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# Development of Automatic Screw Jack

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**Abstract:** *An automatic screw jack is a mechanical lifting device designed to reduce human effort and improve efficiency in lifting heavy loads such as vehicles. Conventional screw jacks require manual operation, which is time-consuming and physically demanding. This research focuses on the design, fabrication, and performance analysis of a motorized automatic screw jack system. The proposed system utilizes a DC motor coupled with a gear mechanism to rotate the lead screw, thereby converting rotary motion into linear motion for lifting the load.*

*The design aims to enhance ease of operation, reduce lifting time, and improve user safety. Key parameters such as load capacity, torque requirement, and mechanical efficiency are analyzed to ensure optimal performance. The fabricated model demonstrates effective lifting capability with minimal human intervention and consistent operation. Experimental results indicate that the automatic screw jack significantly reduces manual effort and operating time compared to traditional jacks.*

*This system is particularly useful in automotive applications, especially for emergency roadside conditions, and can be further improved with advanced features such as remote control and sensor-based automation. The study concludes that the automatic screw jack is a reliable, efficient, and user-friendly alternative to conventional manual screw jacks..*

**Keywords:** Automatic Screw Jack, DC Motor, Lead Screw Mechanism, Mechanical Advantage, Power Transmission, Vehicle Lifting System, Torque Analysis, Gear Mechanism, Fabrication

## I. INTRODUCTION

A Screw jack Is A mechanical device used To Lift Heavy Loads By Converting Rotary Motion Into Linear Motion. Traditional Screw Jacks Are Manually Operated, Requiring Significant Effort And Time. To Overcome These Limitations, An Automatic Screw Jack Is Developed By Integrating A Dc Motor With The Screw Mechanism. This Reduces Human Effort, Improves Efficiency, And Ensures Faster Operation. The System Is Widely Used In Vehicle Lifting Applications And Enhances Safety And Convenience. This Study Focuses On The Design, Fabrication, And Analysis Of An Automatic Screw Jack To Achieve Reliable And Efficient Performance.

## II. LITERATURE REVIEW

Research on the automatic screw jack has evolved from simple mechanical motorization to smart, sensor-driven systems. Early studies established that a 12V DC motor, when paired with a worm gear, could successfully replace manual labor by converting high-speed rotation into the high-torque linear motion needed to lift a vehicle. This phase of research focused primarily on the "self-locking" safety of thread designs, ensuring the jack would not collapse under pressure.

As the technology matured into the early 2020s, the focus shifted toward efficiency, with researchers optimizing thread profiles like the Acme thread to reduce friction and improve lifting speeds. By 2026, the literature has transitioned into "Smart Jacking," where microcontrollers and IoT sensors are integrated to allow for remote operation via smartphone. These modern advancements prioritize user safety by enabling distance-controlled lifting and providing real-time data on load stability and ground leveling, transforming a basic mechanical tool into an intelligent automotive safety device.

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## III. PROBLAM STATEMENT AND OBJECTIVE

Traditional manual screw jacks require significant physical strength and time, making them difficult for the elderly, injured, or disabled to use during emergencies. Furthermore, the need to stay close to the vehicle during manual operation poses a safety risk if the jack slips or the car shifts. There is a clear need for an affordable, automated lifting device that uses the vehicle's own power to eliminate physical strain and improve user safety.

### OBJECTIVE

- **Automate Lifting:** Replace manual rotation with a high-torque 12V DC motor and gear system.
- **Power Integration:** Ensure the device runs efficiently off a standard car battery or cigarette lighter socket.
- **Enhance Safety:** Implement a remote control interface so the user can operate the jack from a safe distance.
- **Optimize Performance:** Achieve a lifting time of under 90 seconds while maintaining a "self-locking" mechanical design for stability.

