



# International Journal of Multidisciplinary Research in Science, Engineering and Technology

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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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# Design & Fabrication of Pneumatic Weight Lifting Trolley with Three Way Movement

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**ABSTRACT:** The material handling vehicles usually take more time to adjust its position, and unload at the exact location. The system now available is to unload material on back side. As considering the mines space available is less due to which unloading raw material on left or right side is not possible to take this as a problem multi directional trolley is the solution. This paper explains the design and fabricates a trolley with 3 directional unloading and lifting arrangement.

This mechanism is proposed to make the unloading easier in multi direction, only by providing three directional movements to the trolley rather than the vehicle in order to make the work more economic and efficient. The dumping will be done by using pneumatic cylinder; the compressed air will pass from the compressor to the direction control valve which will control the compressed air according to the required action (forward or backward stroke).

**KEYWORDS:** Pneumatic Cylinder Air Compressor Solenoid Valve, Actuator.

## I. INTRODUCTION

**The project objectives are:**

1. To design a mechanism of weight lifting trolley with 3 way unloading or we can say 3 directional unloading.
2. To fabricate a mechanism so that loading and unloading will be easy.
3. To lift the trolley using Pneumatic means.
4. To save time for setting up the trolley.
5. To fabricate the Trolley for medium application.

### Project background and Process

The material supply to civil and construction is provided through trucks, dumper etc. The dumper unloads the material in only one direction. But this incapability can be fulfilling by new method mechanism as the Multidirectional dumper. The material is unloaded in 3 directions and hence can be stated as "Multidirectional Dumper." The major outcomes of Multidirectional dumper has overcome space requirement which often result in road blocking. Hence, we have inversion in the existing mechanism providing the unloading in 3 ways. This mechanism prevents blocking of road, saves time and enhances productivity at lowest cost. Three direction dumper can be helpful for farmers, site construction garbage collectors as well for dumping gravels, sand etc. It also reduce the work while it can dump in three directions and also takes less time than traditional dumpers which reduce work time as well.

### Project Need:-

This idea was came from the visited a construction site few days ago. There we found that a dumper was unloading loose material such as sand, gravel, and dirt. A dumper is an integral part of any construction work and hence its role is important for completion of work on site. Typical dumper trucks can generally unload material only exactly of its back side. One thing was remarkable that on complicated locations such as on angular sides and directional sides (left and right) of dumper the unloading of material became quite difficult. In such conditions dumper truck remained ideal. It consumed extra. Dumpers are also the most common cause of accidents involving construction site and plant also. A typical dump truck is equipped with a pneumatically operated open box dead hinged at rear. The front of which can be lifted up to allow the contents to be deposited on the ground behind the truck at side of delivery only on solving the problem of unloading on directional sides of dumper. One of the problems is cited with dumper in the time & energy for operating the huge dumper in the proper direction to dump the material carrying in it hence the need of Multidirectional dropping dumpers which dump the material in any direction.





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### II. LITERATURE SURVEY

Michael Kay noted out the different ways of handling various materials. It involves “short-distance movement that usually takes place within the confines of a building such as a plant or a warehouse and between a building and a transportation agency”. It can be used to create “time and place utility” through the handling, storage, and control of material, as distinct from manufacturing (i.e., fabrication and assembly operations), which creates “form utility” by changing the shape, form, and makeup of material. It is often said that material handling only adds to the cost of a product, it does not add to the value of a product. Although it does not provide a product with form utility, the time and place utility provided by it can add real value to a product. Hemant and Nilesh point out that trucks, tippers and dump trucks are used to transport loose material from one place to another place at construction site in mines or in dump yards to accomplish the actual site requirement. The existing system available is to unload material on back side. As considering the mines space available is very less due to which unloading material on left or right side is not possible to take this as a problem multisided tipper tilting is the need of time. To overcome one side tilting of trolley, multisided tilting mechanism is come into focus. This will help to reduce the efforts to unload loose material one side of tipper. Proposed work is on placing three hydraulic cylinders each on front side, right side and left side of trolley to unload loose material on back side, left side and right side of trolley respectively. Some design modification is needed in existing system to work on multisided tipper tilting mechanism.

Ganesh Shinde studied the „Modern 3 Ways dropping dumper which has been conceived by observing the difficulty in unloading the materials. The survey in this regards in several automobile garages, revealed the facts that mostly some difficult methods were adopted in unloading the materials from the trailer. They have mainly focused on above difficulty. Hence a prototype of suitable arrangement has been designed. The vehicles can be unloaded from the trailer in three axes without application of any impact force. The Direction control valve which activates the ram of the hydraulic cylinder which lifting the trailer cabin in required side. Further modifications and working limitations will put this work in the main league of use. This concept saves time & energy which leads to efficient working.

