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ANALYSIS OF A RELIABLE SIZE BASED AUTO SELECTIVE CONVEYOR SYSTEM

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ABSTRACT

ATLS vehicle loading technologies significantly reduce the manpower required on the shipping and receiving docks, eliminate product damage, accidents, and ergonomic injuries related to lift-truck operation. Generally, products can be loaded quicker and product density is increased resulting in more payload per shipment which reduces shipping cost, using a loading automation system. Loading automation is often the key component to achieve complete plant automation. In this thesis, a system of Mechanical Conveyor belt has been developed and proof of concept has been tested for further testing and trial purpose. The main reason behind proposed system is to automate small scale industries which are not able to afford expansive automation systems.

I. INTRODUCTION

Different methods such as fork lifting, use of bucket elevators, conveyors systems, crane, etc. has been identified for lifting or transporting bulk materials or products from one place to another in the manufacturing industries depending on the speed of handling, height of transportation, nature, quantity, size and weight of materials to be transported. The objective of this research work is to provide design data base along with prototype hardware for the development of a reliable, cheaper and efficient automated belt conveyor system that will reduce cost and enhance productivity while simultaneously reducing manual labour to workers operating them by selecting material on the basis of height. Conveyor system is a mechanical system used in moving materials from one place to another and finds application in most processing and manufacturing industries. It is easier, safer, faster, more efficient and cheaper to transport materials from one processing stage to another with the aid of material handling equipment devoid of manual handling. Handling of materials which is an important factor in manufacturing is an integral part of facilities design and the efficiency of material handling equipment add to the performance level of a firm. Conveyor systems are durable and reliable in materials transportation and warehousing.

History of Conveyor belt: Conveyor belt are designed for the sequential organization of workers, tools or machines, and parts. The motion of workers is minimized to the extent possible. All parts or assemblies are handled either by conveyors or motorized vehicles such as fork lifts, or gravity, with no manual trucking. Heavy lifting is done by machines such as overhead cranes or fork lifts. Each worker typically performs one simple operation.

According to Henry Ford

The principles of assembly are these:

(1) Place the tools and the men in the sequence of the operation so that each component part shall travel the least possible distance while in the process of finishing.

(2) Use work slides or some other form of carrier so that when a workman completes his operation, he drops the part always in the same place—which place must always be the most convenient place to his hand—and if possible have gravity carry the part to the next workman for his operation.

(3) Use sliding assembling lines by which the parts to be assembled are delivered at convenient distances.

A conveying system is an automated system of conveying something from one area to another. It utilizes mechanical energy, often via a system of belts and pulleys, thereby avoiding the necessity of human or animal labour while simultaneously achieving highly predictable, repeatable speeds and performance levels. Conveying systems may be designed to transport solids or liquids and may move massive materials, lightweight materials, or anything in between.

II. LITERATURE REVIEW

Chun-HsiungLan (2003): This study is deals with The design of a multi-conveyor system in supporting machine loading and unloading has become crucial to management. However, through the mathematical model proposed in this paper, this issue becomes realistically and concretely solvable. This study not only mediates the concept of balancing the number of parallel machines, the conveyor speed for adjacent pallets, the overall relevant costs and the determination of the number of conveyors into the objective, but also develops a two-staged method to optimize the combined problem to reach a maximum profit.

Daniel J Fonseca, Gopal Uppal & Timothy J Greene (2004): The major objective of this paper is to illustrate how Conveyor equipment selection is a complex, and sometimes, tedious task since there are literally hundreds of equipment types and manufacturers to choose from. The expert system approach to conveyor selection provides advantages of unbiased decision making, greater availability, faster response, and reduced cost as compared to human experts. This paper discusses the development of a prototype expert system for industrial conveyor selection. The system, which was developed on Level V Object, provides the user with a list of conveyor solutions for their material handling needs along with a list of suppliers for the suggested conveyor devices.

Alspaugh M. A.(2004) presented latest development in belt conveyor technology & the application of traditional components in non-traditional applications requiring horizontal curves and intermediate drives have changed and expanded belt conveyor possibility. For Examples of complex conveying applications along with the numerical tools required to insure reliability and availability will be reviewed. This paper referenced Henderson PC2 which is one of the longest single flight conventional conveyors in the world at 16.2611 km. But a 19.123 km conveyor is under construction in the USA now, and a 23.52 km flight is being designed in Australia. Other conveyors 30-50 km are being discussed in other parts of the world.

A.J.G. Nuttall, G. Lodewijks& A.J. Klein Breteler (2006): This paper presents a simplified approach to modeling the rolling contact phenomena that occur at the surface of a wheel driven rubber belt. The main aim of this approach is to determine the rolling friction due to hysteresis and the relationship between traction and slip in wheel driven belt conveyors. The resulting model is an expansion of an existing linear viscoelastic model consisting of a three parameter Maxwell model combined with a Winkler foundation that is used to determine the rolling friction due to hysteresis in a conventional conveyor with a flat belt.

III. MATERIALS AND METHODOLOGY

In the process or manufacturing industry, raw materials and products need to be transported from one manufacturing stage to another. Material handling equipment are designed such that they facilitate easy, cheap, fast and safe loading and unloading with least human interference. For instance, belt conveyor system can be employed for easy handling of materials beyond human capacity in terms of weight and height. This chapter discusses the design calculations and considerations of belt conveyor system for press machines, in terms of size, length, capacity and speed, roller diameter, power and tension, idler spacing, type of drive unit, diameter, location and arrangement of pulley, angle and axis of rotation, control mode, intended application, product to be handled as well as its maximum loading capacity in order ensure fast, continuous and efficient movement of material. The successful completion of this project work is help to the development of an automated belt conveyor system which is fast, safe and efficient. It is aimed to reduce human effort and at the same time increase the productivity & accuracy levels that cannot be achieved with manual operationsAn assembly line is a manufacturing process (most of the time called a progressive assembly) in which parts (usually interchangeable parts) are added to a product in a sequential manner to create a finished product much faster than with handcrafting-type methods.

