

Dual Wheel Drive Mechanism in a Motorbike for Off-Road Application

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Abstract—In the modern day life, sophistication is expected from people side in every fields especially in the automobiles with the main focus on speed, comfort, cost, easy operability. In the automotive sector, the concept of four-wheel drive in cars are becoming popular and the demand is growing day-by-day, but the improvement in the two wheelers is minimal. The concept of dual or two wheel drive mechanism in the motorbike wasn't much focused and also economically implemented, either back wheel or front wheel drive concept is used in the motorbike. Dual wheel driven idea is suitable in the situations like irregular field, highly sloped roads etc., and appropriate for off-road application like agricultural area, military field, desert drive. This paper, proposed a design with the intentions of easy vehicle operation with low production cost which can be expected to be attained with the usage of sprockets and chain drive for minimum power transmission losses. Usually, back wheel drives quicker compare to front wheel drive and there will not be a transmission of power to the front drive while in the turning condition and it will be charged if the rear wheel loses traction while driving in uneven area with high speed.

Index Terms—Front wheel, motorbike, off-road, two wheel drive

I. INTRODUCTION

The automobile companies are bringing out many two wheeler models every year around the world. Nowadays importance is given more to function and performance than the appearance of the vehicle. Motorbikes are preferred for transport as well as adventure riding and other applications. The conventional rear wheel drive motorbike uses chains to transmit power from the engine to the back wheel and the applications are limited. The load carrying capacity is limited. The climbing capacity is also limited as there is torque only at the rear wheel. If the rear wheel slips, vehicle does not make a move. This

study indicated that the conventional motorbikes cannot be used at ease in climbing high inclination roads, driving along muddy roads, desert roads, farm lands, mountains etc. These motorbikes are also not suited in off roads and adverse terrains. Two wheel drive system is a solution to these limitations.

In this system power is given to both the front and the rear wheel. That is, if the rear wheel slips the power given to the front wheel is enough to move the motorbike forward. This system is similar to the four wheel drive system used in cars. With the two wheel drive system the load carrying capacity, traction and cornering ability of two wheelers are increased. It also results in unmatched hill climbing ability when compared with conventional motorbikes available in the market today. Because of this they are preferred for farm lands and military applications (reconnaissance missions). It is evident from the fact that a decade ago the two wheel drive motorbikes were limited to dirt races and mountain races. But now they are being wanted for farm and military applications and more companies are showing interest in the two wheel drive system on motorbikes.

Two wheel drive motorbikes that are already in the market are not accepted well by the customers due to factors like high cost and large size owing to high capacity engine and the complex mechanisms involved for transmission, high fuel consumption etc. The aim of our project is to fabricate a two wheel drive motorbike at low cost. The motorbike would be using chains to transmit power from the engine to both the wheels so as to make the system simpler. A constant velocity joint is used at front wheel to transmit the power between shafts rotating in different axes. A freewheel is used to make the engagement of the front wheel drive automatic.

Power is given to the front wheel only when the rear wheel slips.

Md. Danish Akhtar [1] compared the efficiency of the four wheel steering vehicles with the two wheel steering vehicle and relatively the four wheel steering vehicles shows the higher efficiency.

For better steering movement and stability during running at a certain speed, reducing the radius of turning during low speed are some of the reason for employed it on the four wheelers. The study shows that the vehicle has high stability under the over steer/understeer conditions.

S. A. Milani [2] et al studied, a tilt control mechanism has been modeled which can reduce the danger of roll over by leaning the vehicle towards the turning center in order to decrease the amount of lateral load transfer, and by doing so, system combines the dynamical abilities of a passenger car with a motorbike. Their results are interpreted in presence and absence of controller with different longitudinal speeds and steering inputs; their results are also compared to behavior of a similar front wheel vehicle (FWV) and concluded that the tilt control system could countervail deficiencies of the two wheeler vehicle compared to the FWV.

II. COMPONENTS AND DESCRIPTION

A. Two Wheeler

The selected bike for modification is “BAJAJ Caliber 115” motorbike and the Bike description is shown in the Table. I. It has a 100cc two stroke engine, a centrifugal clutch, a pulley is connected at the clutch output by means of a belt drive and a sprocket drives the back wheel by a chain drive with gear ratio of 4:1. It has a simple tubular frame. Thus it is easy to incorporate the two wheel drive system in the motorbike. Moreover the cost is minimum.

B. Bearing with Bearing Cap

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing of size 20 x 45 x 12 mm, is made up of steel material and the bearing cap is of mild steel.

C. Sprocket and Chain Drive

It is a cycle chain sprocket of pitch 12.7 mm, No. of teeth is 16 and made-up of Steel C45. The chain sprocket is coupled with another shaft and used for

converting the rotatory power to pull power, or vice-versa by engaging with the sprocket.