Amboji Sudhakar studied that Tipper has lots of applications in today’s world. In industrial and domestic considerations, tippers can haul a variety of products including gravel, potatoes, grain, sand, compost, heavy rocks, etc. By considering wide scope of the topic, it is necessary to do study and research on the topic of tipper mechanism in order to make it more economical and efficient. In existing system, tipper can unload only in one side by using hydraulic jack or conveyor mechanism. By this research it is easy for the driver to unload the trailer and also it reduces time and fuel consumption. For making tipper mechanism with such above conditions both mechanisms namely hydraulic jack and conveyor mechanism can be used. But eventually it comes with question that how both systems can arrange in single set up? Answer to this question is nothing but this research work

Alley & McLellan of Glasgow studied hydraulics was being incorporated into truck mounted dump bodies relatively early on, in which record shows one of the first hydraulic dump bodies was the Robertson Steam Wagon with a hydraulic hoist that received power from the truck’s engine or an independent steam engine was developed another early hydraulic dump body in 1907 that was power-driven by steam.

### III. METHODOLOGY

#### Project Analysis

A small scale model has developed made up of ms box pipe chassis material, sheet metal, and pneumatically operated piston and cylinder arrangement. This pneumatic cylinder actuates when the high speed compressed air flows from the compressor to the piston and with the help of automatic actuators controlled by levers the required unloading direction of the trolley is unlocked to unload the material. A conventional trolley is mounted on a truck chassis and has an open dump box pneumatically operated and hinged at the rear of the truck usually by one or more pneumatic rams that raise the dump box to unload contents at a delivery site. This pneumatic cylinder arrangement is mounted in the underbody and is driven from a gear box power take-off. Pneumatic rams mounted in the underbody provide the capability of the dump body to tip the dump box on a three way basis, either to the left or right side or to the rear.

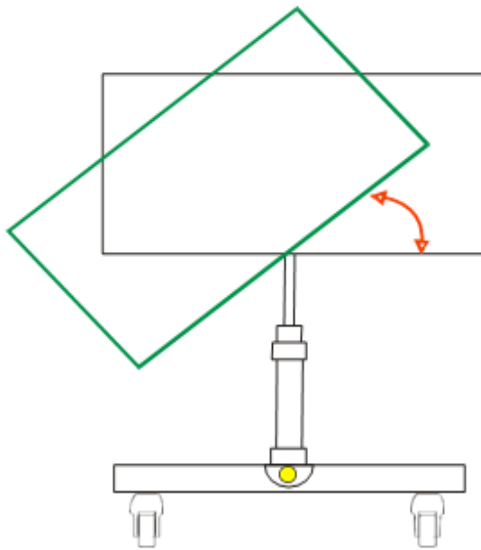


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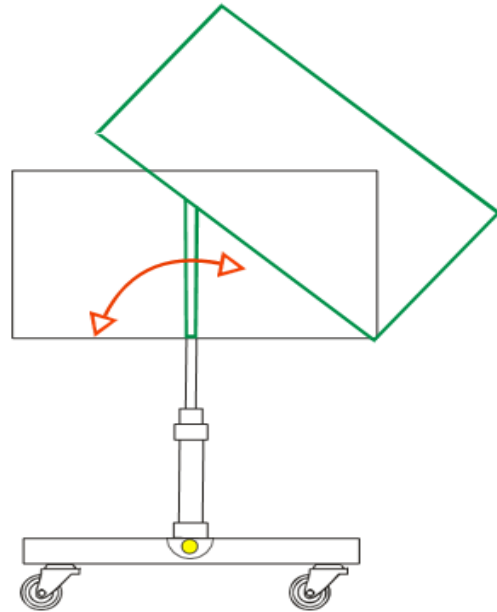
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### IV. WORKING

#### FOR LIFTING THE LEFT-HAND SIDE



#### FOR LIFTING THE RIGHT-HAND SIDE



#### FOR LIFTING THE BACKSIDE

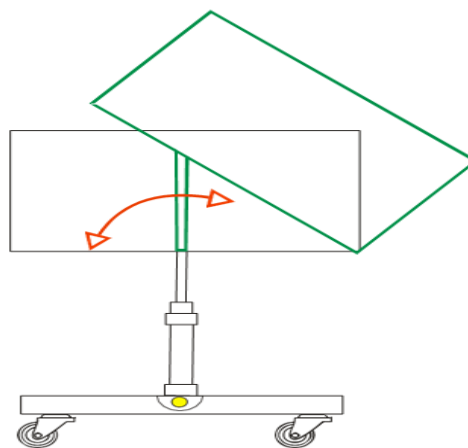


FIG: WORKING MODEL

#### Product Subsystems and Components

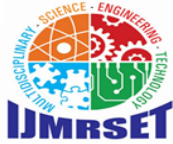
The main component of machine we used. We chose the specifications based on our calculations and the availability of the components in the market:

