Multi Utility Steering Vehicle

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Abstract: In the automobile industry there is an enormous development of technology which reduces the effort of man and increases the comfort in driving. But as per the present situations, we face a lot of problems with our vehicles and at the same time, enormous pollution levels are increased by using fossil fuels. The main motto of our project is to overcome the present problems by introducing a new mechanism. This mechanism can satisfy all the existing problems like more turning radius, parking problems, low efficiency and more pollutions. So finally we reached our goal to overcome all these problems at a time with considerable cost in a single vehicle by introducing some new mechanisms.

One of the main problems is more turning radius because of this vehicle needs more space to take the turning. This is overcome by introducing FOUR WHEEL STEERING MECHANISM. With this mechanism, we can reduce the turning radius so the vehicle can take easy turnings in a required space. Next major problem is parking, today everywhere we face this problem. So we can take it as a challenge and overcome this problem by CRAB MECHANISM. In this, we can use three systems. First one is only FRONT WHEELS ROTATES 90° and rear wheels remain constant (as usual). In the second system, all FOUR WHEELS ROTATES 90° and vehicle move like a crab. And the last one is ALL THE WHEELS TURNS DIAGONALLY, by this mechanism we can move our vehicle in any way within the less area.

In off-road conditions vehicle performance is not much better because of road conditions. At that time, we face a lot of problems to take turnings so at that time we can use 360° ROTATION. With this mechanism we can steer our vehicle in any direction depends on our requirement. In this mechanism, the total body of vehicle rotates in its own radius. The last and biggest advantage of this vehicle is we can reduce the emissions and at the same time increase the efficiency of an engine by ELECTROLYSIS PROCESS. Here our vehicle runs with not only petrol, but we can use water also for the combustion process. So finally, this is a multi-utility and eco-friendly vehicle.

Index Terms – Four wheel steering, crab motion, front wheel 90•, all wheels turns diagonally.

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I. INTRODUCTION

The early history of the automobile can be divided into a number of eras, based on the prevalent means of propulsion. Later periods were defined by trends in exterior styling, size, and utility preferences. In 1870 Siegfried Marcus built the first gasoline powered combustion engine, which he placed on a pushcart, building four progressively sophisticated combustion-engine cars over a 10-to-15-year span that influenced later cars. Marcus created the two-cycle combustion engine. The car's second incarnation in 1880 introduced a four-cycle, gasoline-powered engine, an ingenious carburetor design and magneto ignition. He created an additional two models further refining his design with steering, a clutch and brakes.

Fig.1. steering mechanism

The basic aim of steering is to ensure that the wheels are pointing in the desired directions. This is typically achieved by a series of linkages, rods, pivots and gears. One of the concepts is that of caster angle - each wheel is steered with a pivot point ahead of the wheel; this makes the steering tend to be self-centering towards the direction of travel. The steering linkages connecting the steering box and the wheels usually conforms to a variation of Ackermann steering geometry, to account for the fact that in a turn, the inner wheel is actually travelling a path of smaller radius than the outer wheel, so that the degree of toe suitable for driving in a straight path is not suitable for turns. The angle the wheels make with the vertical plane also influences steering dynamics (see camber angle) as do the tires. Many modern cars use rack and pinion steering mechanisms, where the steering wheel turns the pinion gear; the pinion moves the rack, which is a linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car (side to side motion). This motion applies steering torque to the swivel pin ball joints that replaced previously used kingpins of the stub axle of the steered wheels via tie rods and a short lever arm called the steering arm.

