

Design and Development of Single Seat, Three Wheeled Multi Purpose All-Terrain Vehicle

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ABSTRACT: Despite agriculture being the backbone of the Indian economy, it still needs a lot of improvements technically.

This paper concentrates on the development of new innovations and technology in order to sustain its growth. Considering the amount of number of small scale farmers a compact agro-based all-terrain vehicle is the need of the hour. Besides being a vehicle it also enables multiple operations like spraying pesticides, Cutting grasses and can be used as a power generator. There is a huge scope and potential for agro-based multi-purpose vehicles. **Keywords:** Agro-Based, Multi-Terrain, Truck, Agriculture, Multi-Purpose

I. INTRODUCTION

The “**Musk Truck**” is a multi-purpose off-road agro-based vehicle. Since the advent of tractors, the farming practices in our country progressed rapidly. But being a developing country with enormous population, agriculture in India mainly depends on small peasants. Affording a tractor is not so easy for masses of people in India. This Musk truck is created mainly as substitute for tractor. Besides performing few operations of the tractor the muck truck also generates electricity when required. Primarily it is very much affordable and easy handling when comparing the usage of tractors in farmland.

II. LITERATURE REVIEW

As per Agricultural Census data shows that there were about 121 million agricultural holdings in India in 2000-01. Around 99 million were small and marginal farmers. Kotaks and ICRA reports estimate that nearly 4.3 million tractors were in operation, and 1 in 20 rural households owned a tractor in 2011. They project that the market will grow at 7% to 8% per year, and only 19% of Indian rural farming households that can afford a tractor have as yet purchased a unit. In future, given the scarcity of farm labour and its high cost, most farm practices will become mechanized. So it will create a lot of demand for tractors. But the main problems faced by the tractor industry is to bring in appropriate technology to address mechanization needs of the large percentage of small and marginal farms of India where the farm size is below 2 Hectares. The small farmers in our country may not find it cost-effective to buy the conventional tractors due to their small land holdings. The average land holding of a small Indian farmer is less than 1 hectare for which the standard tractors of 35 horsepower are unsuitable. Among inputs, fertilizers are the most expensive, followed by labour. Does this income get the family through the month? For this, we compared income and consumption expenditure for farm households by the size of their landholdings.

In this scenario for a country like India a compact multi utility vehicle is inevitable. Though number of load carriers and agro based vehicles are available none is multipurpose utility vehicle. The basic idea of Musk truck relies in the fact that there should be an affordable vehicle that every peasant should have in their backyard which can also be used as a source of power.