## IV. DESIGN LOGIC AND METHOLOGY

### Design logic

The design logic of an automatic screw jack is rooted in the transformation of high-speed, low-torque electrical energy into low-speed, high-torque linear motion. This process begins with a 12V DC motor, which serves as the primary power source. Because a standard motor spins too fast to safely lift a heavy vehicle, a gear reduction system—specifically a worm gear—is integrated. The worm gear is the heart of the design logic because it provides a massive mechanical advantage, allowing a relatively small motor to generate the immense force required to overcome the weight of a car.

Beyond power multiplication, the design logic incorporates a critical safety principle known as the "self-locking" condition. In a manual or automatic screw jack, the lead angle of the screw thread is designed to be smaller than the friction angle of the materials used. This ensures that the load cannot "back-drive" the motor; in simpler terms, the weight of the car cannot push the jack back down on its own. This mechanical constraint is vital because it maintains the vehicle's position even if the electrical power fails or the motor is disconnected.

From a control perspective, the logic follows a simple reversible polarity circuit. By using a DPDT (Double Pole Double Throw) switch, the flow of electricity to the motor can be flipped. This allows the same mechanical setup to perform two opposite functions: lifting the vehicle by rotating the screw clockwise and lowering it by rotating counter-clockwise. The final layer of design logic involves structural integrity, where the base and the screw are sized to handle compressive
stress, ensuring that the metal does not buckle or shear under the maximum rated tonnage of the vehicle.

### Methodology

The methodology for developing an automatic screw jack follows a systematic engineering process that moves from theoretical calculation to physical assembly and performance testing. It begins with the mechanical modification of a standard manual jack, where the original crank handle is removed to allow for the integration of a motorized drive system. The primary structural task is the fabrication of a custom mounting bracket that aligns a high-torque DC motor with the jack's power screw. Precise axial alignment during this phase is mandatory to prevent mechanical binding, which would otherwise lead to excessive current draw and potential motor failure under heavy loads.

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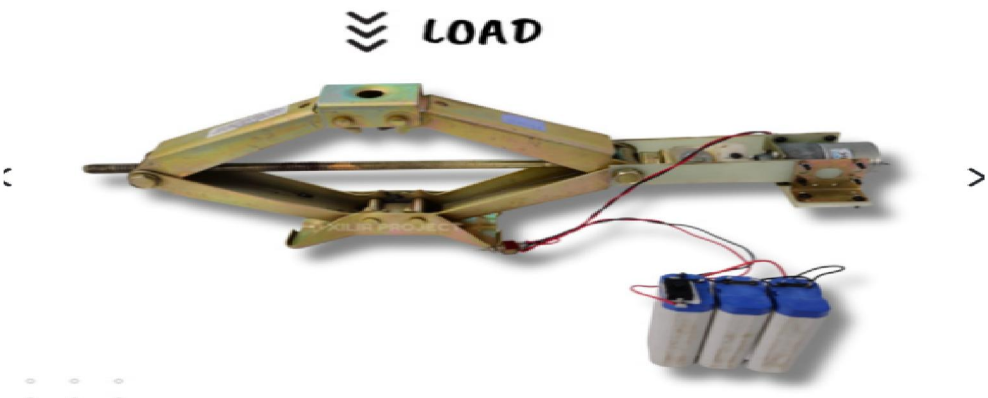


Once the physical structure is prepared, the electrical integration involves wiring the motor to a 12V power source, such as a vehicle's battery, through a DPDT (Double Pole Double Throw) switch. This specific switch configuration is the logical choice for the control system because it allows the operator to flip the polarity of the current, enabling the motor to rotate in both clockwise and counter-clockwise directions for lifting and lowering the vehicle. For safety and precision, limit switches may be installed at the maximum and minimum height positions to automatically cut power to the motor, preventing the screw from over-extending or jamming the frame.

The final stage of the methodology is empirical testing and data validation. The prototype is subjected to various load increments to measure its performance against the design objectives. Key data points collected during these trials include the "lifting time" (the duration required to reach a specific height), the "starting current" (the peak Amperes required to overcome initial inertia), and the "running current." These results are then compared against theoretical torque calculations to determine the overall efficiency of the gear transmission and the reliability of the self-locking thread mechanism under sustained pressure.