2. SYSTEMS IN OUR MODEL:

- ➢ Four wheel steering mechanism
- ➢ Smart Parking
- ➢ Front Wheel 90°
- ➢ Total vehicle 360°
- ➢ Crab motion
- ➢ Electrolysis assistance for fuel saving and pollution control

3. REASONS FOR DEVELOPING FOUR WHEEL STEERING:

Now a days, the every vehicle existed mostly still using the two wheel steering system to control the movement of the vehicle whether it is front wheel drive, rear wheel drive or all-wheel drive. But due to the awareness of safety, four wheel steering vehicles are being used increasingly due to high performance and stability that they bring to the vehicles. In this report, the performance of four wheels steered vehicle model is considered which is optimally controlled during a lane change maneuver in three type of condition which is low speed maneuver, medium speed maneuver and high speed maneuver. Four-Wheel Steering – Rear Wheels Control. For parking and low-speed maneuvers, the rear Wheel steer in the opposite direction of the front wheels, allowing much sharper turns. At higher speeds, the rest wheels steer in the same direction as the front wheels. The result is more stability and less body lean during fast lane changes and turns because the front wheels don't have to drag non-steering rear wheels onto the path.

Our Method to Develop Four wheel steering:

Firstly, for changing the car mechanism from two wheel steering to four wheel steering and all other remaining modes here we developed a mechanism is called Lever Mechanism.
In Our Project hand Lever mechanism Play a very key role. Here we fabricated two levers, which are used for two wheel steering, four wheel steering, 90^0 motion, Crab Motion and Ring Motion. This two levers are connected to a three sleeves with the help of Bowden cables. These whole lever system is connected to the chassis.

Fig 2. Lever Mechanism

Design and working for four wheel steering:

This project aims at developing a Four Wheel Steering System which would cater to the needs of people. This system is employed to improve steering response, increase vehicle stability while maneuvering at high speed, or to decrease turning radius at low speed. The concept is simple. Rather than controlling a car solely by the angle at which the front tires meet the road the method used by wheeled vehicles since the horse-drawn carriage, four-wheel steering turns the wheels simultaneously at both ends of the car. The idea is intuitively appealing to any city driver who has ever pulled up to a too-short parking space and wished he could point all four tires, toward the curb and crab right in.

The difference comes from the dynamics of high speed motoring. When a driver travelling at highway speeds turns the wheel of a conventional, two-wheel steering car, the front tires immediately begin to pivot and the car's forward momentum generates a powerful sideways or cornering force at the front axle. The rear tires, however, have to wait until the car has actually started its turn before they begin to generate a corresponding force at the rear axle. That is why a car with two-wheel steering fishtails during lane changes; the back end is trying to catch up to the front. In extreme cases, or under slippery conditions, the rear of the car may fishtail out of control.
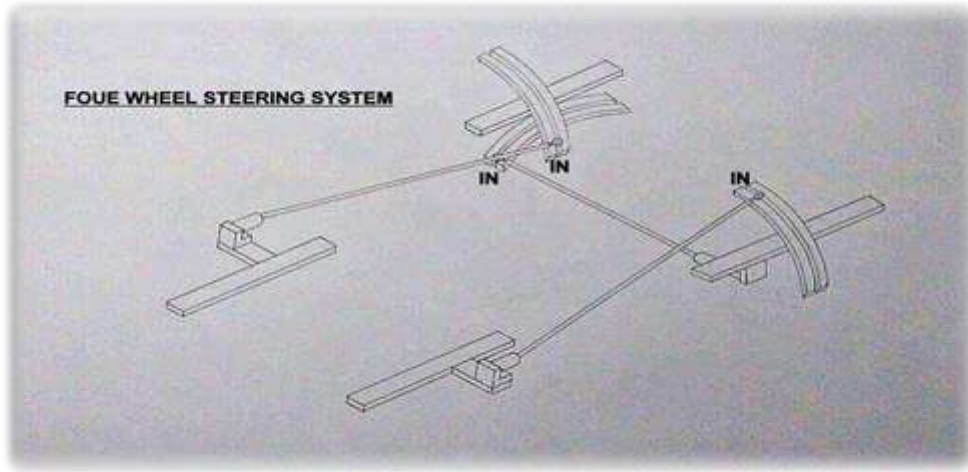
Fig.3. Design of four wheel steering