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Input costs

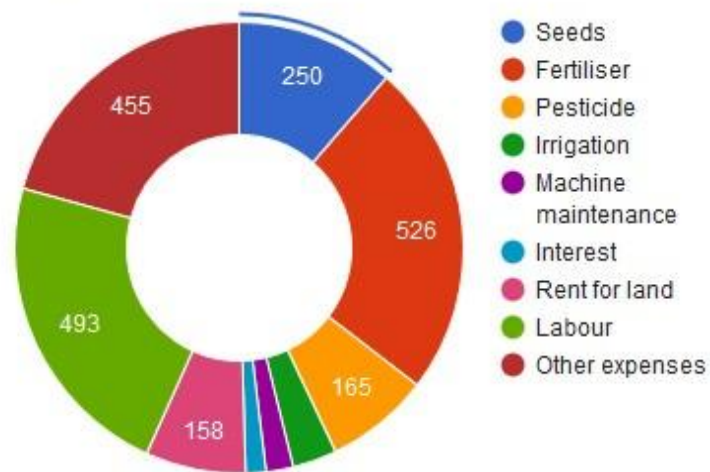


Figure 1 Input costs for Agriculture in India

Balancing a farm budget

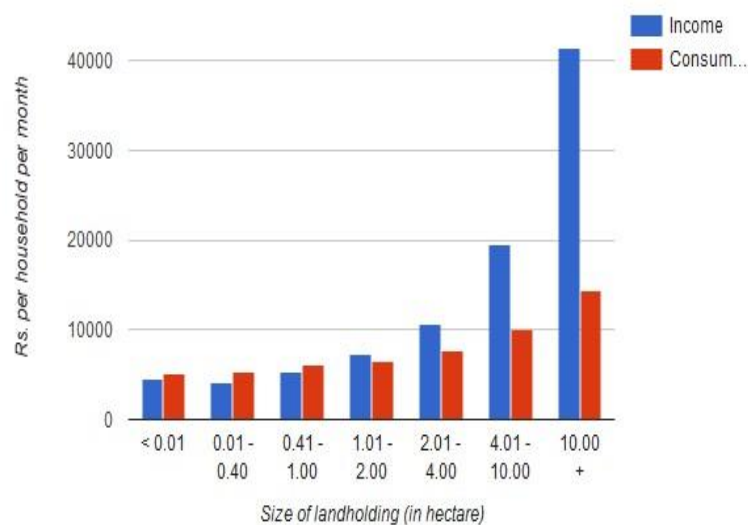


Figure 2 Income and consumption based on the landholding

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III. MODELING

Modelling of the muck truck is done using CATIA software. CATIA is a parametric feature based modelling software developed by Dassault systems.

