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360-Degree Smart Conveyor Belt

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Abstract—**In most of the heavy-duty industries to transfer a material from one point to another, for packaging purpose conveyors are used. They are also used in low and medium industries for the purpose of smooth working of assembly line, as they can transfer produced goods with the same quantitative flow. So, in all industry conveyors are widely used. Nowadays as the arena of production ischanging demand for the requirement of new types of special purpose conveyors are increasing. In the era of automation, the conveyor is on the verge of high demand, who can change its orientation according to the requirement of producer. In this project we are developing a 360-degree Smart conveyor with automatic ground clearance system which can move in all 3 degrees of freedom.**

Keywords— **Pneumatic, CAD, Conveyors.**

I. INTRODUCTION

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available and are used according to the various needs of different industries. There are Belt conveyor screw conveyor, chain conveyors as well as telescopic conveyors. Pneumatic cylinders are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like in hydraulic cylinders, something forces a piston to move in the desired direction. Thus, it produces a lift in desired direction. Air compressor is utilized to produce a pneumatic lift to increase the ground clearance whenever required otherwise it brings the chassis down to its position to have standard ground clearance by acting as an active suspension system.

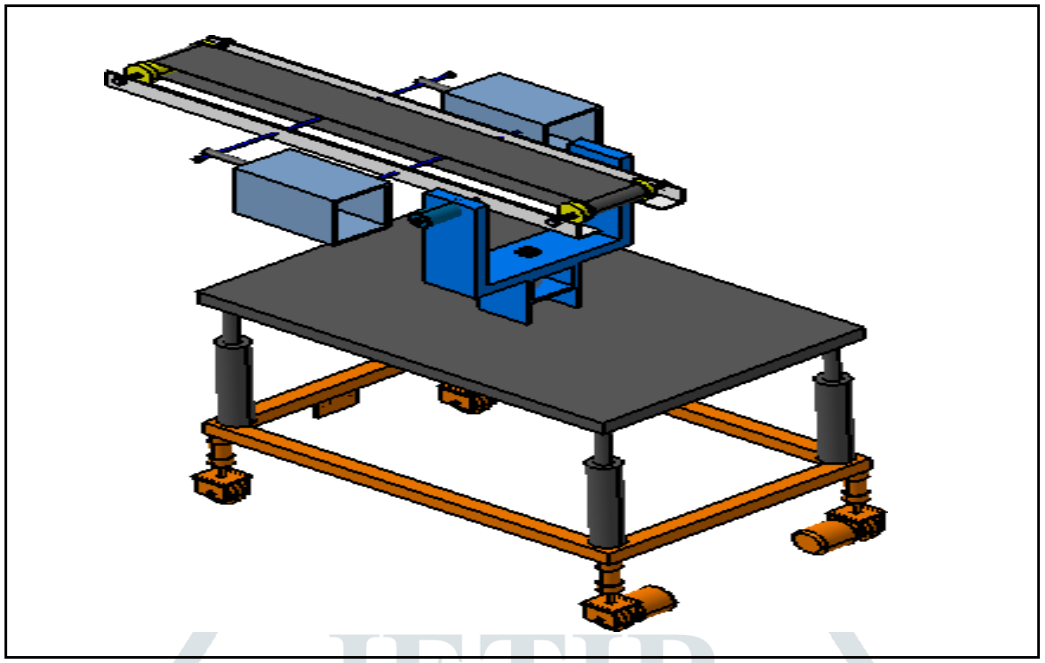
II. OBJECTIVES

- To analyse the performance of traditional conveyors and modify it into smart conveyor system.
- Design and develop modified system for extension and retraction in both planes.
- Reduce loading and unloading time as well as human efforts in term of man hours.
- Develop compact system that consumes minimum storage space and minimum energy.
- To design and fabricate automatic ground clearance adjustment.
- To make system is very user friendly.
- The automatic in-built pneumatic system is used to lift the chassis from the ground without human efforts and time.
- Pneumatic lifting technique system is used to provide higher ground clearance at the time of rough roads and speed bumps.