Fig. 4.Our model in four wheel steering mechanism

4. REASONS FOR DEVELPONING PARALLEL PARKING:

It gives immense pleasure when a person rides a car and goes on a smooth nice highway. On the other hand, the same person gets frustrated when he has to make sharp maneuvers to parallel park his car in closely packed parking spot with front and rear car taking a portion of his parking space. I suggest a feature in cars that may alleviate the pain. Let's see the pain and the solution. Parking on the streets, in apartment complexes and even some other parking areas, requires one to Parallel Park a car. In Parallel parking of car, a person needs to park his car lengthwise parallel to curb. There may be car ahead and behind the parking spot where this car needs to be parked. The space provided to park this car may be around 1.5 car length – 1 length for the car and 1/4 length ahead of and 1/4 length behind the car.

Fig.5. 90 wheel position

4.1 DRAWBACK OF PARALLEL PARKING IN CONVENTIONAL WAY:

1. Parallel parking a car is a skill that one needs to learn and practice. One may not perform parallel parking without first learning it. This is the reason, Department of Motor Vehicles in USA Even with all the learning drivers do make some mistake while parallel parking a car and the result is nicks on the bumper of car.

2. Most of the time, parallel parking requires one vehicle to acquire 1.5 to 2 car parking length so that the car can get in the parking spot and come out of it.

3. Parallel parking requires a vehicle to move forward and then reverse causing it to travel more distance than was really required.

    1. More distance leads to more fuel consumption

    2. More distance leads to more wear and tear of the car

    3. More distance and parallel parking causes more time spent.

    4. Above point also causes more money spent to Parallel Park a car.

4.2 Our Method to overcome the problems:

In this project, undoubtedly, seem fascinating but they are not natural and some of the drawbacks still exist. My suggestion may supplement these solutions rather than replace it.

Design axle and driving mechanism of a car such that wheels can turn 90 degrees to park a car straight away rather than making maneuvers required for parallel parking. In other words,

1. A car stops moving forward (or backward)

2. All the wheels of the car turns 90 degrees

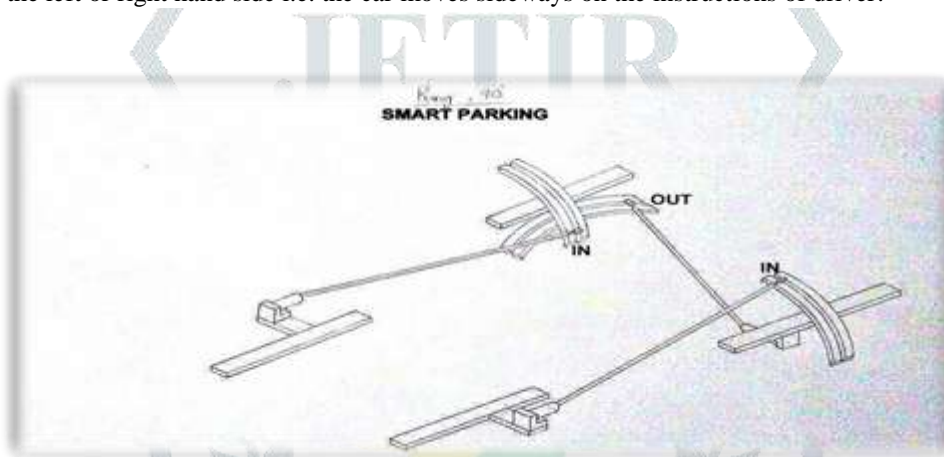3. The car moves to the left or right hand side i.e. the car moves sideways on the instructions of driver.

Fig.6. Design for Parallel Parking

Fig.7. our model in smart parking mechanism

4.3 Challenges:

1. This solution is not in market for all this time cars/automobiles are there in the world (200 to 400 years) implies this solution is extremely challenging.

2. Axle and driving mechanism will need to be designed so that wheels can turn 90 degrees. There will be no precedence of such mechanism so one will need to undergo all the Research and Design for this solution.