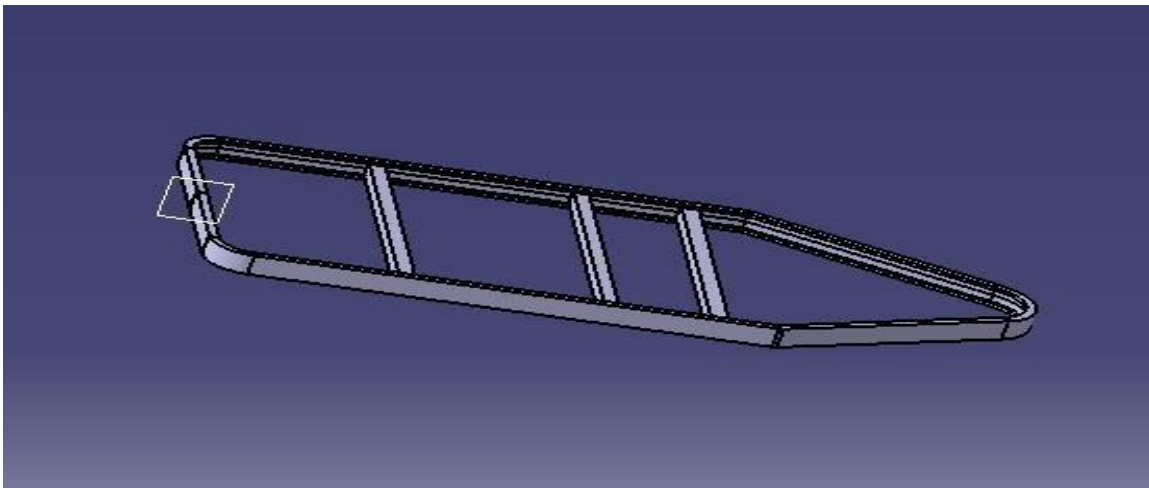


Figure 3 Chassis

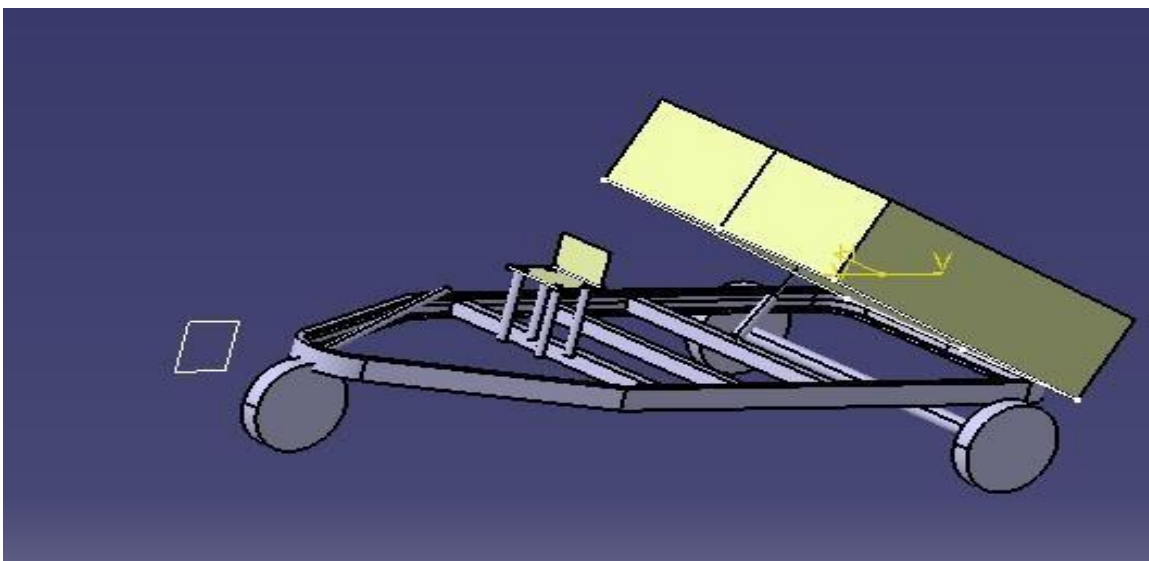


Figure 4 3D view Muck Truck

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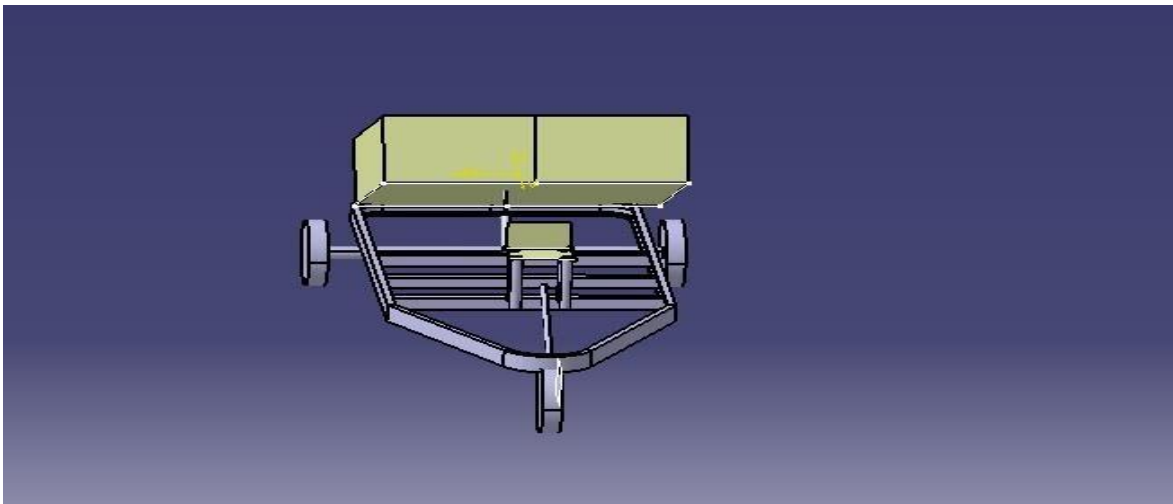