III. METHODOLOGY

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used. Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software. The design of geometric models for object shapes, in particular, is occasionally called computer-aided geometric design (CAGD). 3D "dumb" solids are created in a way analogous to manipulations of real-world objects (not often used today). Basic three-dimensional geometric forms (prisms, cylinders, spheres, and so on) have solid volumes added or subtracted from them as if assembling or cutting real-world objects. Two-dimensional projected views can easily be generated from the models. Basic 3D solids don't usually include tools to easily allow motion of components, set limits to their motion, or identify interference between components.

IV. DESIGN



V. CALCULATIO

NSFor the design of conveyor, we are considering some data,

1. We are designing the belt conveyor for light utility, so we took its material as Rubber.
2. Density of rubber=1522kg/m3
3. Minimum thickness of belt=1.5mm
4. Length of the conveyor(L)=2.5 feet=762mm
5. Mass of the belt=1.7396 kg
6. Coefficient of friction between bottom surface of the belt and top surface of the rollers having length 200 mm (u)=0.4(Empirical experimental value)
7. RPM of the rollers (N)=10
8. Mass of the objects placed on conveyor= (2*0.5) =1 kg. Here we are placing two boxes of 0.5kg

mass.Now, the linear speed of belt conveyor is calculated as, V=2*3.14*N/60 V=1.047 m/s

Now total vertical force applied by packages on belt conveyor.

F= (Total mass of boxes) *(Acceleration due to gravity) = (1) *(9.81)

F1=9.81 N

Total weight of the belt= (Mass of belt) *(Acceleration due to gravity)F2= (1.7396) *(9.81)

F2=17.065 N

Total belt pull= [(Total weight of all packages) + (Total weight of the belt)] *(Coefficient of friction between belt and rollers)

= [(9.81) +(17.065)] *(0.4) F =10.755

Now the total required power to move the conveyor belt is calculated as,

P= (Belt pull) *(Belt speed) =10.755*1.047 N-m/s

P=11.255 Watts----------A

Now we have to give more power than A to move the belt, so select the drive accordingly. Here we have taken 12V&2A motorwhich produces 24-Watt power,

so, our design is safe.

Design of Motor placed at BottomWe know the total mass of the system is 15 kg.So total vertical force=15*9.81 =145.15N

Hence, we have to take this total vertical force in consideration to design the bottom motor, which is going to rotate the uppersection in 360 degrees.

Now the total required torque, T=F*R = (145.15) *(0.225)

=33.108 N-m.....B

Here R is the distance of the extreme point of upper frame from center point where motor is mounted. Now for 12V&2A motor,with 5 rpm the supplied torque is calculated as,

T= [24*60]/ [2*3.14*5] =45.83 N-m----------C

As, C>B our design is safe.

So, we have taken 12V&2A Motor.

Design of the pneumatically operated cylinderTake material of the rollers as M.S. So, density of M.S.=7860kg/m3

Mass of two rollers with diameter 0.02m and length=0.1m=0.492kg.
Now we know the total weight of the conveyor with objects placed on the it,
F = [Weight of the objects] + [weight of the belt] + [Weight of the rollers] + [weight of the supporting frame]F = (9.81+17.065+4.826) +39.24
F =70.941 N
Now we are supplying P=4 Bar=0.4 N/mm2We know that, P=F/A
As the total weight is distributed on two cylinders, O.4= (35.4705)/A A=14.18 mm2
So, diameter of the cylinder=4.25 mm.
We have taken standard available size cylinder with diameter=10 mm
Here stroke length of the cylinder depends upon the amount for which you have to increase the height of the belt conveyor, herewe are taking it 75 mm.
So, length of cylinder is L=75.
Now volume of the cylinder=A*L = (14.82) *(75)V=1111.5mm3
So, we have taken a standard cylinder size as, Diameter=10 mm, Length=75mm

VI. CONCLUSIONS

In conclusion, conveyor belts have played a vital role in facilitating the movement of goods and materials in manufacturing and logistics industries. They offer a reliable and efficient way to transport heavy loads and can be customized to suit specific needs and requirements. In addition, conveyor belts can help reduce labor costs, improve safety, and increase overall productivity. In summary, conveyor belts have proven to be an essential tool in the manufacturing and logistics industries, and their continued development and innovation will be critical to meeting the demands of modern supply chain logistics.

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