3. The 2 wheel drive vehicles will need to be redesigned so that power can be shifted to a front and rear wheel rather than to pair of front wheels or rear wheels. Four wheel drive vehicles may have an advantage in this term.

4. Sideways driving of car may be dangerous when passing a struck car in front. Car's signal mechanism will need to be designed to warn the driver coming from behind that car is moving sideways.

5. The forward and reverse gears in current vehicles may not work well for sideways movement. Sideways movement should be slower than forward and rear movement.

6. Mechanism will need to be made for a driver to stop the car completely before he makes sideways movement.

7. The cost of this mechanism once implemented may be high. One may consider designing this solution for bigger and costlier car, which may derive premium from wealthy customers, and the car's bottom has more room to turn wheels 90 degrees.

8. The competition with Park Assist Technology and Backup Camera may be steep even though these technologies can supplement our solution.

4.4 Advantages

1. The mechanism is intuitive so a driver needs to spend very little time to learn if such mechanism is implemented in a car.

2. Cars can be parked very close to each other. This may save costly parking space, lead to more parking fees to commercial parking spaces and eventually passing on the benefit to drivers (reduction of parking fees).

3. In congested apartment complexes where parking is limited, this mechanism can be very helpful.

4. This mechanism addresses all the drawbacks of parallel parking

5. On a congested road, if the car in front breaks down and you have little space to pass (overtake) that car then this feature may be very helpful.

6. REASON FOR DEVELOPING 360° MECHANISM:

Main function of car is to move from one place to another place. We find that every member of the family have their own vehicle. Car provide us lot of benefits like protect us from sun heat in summer and from rain in monsoon. Travelling is inevitable part of person's life Car is the most common thing in today's world. Having a car is the status in the society but having a costly car is a royal status in the society, with increase in number of vehicle people have to face traffic problems like parking, taking reverse etc. So here we have "implemented a 360° rotating mechanism car" for these above mentioned purposes. These problems can be efficiently reduce and eliminated by the use of this application we use. It operates in a clockwise and anticlockwise direction A primary objective of the present invention is to provide a simple, stable, easy control, smaller space needed and a more concise movement of car To better understand the present invention, detailed descriptions shall be given with the accompany drawings.
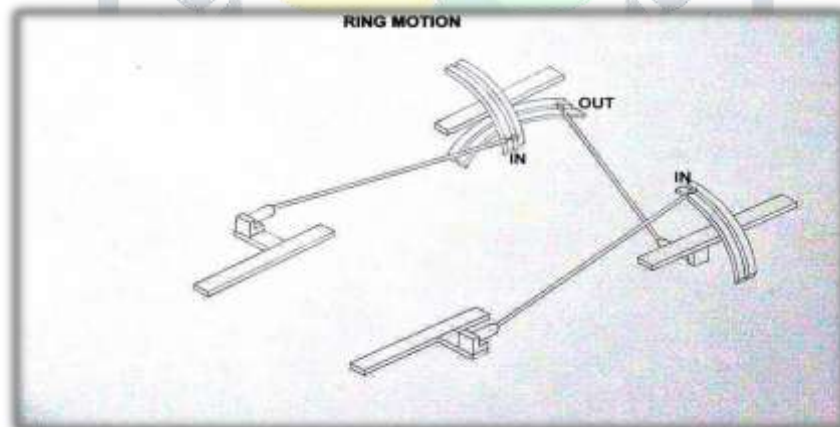
Fig 8. Design of 360° mechanism

Fig.9. Our model in 360° mechanism

In this mechanism by using levers we can set the mode into ring motion by adjusting the two levers. The rotation can be done in both in clockwise and anticlockwise direction by operating switch forward and backward. After achieving the particular direction, we can stop the car by applying the break and change the levers into required motion based on the driver comfort.

