

E-Stand: An Assistive Main Stand for Effortless Motorcycle Lifting

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Abstract- Motorcycles are widely used for daily transportation; however, operating conventional main stands often requires considerable physical effort, particularly for heavy motorcycles and for riders with limited physical strength. This paper presents the design and development of an Electric Assistive Main Stand (E-Stand), an electromechanical mechanism that automates the process of lifting and parking a motorcycle. The proposed system incorporates a compact DC motor, planetary gear-rack transmission mechanism, lightweight alloy support legs, and an electronic control unit (ECU) integrated with safety sensors. Upon user activation through a handlebar-mounted switch or remote control, the motor-driven mechanism deploys the stand and lifts the motorcycle into a stable upright position. The system is powered by the vehicle's 12 V battery and includes safety features such as load sensing, limit switches, mechanical locking, and manual override operation. Experimental evaluation demonstrates that the E-Stand significantly reduces rider effort, improves parking convenience, and enhances operational safety. The developed mechanism offers a practical and user-friendly solution for elderly riders, women riders, and users of heavy motorcycles, contributing to improved accessibility and comfort in motorcycle operation.

Keywords: *Electric Main Stand, Motorcycle Parking System, Electromechanical Mechanism, DC Motor Actuation, Automated Stand System, Rider Assistance.*

I. INTRODUCTION

Motorcycles are among the most widely used modes of transportation because of their affordability, fuel efficiency, and ease of mobility. Despite these advantages, operating the conventional main stand remains a physically demanding task, especially for heavy motorcycles. The process requires considerable force and proper balancing of the vehicle, which can be difficult for elderly riders, women, and individuals with limited physical strength. Consequently, many users prefer the side stand, although it provides lower stability and may not be suitable for long-term parking or maintenance activities.

Recent advancements in electromechanical systems have enabled the development of rider-assistance technologies aimed at improving convenience and safety. In this context, the Electric Assistive Main Stand (E-Stand) is proposed as an automated solution to simplify motorcycle parking. The system employs an electric motor-driven mechanism that enables the main stand to be deployed and retracted through

a simple user command. By reducing manual effort and ensuring controlled operation, the E-Stand enhances rider comfort and accessibility.

The proposed system integrates mechanical, electrical, and control components to provide reliable and efficient stand operation. In addition to improving user convenience, the system contributes to safer parking by maintaining the motorcycle in a stable upright position. The project demonstrates the potential application of automation technology in two-wheelers to improve overall user experience.

II. LITERATURE SURVEY

- Several researchers have proposed mechanisms to reduce the effort required for operating motorcycle stands. Aakarsh B. S. (2018) developed an automatic center stand using a battery-powered linear actuator and DC motor system to improve parking convenience and stability. Nirmal Kumar Kushwaha (2015) investigated hydraulic, pneumatic, and electric actuation methods for automatic main stand operation and performed stress analysis to validate the design.
- Kiran Mukund (2018) designed an automated center stand incorporating hydraulic and electrical components and evaluated its structural performance using ANSYS analysis. Similarly, Piyush Choudhary (2020) proposed a pneumatic-assisted center stand capable of lifting high loads while reducing rider effort. These studies demonstrated the feasibility of automated stand systems for two-wheelers.
- Research has also been conducted on parking safety and stand mechanisms. Vivek Vishwakarma and Harshali Lunkad (2018) developed an adjustable parking stand for uneven surfaces, while P. Vijay et al. (2019) introduced an automatic side-stand retrieval system to prevent accidents caused by rider negligence. Ankitkumar K. Shriwas et al. (2017) focused on improving vehicle stability and ease of handling through an enhanced standing device design.
- The US Patent 3591202, "Motor Cycle Ride-Off Stand," proposed a parking stand that improved sidewise stability while keeping both wheels in contact with the ground. However, the design was unsuitable for parking on inclined surfaces due to unrestricted forward movement. Additional studies by Everett et al. highlighted the importance of safety measures in reducing transportation-related accidents, while Shin and Lee (1998) demonstrated the application of

intelligent design approaches in pneumatic systems.

5 Research Gap _ Most existing systems rely on hydraulic or pneumatic actuation, resulting in increased complexity, maintenance requirements, and higher manufacturing costs. Furthermore, many designs focus either on parking stability or rider convenience without integrating both aspects effectively. Therefore, there is a need for a compact, electrically actuated, reliable, and user-friendly main stand system capable of reducing rider effort while ensuring safe and stable motorcycle parking. The proposed E-Stand addresses these limitations through an integrated electromechanical design with automated operation and enhanced safety features.

III. PROBLEM STATEMENT

Conventional motorcycle main stands require significant physical effort to lift and stabilize the vehicle. This operation can be challenging for elderly riders, women, and users handling heavy motorcycles, often leading to improper parking practices and increased reliance on side stands. The manual operation of the stand may also cause discomfort, poor posture, and safety concerns during parking.

