Motorized Smart Steering Mechanism

Prof. Jugal Jagtap[1],

Rasalkar Awais Azim[2], Gupta Abhishek Rajkumar [2], Shah Kunal Rakesh[2], Shaikh Mohd Ahmed Liyakat Ali[2]

Asst. Professor[1]
Student[2]

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ABSTRACT – Production automobiles very never oversteer; instead, they are built to understeer. A car that could automatically correct for understeer or oversteer would provide the driver with almost neutral steering in a variety of driving situations. The implementation of four-wheel steering is a significant endeavor by automobile design experts to achieve almost neutral steering. Driving would be extremely difficult in scenarios like low-speed maneuvering, parking, and driving in crowded cities with limited space because of the vehicle's bigger wheelbase and track width. Thus, a mechanism that produces a smaller turning radius is needed, and a four-wheel steering mechanism can do this.

This project's primary goal is to make the back wheels rotate counterclockwise to the front wheels. To do this, a clever mechanism was created that has an interrelated turning mechanism that powers the turning of the entire vehicle and all of its trailing carts using a single engine, ensuring that the trailing cart travels precisely the same path as the main cart. The ability of the prototype to corner was evaluated. It facilitates tighter bends and better handling for the car. The turning radius is reduced with the use of this system. The suggested design has significantly increased the car's performance.

Keywords: Arduino, Bluetooth, D.C. motor, frame, linkage, battery, and servo motor

1.INTRODUCTION

Here, we suggest a cleverly created turning system that enables smooth turning in big, networked vehic les like trucks, trailers, and lengthy airconditioned buses. The system has an interconnected turning m echanism that powers the turning of the whole vehi cle and all of its trailing carts using a single motor, allowing the trailing cart to follow the main cart's i dentical course. A motorized cart frame is joined to another frame via a system of interconnected . connecting rods to form the mechanism. Twowheel driving motors and a turning motor are installed on the forward frame. The turning motor automatically spins the trailing kart frame to match the motion of thevehicle frame and guarantee that it travels along the same path. The vehicle moves smoothly on roadways as though it were following a track since the driving motors are employed to propel the front.

2. LITERATURE SURVEY

A turning mechanism is a system that certain vehicles use to reduce turning radius at low speeds, boost vehicle stability when cornering at high speeds, or improve turning responsiveness. Actuators and a computer control the rear wheels of the majority of active four-wheel steering systems. Generally speaking, the front wheels may turn farther than the rear wheels. Certain systems allow the back wheels to be steered in the opposite direction from the front wheels at low speeds. Examples of these systems are Honda's Prelude series and Delphi's Quadra steer. This enables the car to turn in a much smaller radius, which is frequently necessary for big trucks or cars pulling trailers.

With the weight of automobiles increasing and their conversion to front-wheel drive, turning the steering wheel by hand has frequently gotten more difficult to the point where it requires significant physical effort. Automakers have created power steering systems to help with this. Power steering systems come in two varieties: hydraulic and electric/electronic. It is also feasible to have a hybrid hydraulic-electric system. Instead, our solution uses a servo motor to power the motorized turning mechanism, which effectively turns the vehicle's cart.

3. WORKING PRINCIPLE

Cart, linkage, servo motor, DC motor, Arduino, Bluetooth, and battery make up the project. This clever mechanism has an interconnected turning mechanism that powers the turning of the whole vehicle and all of its trailing carts with a single motor, ensuring that the trailing cart travels precisely the same path as the main cart. A motorized cart frame is joined to another frame via a system of interconnected connecting rods to form the mechanism. Two-wheel driving motors and a turning motor are installed on the forward frame. The trailing kart frame is involuntarily rotated by the servo motor when it rotates the vehicle frame, ensuring that it follows the same path and aligns with the motion. To control the servo motor, a smartphone and Bluetooth connection are made.

The vehicle moves smoothly on roadways as though it were following a track since the driving motors are employed to propel the front kart.

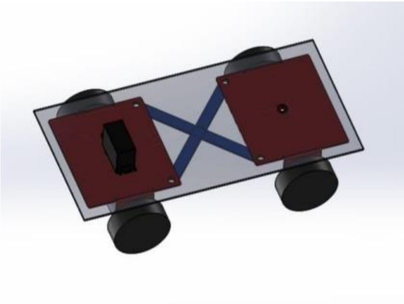

Fig. 1. 3-D Solidworks Model

4. COMPONENTS

A. Base Plate and Frames

Four frames that are affixed vertically to the base plate make up the model. Mild steel is used to make both the frames and the base plate. Mild steel is a lightweight, pliable metal that can have a dull gray or silvery look depending on how rough the surface is. It does not readily ignite and is nonmagnetic. New mild steel films are good reflectors of visible light (around 92%) and outstanding reflectors of medium and far-infrared radiation (up to 98%). Mild steel has a yield strength of 7–11 MPa, but the yield strengths of aluminum alloys range from 200 MPa to 600 MPa. The density and rigidity of mild steel are around one-third that of steel. It is simple to extrude, sketch, cast, and machine. The structure of mild steel is a face-centered cubic (fcc) arrangement of atoms. The stacking-fault energy of mild steel is about 200 mJ/m2. With only 30% of copper's density, mild steel has 59% of copper's electrical and thermal conductivity, making it a good thermal and electrical conductor.

