Development & Construction of Reverse Gear Mechanism for Physically Challenged Vehicle

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Abstract— The project is specifically designed and fabricated for the convenience of physically challenged people who are disabled by their legs. As in this date there are many options for transportation available for physically challenged persons portable bike. In order to take the vehicle out of the parking, they need to seek others help or they should push it out of the parking. As a help to them, this research paper aims at designing and fabrication a reverse gear mechanism, which will be fitting to the vehicle with little modifications of the existing mechanism. The paper deals with the design of such a gear box and the assembly process of the gear box to the vehicle. The design deals with the conditions of the gear box operation, and the design of the gear box based on easy assembly and easy manufacturing at low cost.

Key words: Disabled People, Disability, Foot Operated System, Rack and Pinion

I. INTRODUCTION

In motor vehicles, the transmission generally is connected to the engine crankshaft via a flywheel and or partly because inter combustion engines cannot run below a particular speed. Transmission may be Directional i.e. Forward and Reverse control may be provided. Reverse gear mechanism is used to transmit the power in reverse direction. The reverse gear was used in locomotive engine in order to stop the Train. The later it was used in three wheelers (Auto) and it became a prominent feature of four wheelers. Recently the reverse gear mechanism is implemented in two wheelers also for various applications. To design reverse gear mechanism in a two wheeler Engine. To fabricate the designed gear mechanism. The main Moto of our project is to fit the reverse gear mechanism in differently able person's vehicles because they find it difficult to move the vehicle backward without the help of others. A simple but rugged sliding- mesh or unsynchronized/non-synchronous system, where straight-cut spur gear sets spin freely, and must be synchronized by the operator matching engine revs to road speed, to avoid noisy and damaging clashing of the gears.

Types of Disability	Males	Females	Persons
Mental retardation	8,70,708	6,34,916	15,05,624
In hearing	4,15,732	3,07,094	7,22,826
In seeing	26,77,544	23,93,463	50,71,007
In speech	26,38,516	23,93,947	50,32,463
In movement	11,22,896	8,75,639	19,98,535
Any other	33,70,374	20,66,230	54,36,604
Multiple disability	27,27,828	21,99,183	49,27,011
Multiple disability	11,62,604	9,53,883	21,16,487
Total	**1,49,86,202**	**1,18,24,355**	**2,68,10,557**

Table 1: Population of people with disabilities by type of disability

Residence	Males	Females	Persons
Urban	45,78,034	36,00,602	81,78,636
Rural	1,04,08,168	82,23,753	1,86,31,921
Total	**1,49,86,202**	**1,18,24,355**	**2,68,10,557**

Table 2: Disabled population by sex and residence

A national level survey conducted in India by the Central Government of India once in ten years revealed that, around 27 million people which are about 2.21% of the Indians are differently able. Among them, around 14.98 million were men while 11.84 million were women. Thus, the percentage of disabled people in rural area was higher than those in urban areas. A total of 5.43 million people were identified with disabilities in movement which was the highest among other categories such as hearing, seeing etc. in terms of numbers of people affected.

II. LITERATURE REVIEW

A. A Low Cost Mobility Solution for Physically Challenged People; "Pranchal Srivastava, Raj Kumar Pal"

The most common approach used in most powered wheelchairs is having two motors for traction each driving a wheel on either side of the machine. Forward motion is achieved by keeping the speeds of the motors identical in one direction and the other direction for reverse motion. Turns are executed by making the speeds of the motors different. The radius of turn depends on the speed difference. This system depicts three novel approaches for cost effectiveness and efficient working, firstly having a powered wheel chair drive with a gear mechanism which is used to generate proper speed of the wheels on the either side with single power motor. The advantage of this system is that it makes the system control easy and cheap. Secondly, utilization of waste brake energy for battery charging which lead to reduced cost of powered wheel in the long run.

B. Dual Steered Three Wheeler for Differently Able People; "Arun Raju C, Anish Raman C, Veerappan K.R. Venkat Narayanan

The aim of this study is to design and fabricate a 3 wheeler with dual steering system for people with locomotive disabilities .A greater steering effort is required in the case of a four wheeler compared to a three wheeler. Hence, a three wheeler was selected instead of a four wheeler. In this case, handle bar steering system and leg steering system can be individually steered with hands and legs respectively, enabling its utility people with disabilities in upper extremities. Sprocket chain system was used in leg steering

system. A 98cc Kinetic Honda Engine was used as the power source and the engine was placed towards the rear end of the vehicle. Single Rated and double rated suspension spring was used in the front and rear drive shaft respectively. Sprocket chain system was used in leg steering system.