Therefore, there is a need for an electrically assisted main stand system that minimizes manual effort and enables safe, reliable, and convenient operation. The proposed E-Stand aims to automate the lifting and lowering process, improving rider comfort, accessibility, and parking stability.

IV. OBJECTIVES

3.1 Scope of the Project

The project focuses on the design and development of an electrically assisted main stand system capable of automatically lifting and lowering a motorcycle using a linear actuator and control unit. The scope includes mechanical design, actuator selection, electrical integration, control system development, mounting arrangement, and performance evaluation under varying load conditions. A functional prototype is developed and tested on a standard motorcycle frame. The system is limited to button-controlled operation and does not include IoT connectivity, mobile application control, or advanced self-balancing features.

3.2 Objectives

- To design an electrically actuated main stand mechanism for motorcycles.
- To reduce the physical effort required for parking operations.
- To improve safety and stability during motorcycle parking.
- To develop a simple and reliable control system for stand operation.
- To validate the performance of the system under different load conditions.

3.3 Need of the Project

- To reduce the high physical effort required to operate conventional main stands.
- To assist elderly riders, women, and users with limited physical strength.
- To improve vehicle stability during parking.
- To reduce dependence on side stands, which provide lower stability.
- To enhance user comfort during parking on uneven surfaces or with luggage.
- To modernize motorcycle systems using basic electromechanical automation.

3.4 Future Scope

- Integration of sensors for automatic ground detection and safer deployment.
- Development of smartphone-based control using Bluetooth or IoT.
- Use of high-efficiency actuators with improved load capacity and reduced power consumption.
- Addition of safety features such as overload protection, auto cutoff, and tilt sensing.
- Customization for different motorcycle models and electric two-wheelers.
- Optimization of design using lightweight materials for commercial applications.
- Integration with vehicle battery management systems for efficient power usage.
- Development of automatic modes such as self-lift or self-park systems.

3.5 Working Principle

The E-Stand operates on an electromechanical actuation system driven by a linear actuator. When the user activates the "Lift" command through a switch, electrical energy from the motorcycle battery is supplied to the actuator via a control relay circuit. The actuator extends and generates a linear force that lifts the motorcycle onto the main stand. Similarly, activation of the "Lower" command reverses the actuator motion, allowing controlled lowering of the vehicle.

Limit switches or position control mechanisms are used to prevent over-travel and ensure safe stopping at defined endpoints. The system thus converts electrical energy into controlled linear mechanical motion, enabling automatic operation of the motorcycle main stand with improved safety and reduced human effort.

V. METHODOLOGY

Conventional motorcycle main stands operate using a manual lever mechanism that requires considerable physical effort. Studies in vehicle ergonomics show that this task is difficult for elderly riders, women, and users handling heavy motorcycles, often leading to improper usage of side stands with lower stability.

Several assistive approaches have been explored, including hydraulic and pneumatic systems. However, these methods are generally bulky, costly, and unsuitable for direct integration into motorcycles. Hydraulic systems increase maintenance requirements, while pneumatic systems require external compressors, limiting practicality.

Electric actuators have emerged as a more feasible solution due to their compact size, low power consumption, and precise motion control. They are widely used in automotive applications such as seat adjustment and window systems, demonstrating reliability and ease of integration with electronic control units.

Despite these advancements, fully automated motorcycle main stand systems remain limited. Existing solutions do not offer a compact, cost-effective, and user-friendly design suitable for everyday use.

The proposed Electric Assistive Main Stand (E-Stand) addresses this gap by using a linear actuator-based mechanism to automate lifting and lowering operations, improving rider convenience, safety, and accessibility.

VI. SYSTEM DESIGN

Hardware Block Diagram: E-Stand System

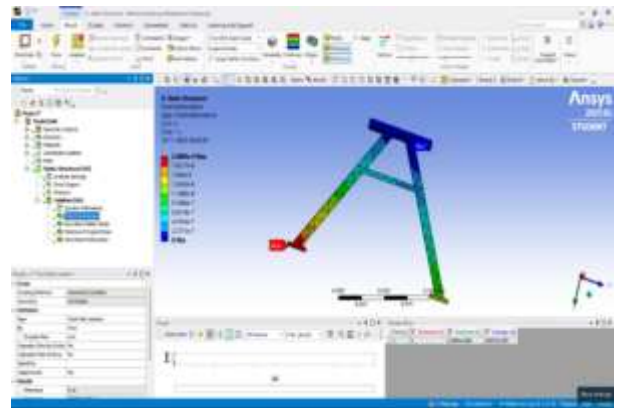
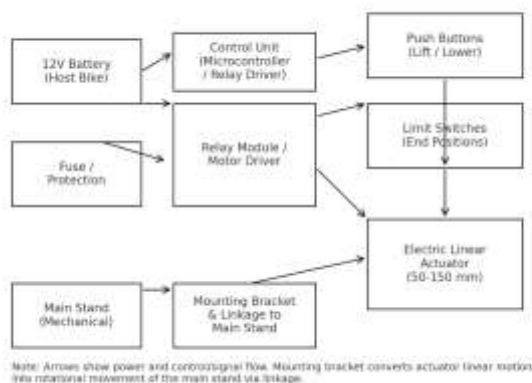