Figure 5 3D view from front

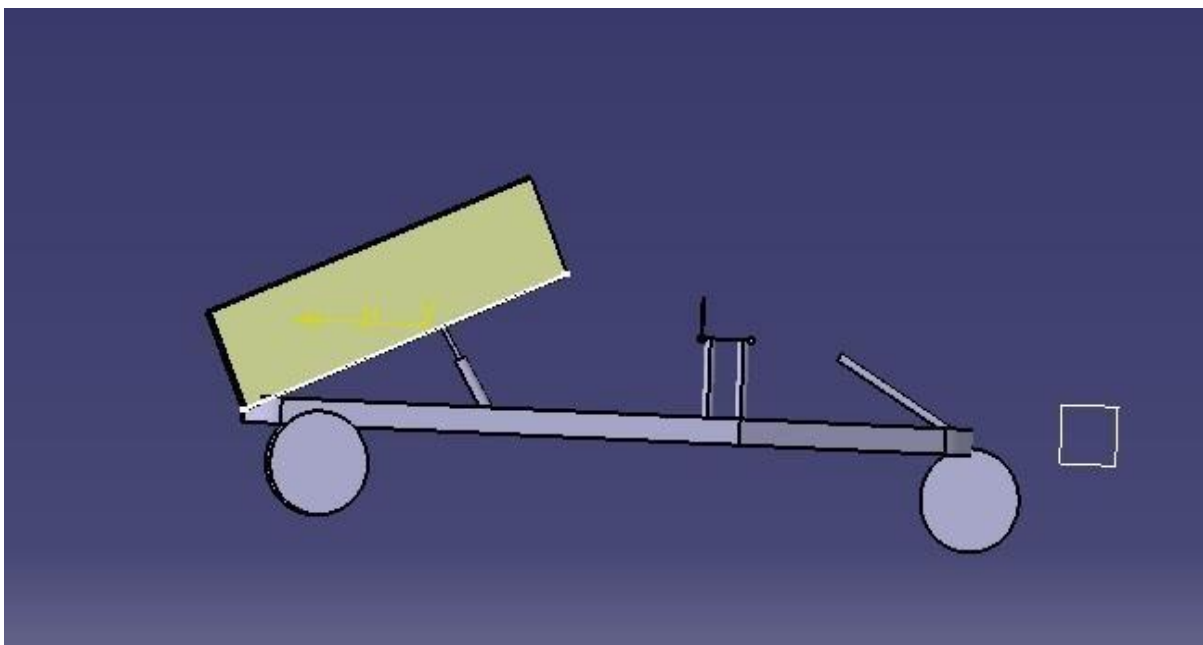


Figure 6 3D View from Side

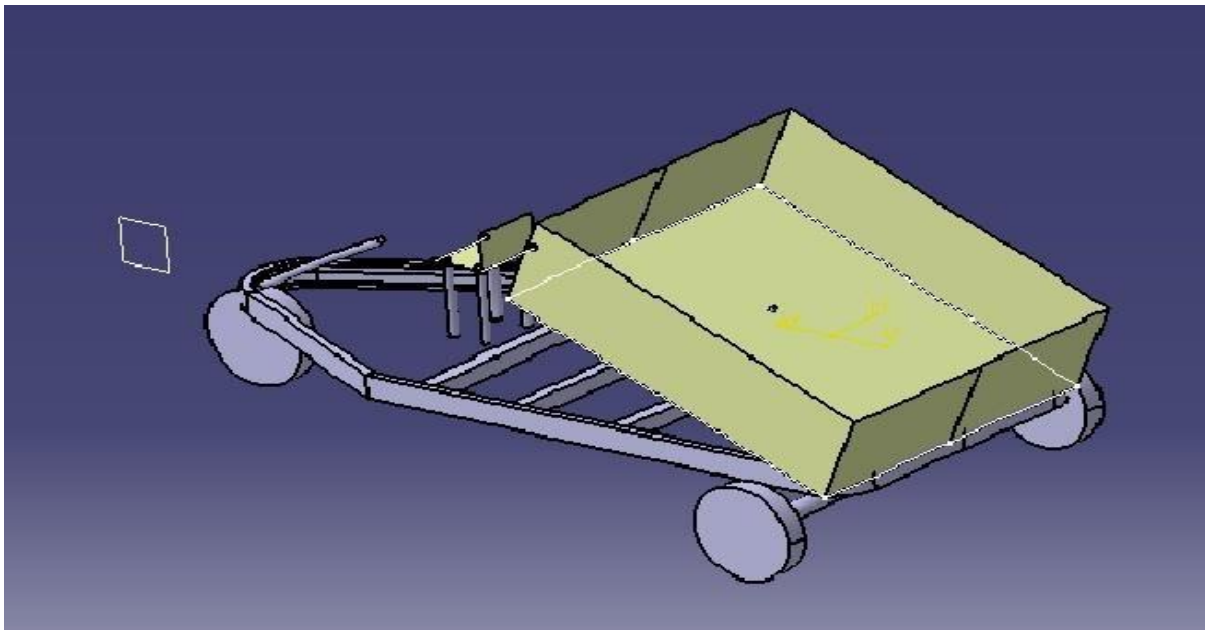


Figure 7 3D view from Top

IV. SPECIFICATIONS

The Truck has following Specifications.

Chassis: C-Section

Cross Bars: Square channel

Trailer Dimensions: 5' *5' *1'

Engine: 7.5 hp (4-Stroke Diesel Engine)

8.5 KW @ 4300 rpm

Gear Box: 4 speed manual transmission

Alternator: 5 KW (recommended)

Max. Load: 1000 kg with factor of safety

Max operating Speed: 50 kmph

V. DESIGN AND FABRICATION

Musk Truck has a simple construction as that of normal automobiles. Based on the need to drive in farmlands, we have altered few features of the vehicle for easy driving. The design of the vehicle is explained below.

5.1. Transmission System:

The Transmission system consist of the following

- Engine
- Gearbox

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- Propeller shaft
- Differential Unit

5.1.1. Engine:

The vehicle is powered by 7.5 hp diesel engine. Since diesel engines are more suitable for heavier applications it is preferred over high speed petrol engines. The engine operates on compressive ignition system with the help of Fuel injection Pump and Nozzle setup.

Engine Displacement	395 cc
Maximum Power	7 bhp @ 3400 rpm
Off-road Gradeability	18 %
Maximum Speed	50 kph

5.1.2. Gear Box:

Gear box also known as transmission is an integral part of the transmission system. It is coupled with the engine and has Main shaft and Counter shaft. With calculated Gear ratios the power and torque can be varied. In Musk Truck a 4-Speed Synchronesh Gear box is used for transmission. A clutch assembly is used to engage and disengage the gearbox from the engine.