D. Petrol Engine

The engine which gives power to propel the automobile vehicle is a liquid fuel burning internal combustion engine.

Table. I Description of the motorbike

Engine Displacement	111.6 CC
Engine Type	Air cooled, 4 stroke
Number of Cylinders	1
Valves per Cylinder	2
Max Torque	8.1 Nm @6000 rpm

III. DESIGN OF THE DUAL WHEEL DRIVE

From the pulley located below the handle a chain drive is taken and one end of the chain drive is attached to a Universal joint one end while the right end of the Universal joint is coupled to a sprocket. From the sprocket another chain drive is taken and it's connected to the front wheel. An additional sprocket is added at the pulley end because of the pulley axis length is increased to certain extend. Fig.1 indicated the difference views of the Universal joint modelled in the Software.

The position of the Universal joint placed below the handle so, that the axis of the Universal joint and the shafts axis are coincides at a common point. Fig.2 shows the position of the Universal Joint in the Front side of the motorbike. A free wheel acts a one way clutch for uni-directional power transmission and it's fitted to the left side shaft of the Universal joint while the right side end of the Universal joint is attached to another which has a high pitch value. The front wheel sprocket is replaced with the similar sprocket to the rear wheel and it's taken from another motorbike. The sprocket ratio from the engine to front wheel side is nearly 4.5:1 and to the rear wheel side is around 4:1. Due to this, the rear wheel is driven faster compared with the front and 1.125:1 is the velocity ratio of the wheels from rear to front wheels drive. Fig.3 shows the various components used while modified the motorbike to front wheel drive without affecting the rear wheel drive.

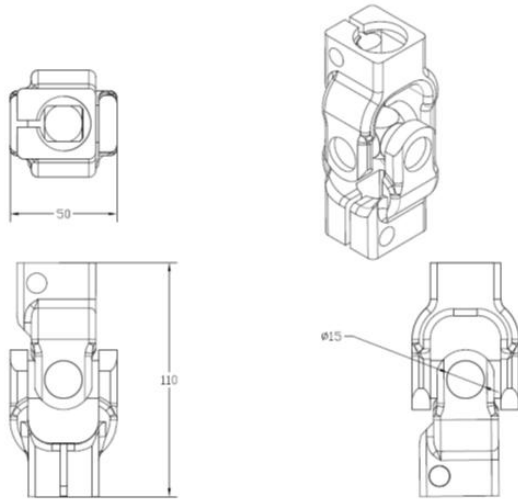


Fig.1 Universal joint



Fig.2 Location of Universal joint

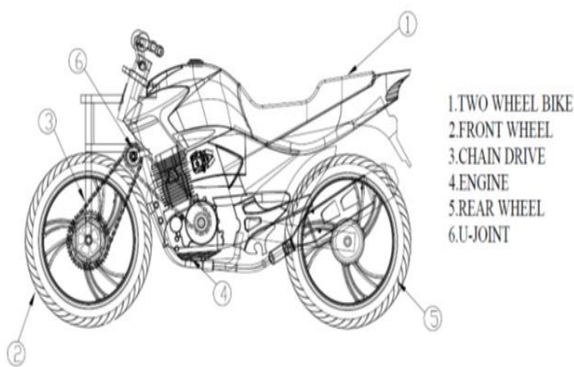


Fig.3 Two wheel drive bike with components

The fabricated model with the mentioned components are show in the Fig.4 and the list of Components used are represented in the Table. II. The dual wheel drive has the advantages like Construction is simple, easy to fabricate, easily available components, high efficiency and reliability,

the system is safe and low cost, No need of skilled operators to operate this system. Some of the limitations of this concepts are, more number of moving parts, repairing and replacing of the parts is not that much easy and the engine power is shared to the front and rear wheels are equal. The designed two wheel drive motorbikes is suitable in the off-road applications and it can also be implemented in bicycle and light commercial vehicles.



Fig.4 Front wheel driving Mechanism

Table. II List of Components

Parts	Qty.	Material
Bearing with cap	6	MS
Sprocket	6	Steel
Chain drive	3	Steel
Shaft	1	MS
Wheel	2	Rubber
Handle bar	1	Steel
Seat	1	-
Engine	1	-
Fuel tank	1	-

IV. CONCLUSION

The concept of dual wheel drive in motorbike application is designed with the basic details and the proposed model is working with satisfactory conditions. In the modified design difficulty arise in tolerance and quality maintenance. This dual wheel drive bikes is suggested for off-road applications with considering the economical as well as easy driving factors. The vehicle is tested in the running

condition and the results indicate that there is a reduction in transmission power loss during from the engine to front and rear wheels because of chain drive and sprockets usage. The universal joint helps in for smooth turning in the road and it functioned well. Future work will be suggested to test the vehicle in the off road track with the necessary modification needed while driving the dual wheel drive motorbike.

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