Fabrication of Ackerman Steering Mechanism in four wheel drive

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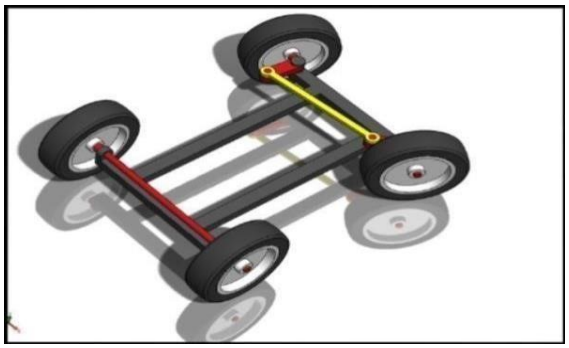
***Abstract*—This paper presents the fabrication of a Four-Wheel Drive (4WD) system equipped with a modified steering mechanism, modifying the conventional ackerman steering mechanism . The primary goal of this work is to optimize vehicle handling, stability, and tire wear across different driving conditions. The integration of AntiAckermann geometry aims to reduce tire scrubbing during tight turns, improve cornering stability, and increase the overall performance of the vehicle. The paper covers the theoretical background, design process, , fabrication of the prototype.**

I. INTRODUCTION

In automotive engineering, steering mechanisms play a crucial role in the stability, handling, and overall performance of vehicles. Traditionally, the Ackerman steering mechanism has been employed in most vehicles to ensure that the inner wheel of a turn follows a smaller radius than the outer wheel, reducing tire wear and improving maneuverability. However, in high-performance and off-road vehicles, modifications such as Anti-Ackerman steering are being explored to optimize vehicle handling in specific conditions. This paper examines both systems in a Four-Wheel Drive (4WD) configuration.

Fabrication of the 4WD Prototype:

1.1 Chassis Design
The vehicle chassis is designed using lightweight steel alloys to balance strength and weight. The chassis incorporates the following key components: Reinforced suspension mounts to support the higher forces generated by the Anti-Ackermann system.A modular frame for easy integration of different drive train and suspension systems. Steering Mechanism Fabrication:



1.2Anti Ackerman Steering: The Steering system is that the key interface between The driving force and also the vehicle. Steering system Is a mechanism want to management the trail followed By the vehicle. The operation of the Steering system is To turn the front wheels whenever driver offers the Inputs so as to produce all directional control of the Vehicle. The particular angles of steering are modified By the geometry of the suspension, reactions of Powertrain and the steering system geometry if the Vehicle is front wheel drive.The rack and pinion system is wide employed in the Passenger thanks to the benefits sorts of an easier style And better suitability of the front wheel drive system .And adaptability to vehicles without frames. The Gearbox is the main element or we are able to say the First suggests that for the numerical reduction between .

1.3 COMPONENTS:

1.Battery::
A Lithium-Ion (Li-ion) battery is a type of rechargeable battery that uses lithium ions to move between the anode and cathode during charging and discharging cycles. This process generates the electrical energy needed to power devices.Li-ion batteries are popular due to their lightweight, compact, and efficient energy storage capabilities, which make them suitable for a variety of applications.

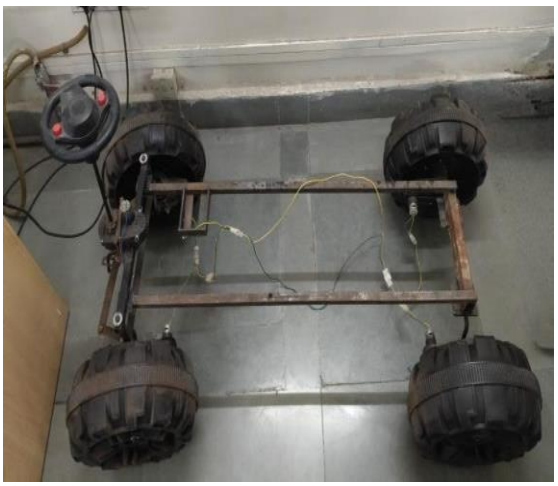
2.Wheel::

Plastic wheels are the most prevalent choice for a vast majority of toy cars, especially in the budgetfriendly and mass-produced categories. Their use is driven by a combination of manufacturing ease, costeffectiveness, and suitability for the intended play scenarios. Here's a detailed description of their characteristics and implications

3.Servo Motor (Steering Actuator)
Purpose: To control the steering angle based on user inputs or control signals.
Description: A servo motor is used to actuate the steering system. It receives electrical signals from the control system, which determines how far the steering wheels should turn.

4.Axles and Suspension System
Axles
Purpose: To transmit power from the drivetrain to the wheels.
Description: The front and rear axles are responsible for connecting the wheels to the chassis and allowing them to rotate. In a 4WD system, these axles must be strong enough to handle torque from all four wheels.
Material: Typically made of steel or aluminum for durability.

5..Four-Bar Linkage Mechanism
The core of the steering system, this mechanism consists of four bars (rigid links) connected by rotating joints. These bars work together to control the angles at which the wheels turn, enabling the desired AntiAckermann geometry.
Input Link: Typically connected to the steering wheel or servo motor. It controls the motion of the other links.



II. RESULTS

Turning Radius: The vehicle demonstrated a larger turning radius at low speeds but showed significant improvement in high-speed stability and cornering performance compared to traditional Ackermann systems.

Handling: The Anti-Ackermann geometry significantly improved handling during sharp turns at high speeds and on uneven surfaces, as the outer wheels followed a more optimal turning path.
Off-Road Performance: The vehicle exhibited superior off-road handling, with increased traction and stability, particularly on rugged terrain.

III. CONCLUSION

This paper successfully demonstrates the design, kinematic analysis, and fabrication of a Four-Wheel Drive system utilizing Anti-Ackermann steering. The prototype exhibited enhanced handling, stability, and traction in both high-speed and off-road conditions. Although there are trade-offs in terms of maneuverability at low speeds, the Anti-Ackermann system is well-suited for vehicles that require superior cornering capabilities and off-road performance.

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