5.1.3. Differential Casing:

The Differential Casing assembly is used to differentiate the power to two wheels. The power from the propeller shaft is differentiated to the rear wheels.

5.2. Chassis:

The main base of the vehicle is its chassis which bears the entire load. The chassis used here is C channel with rectangular flat crossbars.

Beside the main chassis a secondary frame type chassis is used to support the trailer. It is a combination of I type base and L section frames.

5.3. Hydraulic lift with Trailer:

The trailer has its design based on tractor trailer but the difference is that it is attached to the vehicle as like a truck. Supported by the crossbars the trailer made of sheet metal can carry up to 1.5tonnes. But considering factor of safety and hydraulic dipper systems the load is limited to one tonne. The chassis of the trailer is an I section and is used to lift the trailer. The hydraulic system similar to tractor is used to easily drop the load from the trailer. A rotary pump powered by engine acts as a hydraulic power source. Oil is filled in the sump and will acts as a hydraulic power transmitter. When required the pump is operated and with help of a hydraulic cylinders the trailer can be lifted to certain extent.

5.4. Steering System:

The steering subsystem is responsible for the control of the vehicle. In the design process of this process of this subsystem the goal is to achieve a small turning radius and steering stability. The speed of response and the driver's input are also prime factors for the design of the steering system.

