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A Review Paper on Improving Transmission System Efficiency for ATV (All-Terrain Vehicle)

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Abstract: Transmission System is a system which is used to transmit the power from engine to the wheels. TV is a vehicle which requires a transmission system ideal for rough low traction conditions. The goal is to design a Transmission System for the ATV such that it obtains better overall efficiency by using methods such as weight reduction, cooling methods & using software such as solid-work, ANSYS etc. for designing and analysis of the system. Inspired from various research papers it has been observed the various problems faced by them, such as heating of the transmission system, as well as the over-weight of the whole system, and set the main objective to overcome them to design a better efficient system for the ATV.

Going through research papers regarding ATV Transmission design we are able to understand tentative errors and solutions that can occur during designing of the system.

Keywords: Transmission System, Performance of CVT, Efficiency of CVT, ATV, Design Parameter etc.

I. INTRODUCTION

An ATV is a vehicle which is used on terrain of varying conditions, that is dry, wet, rough etc. and there are various factors to be considered during its design. While designing of ATV the design of transmission system is crucial as it decides the power delivery curve as well as other factors such as handling, weight are also affected by it. There are various options of transmission system type available for an ATV such as a manual transmission system or a CVT or a automatic transmission system. Each with their set of advantages and disadvantages so we go through various research papers to decide the best system suitable for our needs and costs. After going through various papers CVT is found to be best suited for our project and we try to improve its efficiency by implementing what we learn from the papers and practical knowledge.

A CVT system does not require manual changing of gears and has a range of varying gear reduction ratio, also has lesser weight and other preferable aspects.

II. LITERATURE REVIEW

Dr. V. K. Saini et al. [1] have reviewed the factors affecting the center of gravity (CG) and their effect on traction, the research clearly indicates that when center of gravity is high, we lose traction and experience roll during turns so for better control it is better to keep it lower. When distance between gearbox and engine is kept minimum better traction is observed. Also, the Centre distance characteristic value should be fixed initially according to the space constraints.

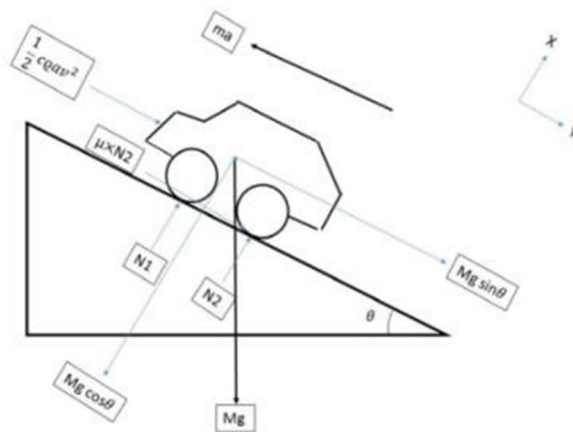


Fig 1: Various Parameters of Centre of gravity in ATV [1]

Avinash Yadav et al. [2] have reviewed about various factors about manual transmission and CVT transmission system

Disadvantages of manual system-

- 1) Difficult installation.
- 2) If clutch not pressed properly vehicle can stall.
- 3) If wrong gear is chosen during driving vehicle will stall.
- Advantages of CVT over manual-
- 4) Much lighter than manual gearbox.
- 5) It allows engine to operate at optimal power for varying driving condition.
- 6) Ease of operating. i.e. Easier operation.

The following table from this research paper tells us how manual is better than automatic transmission and CVT, but for the reasons (disadvantages) stated above, CVT is preferable.

Table 1: Comparison of different types of transmission system [2]

Scale 1-5 5 = Best, 1 = Worst	Weight	Cost	Gear ratio range	Easy installation	Total
Manual	4	3	4	4	3.75
Automatic	3	2	4	3	3.00
CVT	3	2	5	3	3.25

Aditya Patankar et al. [3] carried out research to show that the vehicle under the consideration was an ATV which is subjected to varying and rugged road conditions the power transmission should be constant and uninterrupted. This was done with the help of a CVT and a customized two stage reducer of the required reduction ratio.

So, it is necessary to use a custom two stage reducer so that overall range of reduction is between 7.5 to 8 to obtain uninterrupted transmission for varying road conditions. Without speed reducer the transmission fails to deliver power ideal for all terrain condition. Also, it was concluded that out of materials tested 20MnCr5 was overall best suited considering all parameters such as cost, weight etc.

Table 2: Two Stage Speed Reducer Specifications

PROPOSED GEARBOX SPECIFICATIONS	
Customized 2-stage Speed Reducer	Overall Ratio : 7.68
	First Stage : 2.61
	Second Stage : 2.94
	Gear Type : Spur
	Gear Material : 20MnCr5
	Bearing Type : DGBB
	Lubricant : ISO VG68
Casing Material : Al 2014	

H.Komatsubara, T. Yamazaki, S. Kuribayashi et al. [4] have reviewed about the highlights that the bearing and various spin loss in the traction area, do result in considerable power transmission efficiency reduction. Therefore, reducing service interval between events is advisable to ensure good lubrication and tire health to reduce the mentioned losses.

As because of this efficiency reduction, performance of the vehicle also gets decreased & the change in bearings leads to increase in the cost of overall vehicle.

SamehBdran, SamoSaifullah, and MaShuyan et al. [5] have carried the study on continuously variable transmission and it was concluded that this automotive transmission technology gives higher fuel economy with reduced emissions and better vehicle performance. CVT therefore is found to be a better system even for the fuel economy aspect, as well as environmental.

NurCholisa, SugengAriyonobet al. [6]: The design of single acting pulley actuator (SAPA) of CVT gives combinations of DC motor system, power cam mechanisms and gear reducers for actuating primary movable pulley sheaves on transmission shaft. The simulation results has significantly improved the performance of the conventional controller to complete 75.08 degree rotation of the CAM from lower gear ratio to top gear ratio in less than 6.79 sec (CVT ratio from 0.9 up to 2.8) in terms of percentage overshoot and steady state error, both controllers perform well for Single Acting Pulley.

So, using the same technology would be beneficial in our system if feasible within our constraints.

III. SUMMARY

The goal is to increase efficiency of transmission system for a ATV, going through various research papers helps us realize the various factors that play significant role in designing a efficient transmission system for such a vehicle. It helps understand different types of transmission systems available for use and also compares them to give a brief idea about which one is preferable for such terrain. Technologies such as gear reducers, cam mechanisms are also discussed in order to improve overall efficiency of the system.

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