Fig . Actuator is closed

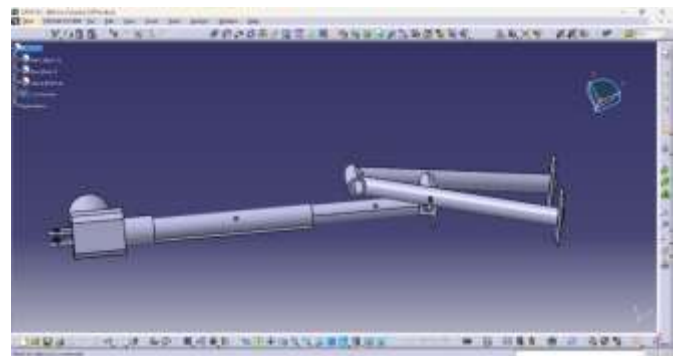


Fig. Actuator is opened

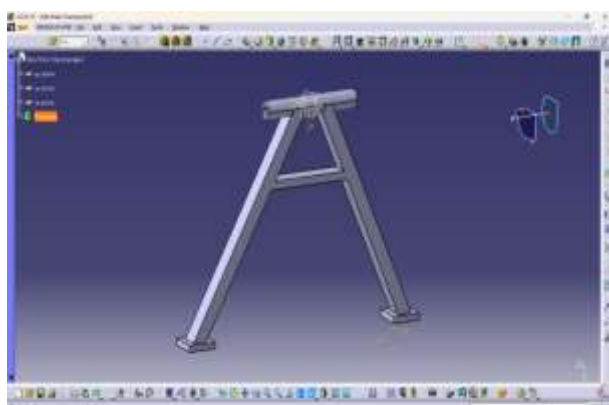


Fig. Actuator is attached to bike chassis

VII. MATERIALS REQUIRED

The development of the Electric Assistive Main Stand (E-Stand) requires a combination of mechanical, electrical, and supporting components to ensure reliable operation, structural stability, and user safety. The major materials and components used in the system are as follows:

1. Heavy-Duty Electric Linear Actuator (12 V DC)
 - Provides the linear force required for lifting and lowering the motorcycle.
 - Equipped with built-in limit switches and overload protection.
 - Compatible with the motorcycle's 12 V battery system.



2. Modified Motorcycle Main Stand
 - Fabricated using mild steel or alloy steel.
 - Reinforced to withstand actuator-induced loads.
 - Designed to maintain vehicle stability in the parked position.



4. 12 V Motorcycle Battery
 - Serves as the primary power source for the actuator and control circuit.
 - Provides sufficient electrical energy for stand operation.



6. DPDT Control Switch and Push Buttons
 - Used for forward and reverse operation of the actuator.
 - Provides user control for lift and lower functions.



The selected materials were chosen based on strength, durability, corrosion resistance, ease of fabrication, and compatibility with existing motorcycle systems.

VIII. FABRICATION PROCESS

The fabrication of the Electric Assistive Main Stand (E-Stand) involved the design, assembly, and testing of both mechanical and electrical components. Initially, the main stand and mounting arrangement were designed according to the motorcycle frame dimensions and load requirements. The existing stand was modified and reinforced using mild steel components to withstand operational loads.



Custom mounting brackets and linkage mechanisms were fabricated and installed to connect the linear actuator with the main stand. The 12 V DC linear actuator was then mounted securely and aligned for smooth operation. The electrical system, consisting of a DPDT switch, relay module, fuse protection, and wiring connections, was integrated with the motorcycle battery.



Finally, the complete assembly was tested for lifting performance, stability, and operational safety. Necessary adjustments were made, and all components were inspected to ensure reliable operation under practical conditions.



IX. CONCLUSION

The E-Stand: Assistive Main Stand for Effortless Motorcycle Lifting was successfully designed and developed to reduce the physical effort required for motorcycle parking. By utilizing a 12 V electric actuator and a simple control mechanism, the system enables smooth and convenient lifting and lowering of the motorcycle.

The developed prototype demonstrated reliable operation, improved parking stability, and enhanced user convenience. The system is particularly beneficial for elderly riders, women riders, and users handling heavy motorcycles. The results indicate that the proposed E-Stand is a practical, safe, and cost-effective solution for modern motorcycles, contributing to improved ergonomics and rider comfort.

X. REFERENCES

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