Report on Report on the Project: Motorized Smart Turning Mechanism

Project Title:

Motorized Smart Turning Mechanism

Team Members:

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Guide:

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Introduction:

In the realm of transportation, the maneuverability of long vehicles like trucks, trailers, and long AC buses poses significant challenges, particularly during turns. The length and multiple connected segments of these vehicles make tight turns difficult, often resulting in large turning radii and inefficient road usage. This project addresses the issue by proposing a **Motorized Smart Turning Mechanism** that uses a single motor to enable coordinated turning of the entire vehicle, ensuring that the trailing carts follow the exact path of the main cart.

Objective:

The main objective of the project was to design and develop a smartly engineered turning mechanism that could synchronize the movement of connected vehicle carts. The system needed to be efficient, smooth, and ensure that the trailing carts adhered to the main vehicle's path during turns. The project aimed to solve the problem of long vehicle maneuverability in tight spaces.

Working Mechanism:

The system consists of a motorized cart frame connected to another frame via a set of interlinked connecting rods. The forward frame is fitted with two motors: one for driving the vehicle and another for turning it. As the turning motor rotates the main cart, the interlinked rods involuntarily turn the trailing cart frame, aligning it with the main vehicle's motion. This mechanism ensures that the entire vehicle, including the trailing parts, follows the same path as the main cart without requiring individual controls for each section. The design allows the vehicle to behave as if it were following an invisible track, ensuring smooth and efficient movement.

Methodology:

1. **Design Phase**: The project team designed the mechanism by analyzing the movement of long vehicles and how connected frames could be synchronized.
2. **Prototype Development**: A functional prototype was built using motorized frames, connecting rods, and a turning motor. The system was designed to work with a single motor driving both the vehicle’s motion and its turning ability.
3. **Testing & Evaluation**: The prototype was tested under various scenarios to ensure that the trailing cart followed the main vehicle's exact path, and its ability to maneuver through tight turns was assessed.

Results:

The project successfully demonstrated a working prototype of the **Motorized Smart Turning Mechanism**. The system was able to reduce the turning radius significantly while ensuring that the trailing carts followed the main vehicle's path with high accuracy. The turning mechanism worked smoothly under different conditions, showing potential for real-world application in improving the maneuverability of long vehicles.

Conclusion:

The project successfully achieved its goal of developing a smart turning mechanism for long vehicles. The system was efficient and required only one motor to control the entire vehicle's motion, demonstrating a high level of synchronization between the main and trailing carts. This solution has the potential to improve maneuverability, reduce road space requirements during turning, and enhance the overall efficiency of long vehicles like trucks and trailers.

Learning Outcomes (Based on Bloom’s Taxonomy) and CO-PO Mapping

1. Knowledge (Remembering) – CO1, PO1

- The students gained fundamental knowledge of mechanical systems, particularly focusing on interlinked turning mechanisms in long vehicles. They were able to recall and apply key concepts such as motorized cart systems, gear mechanisms, and automated path-following technology.

Example Outcome: Students recalled the role of motors in vehicle steering and successfully applied their knowledge to design the turning mechanism.

2. Comprehension (Understanding) – CO2, PO2

- The team demonstrated understanding of how the interlinked turning mechanism works. They understood the principles of synchronized motion and applied it to design a system where the trailing carts of a vehicle follow the exact path of the main cart.

Example Outcome: Students were able to explain how the turning motor's rotation influences the entire vehicle's alignment to ensure smooth and accurate movement.

3. Application (Applying) – CO3, PO3

- The team applied theoretical knowledge to the real-world problem of improving turning in long vehicles. They developed a working prototype that demonstrated how a single motor can power both the driving and turning functions.

Example Outcome: A functional prototype was built, with motors driving the front frame and the turning mechanism ensuring the trailing carts followed the same path.

4. Analysis (Analyzing) – CO4, PO4

- The project required analyzing the relationship between the movement of the forward cart and the trailing carts. The team identified the mechanical challenges that arise when turning large vehicles and broke down the mechanism to solve the problem through interlinked turning.

Example Outcome: Students analyzed the dynamics of connected vehicle frames and solved synchronization issues to ensure that the trailing carts-maintained alignment during turns.

5. Synthesis (Creating) – CO5, PO5

- The team successfully designed and synthesized a new turning mechanism that integrates multiple motors with connecting rods to achieve coordinated motion between connected vehicle frames.

Example Outcome: The students designed a system with a motorized frame and connecting rods that involuntarily align the trailing carts with the lead cart, ensuring efficient turning for long vehicles.

6. Evaluation (Evaluating) – CO6, PO6

- The final evaluation involved testing the prototype under real-world conditions and evaluating its efficiency in comparison to traditional systems. The students compared the performance metrics of their design and justified its advantages.

Example Outcome: The team evaluated their system's ability to reduce the turning radius and improve vehicle maneuverability in tight spaces, validating the success of the project.

Mapping with Course Outcomes (COs) and Program Outcomes (POs):

1. **CO1**: Apply knowledge of mechanical engineering principles in the design of motorized systems.
   - **PO1**: Engineering Knowledge.
2. **CO2**: Demonstrate understanding of the mechanical behavior of linked vehicle frames.
   - **PO2**: Problem Analysis.
3. **CO3**: Apply theoretical concepts to design a working prototype for a motorized turning mechanism.
   - **PO3**: Design/Development of Solutions.
4. **CO4**: Analyze the interaction between vehicle components for synchronized turning.
   - **PO4**: Investigation.
5. **CO5**: Develop and integrate a motorized mechanism using available resources.
   - **PO5**: Modern Tool Usage.
6. **CO6**: Evaluate the efficiency and practicality of the designed turning mechanism.
   - **PO6**: Engineering Practices.

Picture of the Project: