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Mobility Scooter for Disabled People with Reverse Mechanism

Briyan Tom Benny[1], Jeevo Johnson[2], Johns Varghese G[3], Tono Johnson[4]

[1,2,3,4]*UG Students, Department of Mechanical Engineering, Viswajyothi Engineering College, Kerala, India*

Abstract - *India is the largest democratic country in the world and is on its way to become a key player in the global scenario. Transport disability exclude current physically challenged people from all sort of transport like public, private and private transportation. In this project a feasible design solution in form of a user friendly mobility vehicle, which allows physically challenged people to commute on their own and perform their activities without anyone's assistance, has been proposed. The designed mobility scooter can replace the current two wheeler scooter with side mount wheels. We are providing a solution for the disabled person to enter into the mobility vehicle along with his wheel chair using a ramp. This design helps such people to move the vehicle out from the parking lot easily. We also propose a design for reverse mechanism consisting of set of spur gears and parking assistance for those physically challenged people.*

Keywords *– Mobility vehicle, Physically challenged, Wheel chair, Ramp, Spur gear, Reverse mechanism*

1. INTRODUCTION

This project aims to assist the handicapped people for his or her easy convenience for travelling. The disabled people face difficulty in reversing the vehicle earlier. At times when the front wheel gets into a trench it's very difficult to pull the vehicle from that position. Even normal people face many problems to take the vehicle out of the trench at that time. In order to take the vehicle out of the trench they need to seek others help or they should push it out by themself. So to help them, we have designed a gear box which can be connected with the engine output shaft. It is fitted to the main frame of the vehicle and helping in the backing of the vehicle. When the driver wants to move the vehicle backward, he needs to shift the lever which is connected with the sliding gear unit in which the meshing changes and hence vehicle move backward. If the driver wants the vehicle to move in the forward direction, then the rod is to be moved to the former position. Also it is difficult for such people to access the vehicle during the time of entry and exit from the wheelchair and vehicle respectively. Normally they have to take a lot of stress for that movement. If there is a provision to enter into the vehicle with their own wheelchair, then we can avoid injury and the stress they have to bear during the entry. This project is suitable for the disabled individuals (with a healthy upper torso but pelvic to foot restraint).

2. OBJECTIVES AND SCOPE OF STUDY

The objective of this project is to provide a better alternative for the conventional scooters with support wheels. This design approach provide a better transport mobility for the disabled ones and motivate them to engage in business and other public activities to support their families. It also helps them to counteract against the discrimination they faces. In future this vehicle design will provide a benchmark in comfort and handling.

3. DESIGN CHALLENGES

The major challenges in the design was the construction of the ramp framework over the gearbox for the access of wheelchair. The vibration induced by engine can affect the stability of the frame. The initial cost of designing the machine and its components must be recovered in a reasonable time period. The design of components and frame requires analysis and calculations. Gear analysis must be carried out to determine the failure level.

4. COMPONENTS

4.1 Gears

A set of spur gears are used in the project to obtain the reverse motion of the vehicle. The combination used include spur gear with teeth number of 12, 20, 26, 32 and pitch diameter of 30mm, 50mm, 65mm, 80mm respectively with module 2.5. These gears are combined accordingly to obtain clockwise and anticlockwise motion. Also bevel gears with teeth number 16 and 10 are mounted on 2 shaft whose axis are perpendicular to each other. When they are rotated, it is possible to lift the ramp.

4.2 Main frame

Main frame is made of 1.25 x 1.25 inch GI square tube. The frame has a length of 34 inch and width of 14 inch. The engine is mounted on the frame by welding. All the circular shafts with spur gears are mounted on this frame via bearings. It also form the base for the platform for the pathway for the wheelchair access.

4.3 Bearing

Bearing are used to support the shaft that contain the gear combination & made of steel. Bearing with bore diameter 10mm, 16mm and 20mm are selected so that the corresponding shafts would be easily rotated to obtain the necessary motion. Bearings used for the shaft which hold the spur gears are 3710, 4217 and 5020.