Advantages:
1)   It consumes very less time to turn from one direction to other direction.
2)   It is more efficient compare to other type of load carry vehicle.
3)   This type of load carry vehicle is easily parked in any direction

Applications:

1)   In Industries for automation of raw material like automated guided vehicle
2)   In automobile sector there are so many types of vehicle are using to carry goods from one position to another position, there is space problem in the industry so this vehicle is used in automobile applications because this vehicle consumes very less space compare to other type of vehicle.
3)   This vehicle is used in small Industries for transportation of raw material from one position to another position.
4)   Modern development and economical progression of Indian society resulted in increase of vehicle in park so there are also problem. In park other vehicle are taking more space to move from one direction to other direction and 360 degree wheel rotation vehicle have capability to move parallel direction so this vehicle is easily move from one direction to other direction in park.
5)   Take easily U-turn because front wheel of this vehicle are rotating freely by steering, chain drive and sprocket arrangement.
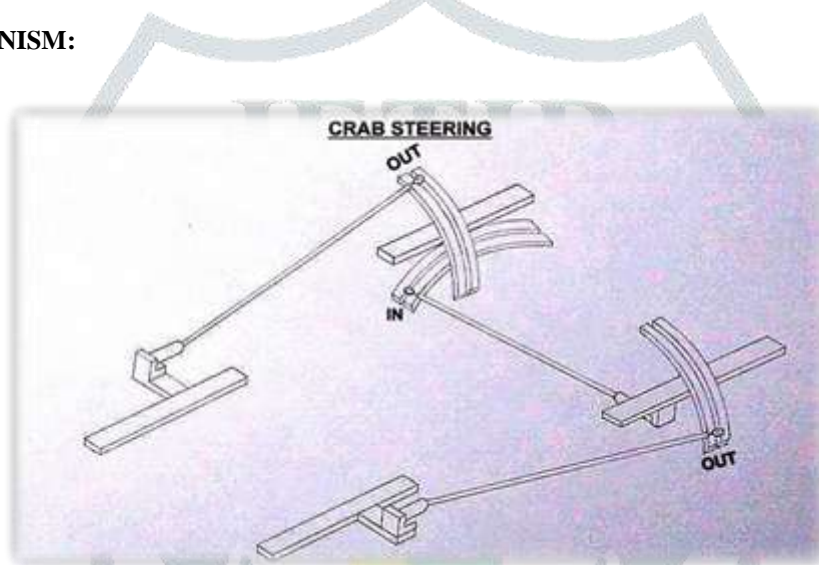
7. CRAB MOTION MECHANISM:

Fig. 10. Design for crab mechanism

In this crab mechanism the four wheels are rotated to more than 45° and less than 90°.based on the space availability and driver comfort we can set the angle by changing the two levers. By using the mechanism we can easy park our vehicle like smart parking mode. Even the space availability is narrow or like an angular space it is not a big deal to our vehicle based on the space we can set the angle of the wheel and perfectly park the vehicle without any difficulty.
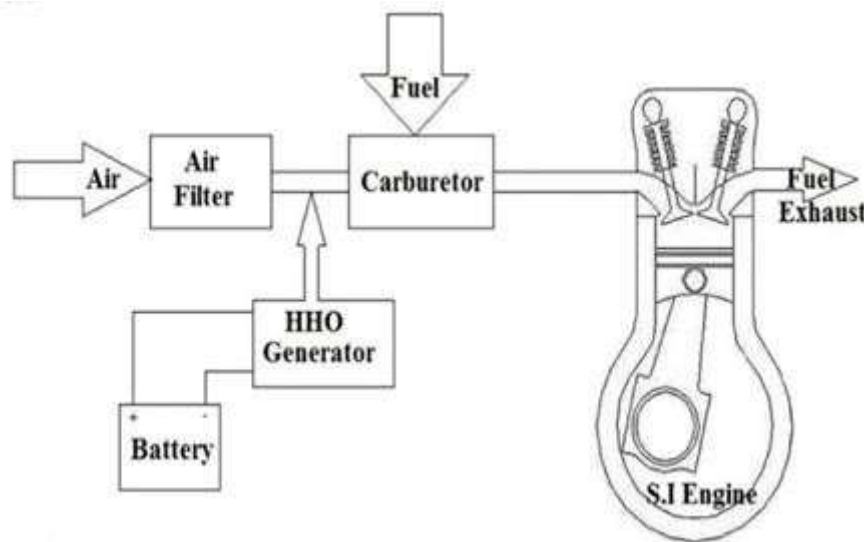
8. ELECTROLYSIS PROCESS:

The main reason behind this process is by using the above mechanism more amount of fuel is consumed and as well as lot of pollutants are released to atmosphere. So we take it as a challenge and overcome this problem by implementing the electrolysis process to our vehicle.