Either conventional steering or hand bar system can be used optionally based on the requirement. As per the initial prototype of the truck only single wheel is preferred in the front, so it is ideal to use hand bar than steering. Brake levers and Gear lever is provided.

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5.5 Sprayer:

Sprayer is an important tool in agriculture which is used to spray pesticide and insecticide. Almost all the farmers are in need of this device. So a sprayer is included in the vehicle assembly with engine as its prime mover.

5.6 Grass Cutters:

Grass Cutter is one of the common tool to cut down excess grasses and weeds. It is so common appliance in most of the farmlands. Grass Cutters can be mounted to the extension of the prime mover that is the engine.

VI. MAJOR APPLICATIONS AND FUTURE REQUIREMENT

- It can be effectively used as an alternate for a tractor.
- It can be used as a power sources
- For a very small farm where 30 hp tractors are not necessary musk truck could be the greatest alternate □
Compact in size
- Less capital
- This could be used as an ATV (All-Terrain Vehicle) since its road clearance is high.
- The generator setup can be used an electrical power source at time of need and in remote places.
- The extended engine shaft can be used to derive power for various static agricultural equipments.
- The truck could be used to carry load of 1.5 tons instead of a lorry or tractor.
- Since the design of the vehicle is based on the need to be driven through farms it could be used to reach to places where tractors, Lorries and mini-trucks fail to reach due to the width of the wheel base.
- Could be used to carry coconuts from inside the farm and reduce the laborer expenditure.
- The truck could also be used to derive power to other moving agricultural equipment such as rotator and Grass Cutters.
- Serves as an “all use vehicle” inside the farms.
- The extension of the shaft provided can be used to drive motors and compressors in farms at the time of power cut.
- The hydraulic system could be used to unload the vehicle with ease.
- And also it saves the laborer charges spent to unload the vehicle.

VII. CONCLUSION

Being in a country whose backbone is agriculture; both the government and the people fail to care about the farmers who are the only sources of the food which we ought to eat daily. So this project would surely be helpful and useful to the farmers. And also since the vehicle could be used not only inside the farms it could also be used to carry loads. The main need of today's farms is lack of proper power supply and this project could serve as a temporary solution for the problem. Everyone wants to serve the society but when money interferes the only the paper wins and human hearts face failure. The same happens in case of farmers and we believe and hope that this project would be revolutionary in reducing the wages of load carriers inside the farm.

Thus this cost efficient truck which is available at the rate of a motorbike but more useful as a truck, tractor, generator, engine to run compressor, grass cutter, Pesticide sprayer etc. could be proposal to the government to provide this vehicle under subsidy to uplift the backbone of the country

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REFERENCES

- [1]Huang Yuhu;Qu Song;Bai Chenping;Qin Jianping;Li Gang; Effect of Closed Cover on Control of Muck Truck Spillage and Wind Erosion Dust Emission Journal of Environmental Hygiene 2013-06
- [2]John Phil Felburn Multi-purpose vehicle US 3966064 A
- [3]Sajjad Yaghoubi, Negar Ali Akbarzadeh, Shadi Sadeghi Bazargani, Sama Sadeghi Bazargani, Marjan Bamizan, Maryam Irani Asl Autonomous Robots for Agricultural Tasks and Farm Assignment and Future Trends in Agro Robots International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol:13 No:03
- [4]Gustavo Ovies, Andres Magaña, Alejandro Burgas Iván Pulido, Iván Williams, Bernardo Valadez CETYS Universidad Baja SAE Design Report Mechanical engineering division of CETYS Universidad, Campus Mexicali
- [5] J. A. Heraud and A. F. Lange, “Agricultural automaticvehicle guidance from horses to GPS: how we got here, andwhere we are going,” in Proceedings of the Agricultural Equipment Technology Conference, vol. 33, ASABE publication no. 913C0109, pp. 1–67, Louisville, Ky, USA,2009.