4.4 Rope and pulley

The rope could also be a light-weight cable or plastic. Pulley may be a wheel with a groove along its edge, which holds a rope or cable. Four pulleys are used over which the rope passes. Two plastic rope of length 3.2m is chosen .Each rope is connected to the ramp and to the front portion which is run over on 2 pulleys. The pulley adjacent to the front portion will recoil the rope so that, the ramp is retracted upwards.

4.5 Ramp

This act as a pathway for the person to enter into the vehicle along with his wheelchair. It has a grooved track so that wheelchair moves accurately to the driving position. It is hinged to the frame and raised up and down using a rope and pulley system. The ramp is made of flat MS bar of length 43 inch and width 1.25 inch which is welded with other two MS bar to form a V shaped groove so that the tyre of the wheelchair could fit in it.

5. WORKING

5.1 Gear box unit

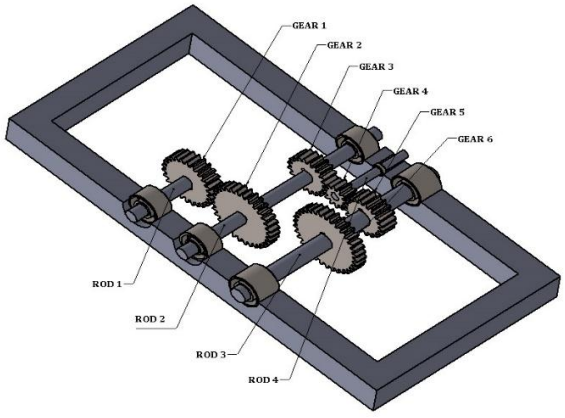
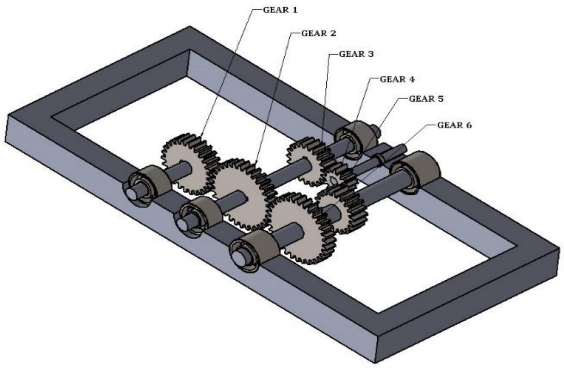


Fig-1: 3D model of the gearbox using SolidWorks

The working of the design involves gear arrangements that function accordingly to the movement of the sliding lever. From fig-1 the gear box unit consist of six spur gears which are mounted on three shafts which are supported by the bearings on the main frame. Rod 1 is a circular M16 shaft that contain the spur gear with pitch diameter 65 mm and 26 teeth which receive the engine output power. Rod 2 which is a circular shaft M16 shaft that has the gear 2 (pitch diameter 80mm & 32 teeth) and gear 3 (pith diameter 50 mm & 20 teeth) as compound gears. Gear 1 and 2 are always in mesh. Rod 4 which is a circular M10 shaft has spur gear 5 with pitch diameter 30 mm and 12 teeth. Rod 3 which is a circular M20 shaft that has gear 5 (pitch diameter 50 mm & 20 teeth) and gear 6 (pitch diameter 80 mm and 32 teeth). Gear 3 and 4 are always in mesh. Gear 5 and 6 can be slided together with the help of a lever through the sleeve cut on the rod 3.

5.2 Forward motion



Fig–2: Gear arrangement for forward motion

As shown in fig-2, engine output is given to gear 1 through a M16 rod. The spur gears 1, 2 and 6 are meshed together to provide the forward motion. Gears 1 and 6 rotate in same direction which is clockwise and hence the vehicle move forward.

5.3 Reverse motion

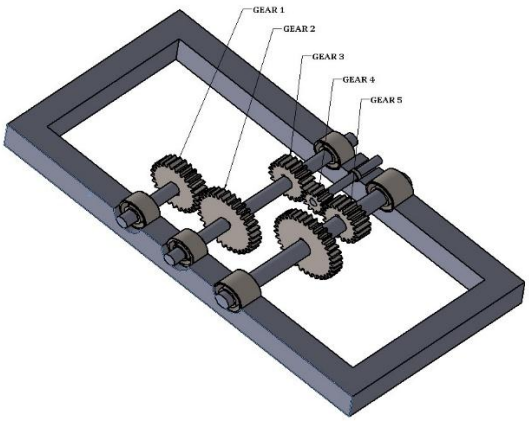


Fig-3: Gear arrangement for reverse motion

Here five gears are engaged to provide the required reverse motion as shown in fig-3. Gears1,2,3,4,5 are engaged while shifting the lever. Gear 4 is the intermediate gear which makes the driven gear 5 to rotate in an anti-clockwise direction, so that the vehicle moves backward.

5.4 Wheelchair access

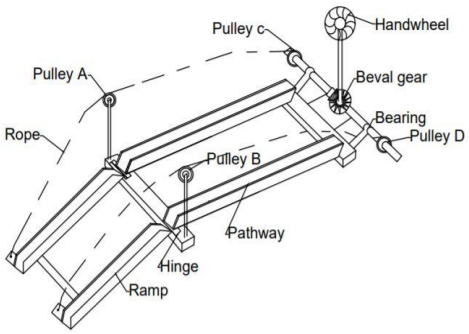


Fig-4: Wheelchair accessing mechanism

From fig-4, the pathway is made of flat MS bar of length 45 inch and width 1.25 inch which is welded with other two MS bar to form a V shaped groove so that the tyre of the wheelchair could fit in it. This pathway is constructed and mounted over the main frame. The person with his wheel chair enters into the vehicle using the inclined ramp constructed similar to the pathway with length 43 inch and width 1.25 inch which is welded with other two MS bar to form a V shaped groove. Pulley C and D are mounted on a M20 circular rod which can be rotated by rotating the hand wheel through a bevel gear combination. When these pulleys start to rotate they recoil the rope on them and thus cause the ramp to retract upwards and vice versa. The ramp and M20 rod are connected via other two pulleys A and B.

6. FABRICATION

The gear arrangements, shaft, bearings, frame, ramp are designed and fabricated. The prototype is built with two stroke, single cylinder heavy duty TVS XL engine.

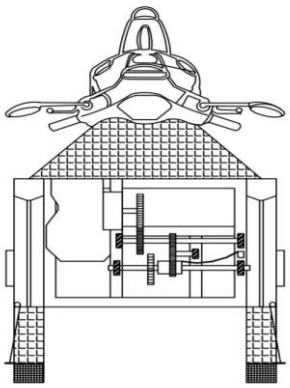


Fig-5: Top view of the mobility vehicle using AutoCAD

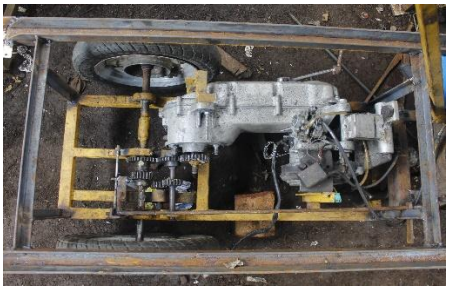


Fig-6: Main frame with gear box unit

Fig-7: Wheelchair accessing mechanism

7. ADVANTAGES

- Easy handling and good comfort
- The working and operation of the gear system is very simple.
- Replacement of parts is easy.
- The vehicle can be operated by the disabled person by himself without an external aid.

8. CONCLUSION

The fabrication and installation has been done considering the data required and stability is ensured. This design helps

the wheelchair users to have mobility freedom, thereby they can come out from the social discrimination and all sort of family problems by engaging in various activities. By this design the disabled persons can easily improve their living conditions more comfortable and will be very helpful for their daily needs. The wheelchair access mechanism help the user to move independently.

9. ACKNOWLEDGEMENT

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