C. An Efficient Car Driving Controller System Design for Physically Challenged People Using Arm Processor; "Katari Ramaiah, T. Mallikarjun"

The aim of the technology is to help those handicapped who don't have healthy hands to run a vehicle by giving the voice commands. In this the driver need not use the steering instead his head. This vehicle is only for those handicapped those who can nod head well. Four switches are interfaced over the neck of the driver, and the vehicle can be controlled by the head movement. Corresponding tactile switches are activated according to the movement of the head, and towards the conclusion the practical difficulties are described and the possible solutions are discussed.

III. MATERIAL SELECTION AND MODELING GEAR RATIO

The gear ratio of a gear train, also known as its speed ratio, is the ratio of the angular velocity of the input gear to the angular velocity of the output gear. The gear ratio can be calculated as directly from the numbers of teeth on the gears in the gear train. The torque ratio of the gear train, also known as its mechanical advantage, is determined by the gear ratio. The speed ratio and mechanical advantage are defined so they yield the same number in an ideal linkage.

Sl. No	Components	Material
1	Power transmission shaft	SAE 1040 (H.T)
2	Spur Gears	SAE 1045 (H.T)
3	Casing of gear box	ALUMINIUM

Table 3: Material Selection

Gear	Module (mm)	No. of Teeth	Pitch Diameter (mm)	Face Width (mm)	Material
Gear a	2	68	136	20	SAE 1045(H.T)
Gear b	2	32	64	20	SAE 1045 (H.T)
Gear 1	2	22	40	20	SAE 1045 (H.T)
Gear 2	2	18	38	20	SAE 1045 (H.T)

Table 4: Gear Design

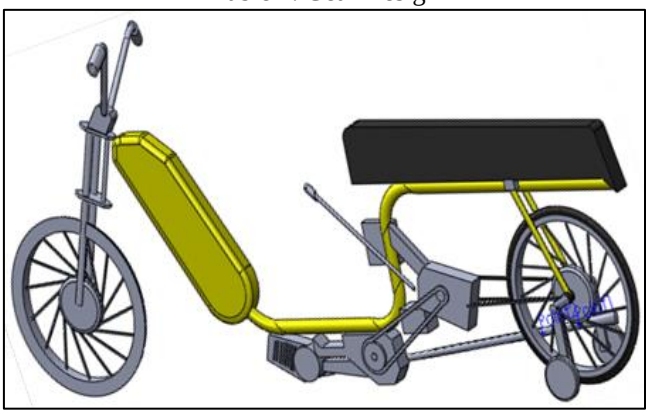

Fig. 1: 3D Modeling View

IV. FABRICATION

A. Gear Ratio Calculation

Gear ratio can be calculated by the following formula
Gear Ratio = Number of teeth in driven gear
Number of teeth in driver gear

B. Forward Direction

Input gear (GA) is directly meshed with the output gear (GB)
Input gear GA has 27 teeth
Output gear GB has 23 teeth.
Gear ratio for input &output gears,
The gear ratio =driven/driver
=27/23
= 1.17391
=~1.2 or 1.2:1
For every 1 revolution of a input gear, the output gear turn 1.2 revolution.

C. Reverse Direction

Input gear (GA) is meshed with one idler gear (GI) and then idler gear is meshed with the output gear (GB)
Input gear GA has 27 teeth
Output gear GB has 23 teeth.
Since we are using compound Idler gear
GI1 has 13 teeth
GI2 has 19 teeth
The Gear ratio for GA and GI1,
Gear ratio= 27/13 = 2.07 or 2.07:1
The gear ratio between GI2 and GB is,
Gear ratio = 19/23 =0.826 or 0.826:1
Hence the overall gear ratio is,
Overall gear ratio =2.07x0.826 =~1.7 or 1.17:1
For every one revolutions of the input gear, the output gear turns 1.7 revolution

Fig. 2: Spur gear arrangement for reverse gear mechanism

Fig. 3: Assembly of Gear Box

Fig. 4: Final Stage Fabrication

V. ADVANTAGES

It requires simple maintenance cares. Low cost to coating a catalytic converter. Checking and cleaning are easy, because of the main parts are easy to Handle. Low cost automation Project. Repairing is easy. Replacement of parts is easy.

VI. APPLICATION

It can be used in physically challenged peoples vehicle. Also this mechanism is less in weight and size, it can be installed in any bikes.

VII. CONCLUSION

Thus, the development and building of vehicle with gearbox is tested for various static and dynamic conditions. The reverse gear mechanism is achieved by adding only about 2% of the original weight balance is maintained. The inclusion of our project in moped vehicles will not reduce the speed of the vehicle; hence the performance of the vehicle is not affected. Since no complex structure is used in our design, it can be easily by physically challenged peoples. The designed vehicle will prove to be of great importance for the handicapped persons and aid them in driving on the heavy traffic intensity roads. Also it will provide a lot of comfort and safety while driving. So, implementing our project will surely provide mobility to all disabled people without any help from others. Our project has a great scope in future as it will assist in parking and also travelling in traffic roads.

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