Fig. 2. Base Plate and Frames

B. Linkages

Connectivity An arrangement of bodies joined together to control forces and motion is called a mechanical linkage. Geometry is used to study the movement of a body, or link, and as a result, the link is thought to be stiff. Joints are the connections between links that are depicted as offering perfect mobility, such as pure rotation or sliding. A kinematic chain is a linkage that is represented as a network of perfect joints and stiff links. Open chains, closed chains, or a mix of open and closed chains can be used to create links. A joint connects each link in a chain to one or more other links.

As a result, a kinematic chain can be represented as a linkage graph, which is a network with joints acting as vertices and links acting as pathways. Generally speaking, the movement of an ideal joint corresponds to a subgroup of the Euclidean displacement group. The degrees of freedom (DOF) of the joint is the number of parameters in the subgroup. Typically, mechanical connections are made to convert an input force and movement into an output force and movement that is desired. The mechanical advantage of the linkage is defined as the ratio of the output force to the input force, and the speed ratio is defined as the ratio of the input speed to the output speed. In a perfect linkage, the speed ratio and mechanical advantage are defined to generate the same number.

C. D.C Motor

Motor Each wheel on this vehicle has a single DC motor that allows it to travel forward and backward. The motor being used has a 12 V specification and runs at 60 rpm. A DC motor rotates in a clockwise direction when power is supplied from a battery, and in an anticlockwise direction when power is supplied in the opposite way. which will cause the car to travel forward and backward. Electrical energy is converted into mechanical energy by an electric motor. Simple electromagnetism underpins the operation of every electric motor.

When a current-carrying conductor is exposed to an external magnetic field, it produces a magnetic field that is proportional to both the strength of the external magnetic field and the current in the conductor. Like polarities (North and South, South and South) repel, while opposite polarities (North and South) attract, as you are well know from your childhood experiences with magnets. A DC motor's internal structure is intended to use the magnetic interaction between an external magnetic field and a current-carrying conductor to produce rotational motion.

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Fig. 3. D.C Motor

D. Battery

One of the crucial components of this process is the battery. This has an electric line connecting it to a DC motor. In order for the vehicle to travel forward and backward, it stores electrical energy and supplies it to the DC motor. Through electrochemical discharge reactions, batteries transform chemical energy into electrical energy. One or more cells, each with a positive electrode, negative electrode, separator, and electrolyte, make up a battery. Primary and secondary are the two main classes into which cells can be classified. Once the reactants are exhausted, primary cells cannot be recharged and must be replaced. Reactants in secondary cells must be recharged using a DC charging source to return to their fully charged condition.

Fig. 4. Battery

E. Servo Motor

Servo Motor In reality, a servo motor is a combination of four components: a gear reduction unit, a control circuit, a position-sensing device, and a standard DC motor. A gear mechanism attached to the DC motor transmits feedback to a position sensor.

Fig. 5. Servo Motor

F. Arduino-UNO

This microcontroller board, which is based on the Atmega328, was created by Arduino. cc. Microcontrollers are a common component of embedded systems, enabling gadgets to function in accordance with our specifications. The Arduino Uno, which has an Atmega328 microprocessor, 14 digital I/O pins, 6 analog pins, and a USB interface, is a very useful addition to the electronics world. Using the Tx and Rx pins, serial communication is also supported. This project uses an Arduino UNO to control a servo motor. Arduino is used to control the servo motor's direction.

Fig. 6 Arduino-UNO

G. Bluetooth

Bluetooth is a wireless technology standard that allows the creation of personal area networks (PANs) and the exchange of data over short distances between fixed and mobile devices using short-wavelength UHF radio waves in the industrial, scientific, and medical radio bands, from 2.400 to 2.485 GHz. To regulate motion and direction, this project uses Bluetooth to connect to a mobile device.

Fig. 7. Bluetooth

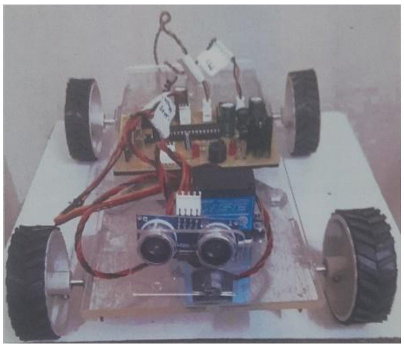

Fig 8. Actual Picture of the Project

5. ADVANTAGE AND APPLICATION

A. Advantages

1. Simple to Turn
2. Turning Long Vehicles Efficiently
3. Boost the stability of the car
4. Reduce the turning radius when moving slowly
5. Better handling and assistance with tighter turns.

B. Application

1. Utilization Parallel parking: The car can be readily parked and unparked towards either the right or left side because of the decreased turning radius
2. High-speed lane switching: This involves less steering sensitivity and demands the driver to pay close attention as they must assess the distance and the cars in front of them.
3. Slippery road surfaces: When rear wheel steering operates on low friction surfaces, direction control of the vehicle is made easier.
4. Narrow Roads: Counter-phase steering minimizes the turning radius on narrow roads with sharp bends because of rear-wheel steering.
5. U-Turns: These maneuvers can be executed on narrow roadways by reducing the vehicle's turning radius and counter-phasing the rear wheels.

6. CONCLUSIONS

Our suggested method demonstrated efficiency in terms of turning without slip and speed accuracy when compared to our base paper. This technique works well even on tracks with incline or decline in slope. Autonomous vehicles with GPS systems are anticipated to be the next big thing in automotive technology. Thus, this clever turning mechanism will be useful due to its strong line following. Wireless protocol is intended to be used for car-to-car communication, which will significantly reduce the risk of collisions and allow vehicles to share relative information about one another, aiding in traffic control.

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