8.1 Working:

Electrolysis is the process that converts water to gas. The electrical supply for the process is used from your battery. An electrical power source is connected to the two electrode materials which are placed in the water. Hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode material (the positively charged electrode).i.e. reduction at cathode and oxidation at anode occurs According to ideal faradaic efficiency. The amount of hydrogen generated is twice the number of moles of oxygen and both are proportional to the total electrical charge conducted by the electrodes solution.

The hydrogen generated at cathode is fed to the inlet manifold that is in air hose pipe of the carburetor, then this gas mix with the coming air from the air filter when the vacuum is created by the piston movement from TDC to BDC. As HHO gas mixed with air then it goes to engine cylinder with gasoline during suction stroke of the engine. At the end of compression stroke the spark is generated from the spark plug the combustion of gasoline and HHO gas occurs. HHO itself contains 1/3 oxygen by volume and 2/3 hydrogen (which has an octane rating of 130).The explosion is so fast that it fills the combustion cylinder at least 3 times faster than the gasoline explosion and subsequent ignites the gasoline from all directions. Hence more power is generated consequently the mileage of our bike gets increased.

Fig.11 Working procedure of electrolysis

8.2 Experimental calculation for electrolysis process:

In order to quantities the process of electrolysis, we have solved some equations that relate the current needed to obtain a certain volume for a gas. The process for this calculation at room temperature and at 1 atm is:

➢ Half-reactions that take place at the anode and at the cathode. Anode (oxidation):
$2H_2O (I) = O_2 (g) + 4H+ (aq) + 4e-$

Cathode (reduction): $2H+ (aq) + 2e-- = H_2 (g)$
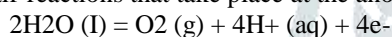
➢ Calculate the number of moles of electrons that were transferred.

➢ *Formula-*

Amperes X time = Coulombs 96,485 coulombs
= 1 Faraday (F) 1 Faraday = 1 mole of electrons

➢ *Calculation-*

$4.5(amps) * 216.5(seconds) = 974.25(coulomb)$ $974.25C * (1F/96,485C) = 0.0105F$
$0.0105F * (1 mole e-/1F) = 0.0105$ mole e-

➢ Calculate the moles of hydrogen and oxygen produced

Using the number of moles of electrons calculated and the stoichiometric from the balanced half reactions. According to the equations, 2 moles of electrons produce 2 mole of H_2 and 4 moles of electrons produce 1 mole of O_2 gas.

- $(0.0105$ mole e- $)*(2$ mole $H_2/ 2$ mole e-$) = 0.0105$ mole H_2

- $(0.0105$ mole e- $)*(1$ mole $O_2/ 4$ mole e-$) = 0.0026$ mole O_2

➢ Calculate the volume of each gas using ideal gas law ($V= nRT/P$).

➢ Where n: number of moles.

R: Boltzmann constant = 0.08206 (L atm/mol K) T: temperature in kelvin.

➢ *Volume of Hydrogen gas*

$((0.0105$ mole $H_2) (0.0826$ Latm/mole K$) (298K))/1atm = 0.25L$ of H_2

➢ *Volume of oxygen gas*

$((0.0026$ mole $O_2) (0.0826$ L atm/mole K$) (298K))/1atm = 0.063L$ of O_2

These calculations have shown that for a Current of 4.5amps during a period of 216.5 seconds, the electrolysis of water yields 0.25 Liters of hydrogen gas and 0.063 Liters of oxygen gas.