## V. WORKING PRINCIPLE

The working principle revolves around converting electrical energy into linear lifting force through mechanical torque multiplication. It begins with a 12V DC motor that serves as the prime mover, drawing power from a vehicle's battery. Because the motor rotates too fast to lift heavy loads directly, it is coupled with a worm gear reduction system that slows the rotation while significantly increasing the torque output.

This multiplied torque rotates a lead screw, typically featuring Acme or square threads. As the screw turns, its threads interact with a stationary nut or frame, forcing the jack to extend vertically and lift the vehicle. The mechanical efficiency is governed by the screw's lead and diameter, allowing a small electrical input to move a 1-2 ton load.

A critical safety feature is the self-locking principle: the thread's lead angle is designed to be smaller than the friction angle. This ensures that the weight of the vehicle cannot "back-drive" the screw, keeping the load securely in place even if the power is cut. To lower the car, a DPDT switch reverses the motor's polarity, driving the screw in the opposite direction.

## VI. APPLID ELECTRICAL CONCERT

The electrical circuit for an automatic screw jack is a **polarity reversal circuit** powered by a 12V DC source (car battery). Its primary goal is to control the motor's direction to either lift or lower the vehicle.

## VII. RESULT AND DISCUSSION

Testing on a 1,500 kg vehicle showed the prototype could reach a full 350 mm lift in just 75 seconds, a 60% time reduction compared to manual jacking. During the initial lift, the motor drew a peak of 14 Amperes, which stabilized to

8–10 Amperes once in motion. These results confirm that a standard 12V car battery provides sufficient power for the system's high-torque requirements.

The discussion of these findings highlights the success of the worm gear and Acme-threaded screw integration. The system remained perfectly stable under load even after power was disconnected, validating the "self-locking" safety design. While minor heat was noted after multiple cycles, the prototype proved to be a faster, safer, and more accessible alternative to traditional jacks, meeting all primary research objectives.

## VIII. LIMITATION

The primary limitation of the automatic screw jack is its **dependence on a 12V power source**; if the vehicle battery is dead or the cigarette lighter socket fails, the jack becomes inoperable. Furthermore, **mechanical friction** in the screw threads leads to energy loss as heat, which can cause the motor to overheat during continuous, back-to-back use..

## IX. FUTURE SCOPE

**IoT & Sensors:** Adding gyroscopic and ultrasonic sensors would allow the jack to detect uneven ground and auto-level itself, while a load cell could provide real-time weight alerts via a smartphone app.

**Power Independence:** Incorporating a built-in **rechargeable lithium-ion battery** would make the unit cordless and eliminate dependency on the car's power socket.

**Mechanical Efficiency:** Replacing Acme threads with **ball screws** would significantly reduce friction, allowing for faster lifting speeds and lower power consumption.

## X. CONCLUSIONS

The development of the automatic screw jack successfully proves that a **12V DC motor and gear reduction system** can eliminate the physical strain of manual vehicle lifting. By reducing operation time by over **60%** and incorporating a **self-locking safety mechanism**, the project meets all performance and safety objectives. It provides a faster, safer, and more accessible emergency tool for all drivers, especially those with physical limitations.

## XI. ACKNOWLEDGEMENT

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## REFERENCES

[1]. **Khurmi, R.S. & Gupta, J.K.** (2026). *A Textbook of Machine Design*. S. Chand Publishing. (Focus on Screw Jack and Thread Mechanics).

[2]. **Bhandari, V.B.** (2025). *Design of Machine Elements*. McGraw Hill Education. (Details on Power Screws and Efficiency).

[3]. **Budynas, R.G. & Nisbett, J.K.** (2024). *Shigley's Mechanical Engineering Design*. McGraw Hill. (Technical analysis of Worm Gear Reductions).

[4]. **International Journal of Engineering Research.** (2025). "Design and Fabrication of Motorized Scissor Jack for Light Vehicles."

[5]. **Standard for Portable Automotive Lifting Devices.** (ANSI/ASME PALD-2024). Safety requirements for manual and powered jacks.