**Pneumatic Cylinder:** We are using Pneumatic Cylinder filled with compressed air for lifting the dumper trolley.

Specifications of cylinder are:

Length: 125mm,

Lifting Capacity: 15Kg



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- **Air Compressor:** We are using reciprocating type aircompressor to increase the pressure for Pneumatic Cylinder. Specification is:-
  - Displacement – 9.6 cc
  - 700rpm
  - Power - 1.5 hp
  - Tank Capacity- 135 ltrs
- **Solenoid valve:** Solenoid valve is anelectro mechanically operated valve.
  - We are using this valve for Engaging / disengaging the lock for lifting the trolley in either direction.
  - This valve will be attached with the Hinges.
- **Star Ball Joint Box Pipe Chassis**

### V. APPLICATION

- i) 3 directional dumper trolleys can be helpful for dumping gravel, sand, etc.
- ii) For farmers
- iii) Garbage collectors
- iv) To transport loose material from one place to another place at construction site in mines or dump yards to accomplish the actual site requirement.

### VI. CONCLUSION

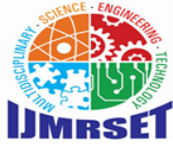
Till now we were using the trolley with single way dumping mechanism. After literature survey it is found that the traditional method used in trolley consumes a lot of time as well as energy. So these problems present in traditional method could be overcome by proposed mechanism. After few modifications, and working on disadvantages will put this paper work in the main league of use. This concept saves time and may lead to efficient working. The constructional work or the infrastructural work demands efficient and user friendly machineries which may lead to more and more use of the present paper work. Design of multidirectional dumper trolley mechanism will help unloading loose material on three side of the dumper as per the availability of space. Design of hinge is the most important part for side tilting of the trolley. Selection of material is also important factor for design. This concept saves time & energy which leads to efficient and effective working. This further line should be modeled using equations and an experimental agreement. The constructional work or the infrastructural work demands efficient and user friendly machinery which will lead to more and more use of three way dumper trolley. Thus we have developed a Modern Three directional Pneumatic dumper trolley which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any one can operate. By using more techniques, they can be modified and developed according to the applications

### VII. ACKNOWLEDGEMENT

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### REFERENCES

- [1] Md Ershad Ansari<sup>1</sup>, Akshay Navgire<sup>2</sup>, Automatic Reverse Breaking System for Trolley, International Research Journal of Engineering and Technology (IRJET), International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 04 | Apr 2019
- [2] Roshan A et. al, Fabrication of three axis pneumatic advance trailer, International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056, Volume: 06 Issue: 01 | Jan 2019
- [3] Dr.Lalit.K.Toke et al, Design and Fabrication of Pneumatic Three Axis Dumping Trolley, International Journal of Institutional & Industrial Research ISSN: 2456-1274, Vol. 3, Issue 1, April 2018, pp.61-63.



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- [4] Zhu, Weiping, and Mingzhe Li. "RFID Reader Planning for the Surveillance of Predictable Mobile Objects." *Procedia Computer Science* 129 (2018): 475-481
- [5] P.Jey Praveen Raj1 , P.M.Mohamed Fuge2 , R.Paul Caleb3 , G.Natarajan4, Design and Fabrication of Stair Climbing Trolley, *International journal of advancement in engineering technology, management and applied science*, ISSN No. 2349-3224, May-2016.
- [6] Chiagozie, Ononiwu G., and Okorafor G. Nwaji. "Radio frequency identification (RFID) based attendance system with automatic door unit." *Academic Research International* 2.2 (2012): 168.
- [7] Cardoso, Diogo Torres, Diogo Manfro, and Edison Pignaton de Freitas. "Study on the usage of UHF RFID for Passengers' Detection in Public Intelligent Transport Systems." *IFAC-PapersOnLine* 49.30 (2016): 267-271.
- [8] Kumari, Leena, et al. "Application of RFID in agri-food sector." *Trends in Food Science & Technology* 43.2 (2015): 144-161.
- [9] Zacharewicz, Gregory, Jean-Christophe Deschamps, and Julien Francois. "Distributed simulation platform to design advanced RFID based freight transportation systems." *Computers in Industry* 62.6 (2011): 597-612.
- [10] Zhang, Yunfeng, and Linjia Bai. "Rapid structural condition assessment using radio frequency identification (RFID) based wireless strain sensor." *Automation in Construction* 54 (2015): 1-11.





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