1. Without Load condition (Ideal)

    a) Before Electrolysis   =   50 min/1lt

    b) After Electrolysis   =   126 min/1lt

2. With Load condition

    a) Before Electrolysis = 2.6km/1lit (speed 10kmph, with load)

    b) After Electrolysis = 4.6km/1lit (speed 10kmph, with load)

8.3 Advantages:

➢ Eliminate harmful exhaust emission that pollute the environment and contribute to global warming. Your engine will add oxygen to the environment instead of polluting it.
➢ Greatly enhance engine power and performance.
➢ Remove carbon deposits and prevent future carbon build up.
➢ Reduce the operating temperature of the engine and waste heat into the environment.
➢ You will notice a calmer, quieter and much smoother engine operation. This is due to the effect water has on the combustion cycle inside your engine.
➢ Enjoy a longer life expectancy of your engine, especially the pistons and valves

9. APPLICATION OF MULTI UTILITY STEERING VEHICLE:

➢ **Parking:** During a parking the vehicles driver typically turns the steering wheels through a large angle to achieve a small turning radius. By counter phase steering of the rear wheels, four wheel steering system realizes a smaller turning radius then is possible with two wheel steering system. As a result vehicle is turned in small radius at parking.
➢ **Junctions:** On a cross roads or other junction where roads intersect at 90^0 degrees or tighter angles, counter phase steering of the rear wheels.
➢ Causes the front and rear wheels to follow moreover-less path. As a result the vehicle can be turned easily at a junction.
➢ **Slippery road surfaces:** During steering operation on low friction surfaces, steering of the rear wheels suppress sideways drift of the vehicles rear end. As a result the vehicles direction is easier to control.
➢ **High speed straight line operation:** When traveling in a straight line at high speed, a vehicles driver frequently needs to make small steering correction to maintain the desired; in phase steering of the rear wheels minimizes these corrective steering inputs.
➢ **Narrow roads:** On narrow roads with tight bends, counter-phase steering of the rear wheels minimizes the vehicles turning radius, thereby reducing side-to-side rotation of the steering wheels and making the vehicle easier to turn.
➢ **U-Turns:** By minimizing the vehicle turning radius, counter-phase steering of the rear wheels enables U-turns to be performed easily on narrow roads.

10. CONCLUSION:

A vehicle featuring different modes of steering mechanisms has been introduced. Our project mainly focused on steering mechanisms which offer feasible solutions to a number of current maneuvering limitations. In our project 6 mechanisms are featured which are operated by the arrangement of lever mechanisms will decrease the effort for drivers. As Two Wheel Steering Vehicle is commonly in present vehicles. In Two Wheel Steering only front two wheels take part in steering. Four Wheel Steering Vehicle is a relatively new technology that improves maneuverability in cars. In Four Wheel Steering all the four wheels play an active role in the steering which helps to stable driving, easy cornering and reduction in oscillation around its vertical axis. Parking tight spaces getting the major problem and are harder for the vehicles forget out from the vehicle which is at the front and back side of the vehicle. So 90^0 rotation helps in parking. In which all the wheels are rotated to move horizontally. As from the working of the 360^0 rotation of the body, it has been clarified that by changing the orientation of the tire and giving the torque to one the wheel results in movement of the vehicle about its own axis. So it will be beneficial in various fields. This technology is still considered experimental but it is a supplemental fuel additive of sorts that could help you increase mileage, increase horsepower, reduce emissions while providing a quieter and cleaner engine. Energy must be conserved in one way or other so we are trying to implement this in the future. This might be a good plan to save the environment. It is clear from the various investigations and analyses that hydrogen has the potential to be a very promising eco-friendly fuel. Harmful emissions are almost negligible when compared to gasoline and other fossil fuels, and there is no cause of concern relating to the sustainability of the fuel as hydrogen is a vastly abundant element. Finally, our model is a different steering function along with eco-friendly mark.

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