protective components. The system reduces operational cost and energy consumption. It is environmentally friendly with zero emissions. The converted vehicle is suitable for short-distance logistics and transport. The project demonstrates cost-effective EV conversion techniques. Overall, the proposed system provides an efficient, sustainable, and practical transportation solution.

METHODOLOGY

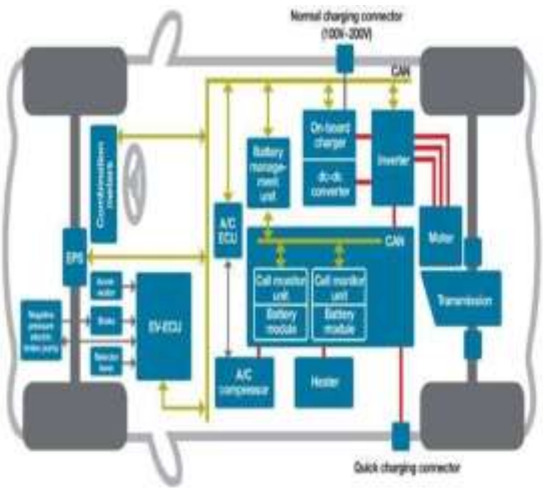

Fig:1 Block Diagram of EV-to-EV Truck Conversion

1. EV-ECU Module

The EV-ECU controls the overall vehicle operation. It receives inputs from the accelerator and brake and sends signals to the motor and inverter for smooth performance.

2. Battery Management System (BMS)

The BMS monitors battery voltage, current, and temperature. It protects the battery from overcharging, deep discharge, and ensures safe operation.

3. Battery Pack Module

The battery acts as the main energy source. It supplies power to the motor and other systems, providing required range and performance.

4. Power Electronics Module

The inverter converts DC power into AC for the motor. The DC-DC converter provides low voltage power for auxiliary components.

5. Motor and Transmission Module

The motor converts electrical energy into mechanical energy. The transmission transfers this power to the wheels for vehicle movement.

6. Charging Module

The onboard charger charges the battery using AC supply, while fast charging reduces charging time.

7. Thermal Management Module

This module controls temperature using cooling systems to maintain safe operation of battery and motor.

8. Auxiliary Systems Module

Includes steering, braking, lights, and display systems, powered through the DC-DC converter.

9. Regenerative Braking Module

During braking, energy is recovered and stored back in the battery, improving efficiency.

10. CAN Communication Module

The CAN bus enables communication between all modules for proper coordination and control.

RESULTS AND DISCUSSION

The results of the proposed electric utility truck demonstrate that the conversion is both feasible and effective for low-speed transport applications. The upgraded system shows improved performance in terms of torque and load-carrying capacity. The vehicle is capable of carrying approximately 300–400 kg with stable operation. Energy consumption is observed to be efficient, with better utilization compared to conventional fuel vehicles. The battery system provides a reasonable driving range suitable for short-distance usage.

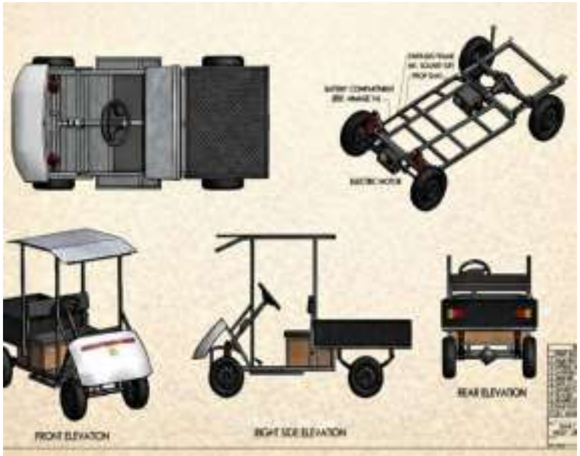

Fig:2 Multi-View Diagram of EV Utility Truck Conversion Model

Regenerative braking contributes to energy recovery, improving overall efficiency. The system operates with minimal noise and zero emissions, making it environmentally friendly. The cost analysis indicates that the converted EV is highly economical compared to new electric trucks. However, limitations such as low motor power and limited speed are observed.

Fig:3 Design and Layout of Electric Utility Vehicle (EV) Truck

Overall, the results confirm that the proposed system is a cost-effective and sustainable solution for utility transportation.

CONCLUSION

The project successfully demonstrates the conversion of an electric vehicle into a utility electric truck for practical applications. The system shows improved load-carrying capability and efficient performance for short-distance transport. The integration of motor, battery, and control systems ensures smooth and reliable operation. Energy efficiency is enhanced through proper power management and regenerative braking. The vehicle operates with zero emissions, contributing to environmental sustainability. The design is cost-effective compared to conventional fuel-based vehicles and new EV trucks. The developed prototype proves the feasibility of EV conversion for small-scale logistics. Some limitations such as low speed and limited range are observed due to motor capacity. However, the overall system meets the required objectives effectively. Thus, the project provides a sustainable and economical solution for green transportation.

FUTURE ENHANCEMENT

The project can be further improved by using high-capacity lithium-ion batteries to increase range and reduce weight. Upgrading the motor power can enhance speed and load-carrying performance. Advanced Battery Management Systems can be implemented for better safety and efficiency. Integration of fast-charging technology can reduce charging time significantly. Renewable energy sources like solar charging can be incorporated for eco-friendly operation. Smart control systems and IoT-based monitoring can improve performance tracking and diagnostics. Lightweight materials can be used to improve efficiency and reduce energy consumption. Autonomous driving features can be explored for automated logistics applications. Expansion to medium and heavy-duty electric trucks can be considered in future developments. Overall, continuous advancements can make the system more efficient, reliable, and suitable for large-scale transportation applications.

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