System Design

The robot design created in this lab was ca-pable of detecting and picking up objects from a conveyer belt. The robot could also differenti-ate between the weights of different blocks and position them in different places depending on those weights. Here is a thorough analysis of the different parts involved in the design of the robot.

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System Architecture

To achieve this goal, the design made use of an infrared sensor connected to one end of the conveyer belt. Once the infrared sensor detected the block, it was picked up at the other end of the conveyer belt by a gripper connected to the end of a two-link arm. The double link arm was controlled using Proportional Integral Derivative Controllers on the joint angles. The desired arm angles values are calculated using the Infrared Sensor value to figure out the desired gripper position. This position can then be translated in corresponding angle values using inverse Kinematics. The process for weighing the block made use of the Digital-to-Analog Converter (DAC) found on the RBE De-velopment Board. The RBE Development Board made use of the Atmel ATmega644P microproces-sor. The Vex interface on the board was used to run the Vex motors in the conveyer belt and the gripper.

Sensing Strategies

As previously discussed establishing a sensing strategy is an essential part of the automated sort-ing system. The three main parts of the sensing system include a method of determining the objects location, a way to sense joint angles of the arm, and a way to measure the weight of the object that has been picked up. In trying to sense where the block is located along the width of the conveyer belt, a GP2D12 Sharp IR Sensor is used. Based on its specifications it has the required range and an adequate resolution for the application. As seen in the review of system hardware the IR sensor is positioned on the same side of the conveyer as the arm and more than 10cm away from the edge of the conveyer belt. Since the IR range finder cannot measure distances less than 10cm that offset is required for the use of this particular sensor. With the IR sensor producing an analog voltage as its output the only step required after configuring the ADC is to linearize the data. This was done using a combination of experimentation and the suggested function provided in the data sheet.

Material handling involves movement of material in a manufacturing section. It includes loading, moving and unloading of materials from one stage of manufacturing process to another. A belt conveyor consists of an endless and flexible belt of high strength with two end pulleys (driver and driven) at fixed positions supported ‘by rollers.

IV. RESULTS AND CONCLUSIONS

Table 1. Speed 15 R.P.M. Using of centre shaft D.C. motor and Torque = 10Kgf

Sr.No.	*Distance between two axis of shafts , (in mm)*	*Weight as sample , (in Kg)*
1	*500*	*8*
2	*1000*	*7.5*
3	*1500*	*7*
4	*2000*	*6.5*
5	*2500*	*6*
6	*3000*	*5.5*

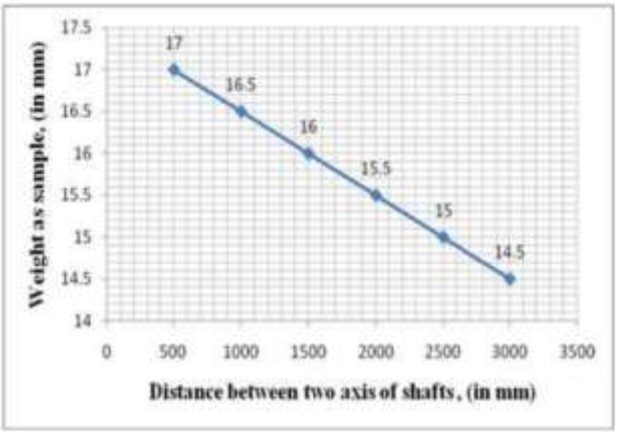

Figure 1. Speed 15 R.P.M. Using of centre shaft D.C. motor and Torque = 10Kgf

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Table 2. Speed 15 R.P.M. Using of centre shaft D.C. motor and Torque = 15Kgf

Sr.No.	Distance between two axis of shafts , (in mm)	Weight as sample , (in Kg)
1	500	12
2	1000	11.5
3	1500	11
4	2000	10.5
5	2500	10
6	3000	9.5

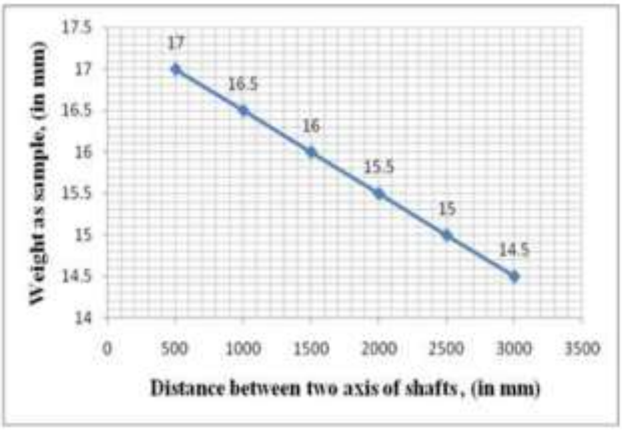

Figure 2. Speed 15 R.P.M. Using of centre shaft D.C. motor and Torque = 15Kgf

Table 3. Speed 15 R.P.M. Using of worm drive type gear box based D.C. motor and Torque = 20Kgf

Sr.No.	Distance between two axis of shafts , (in mm)	Weight as sample , (in Kg)
1	500	17
2	1000	16.5
3	1500	16
4	2000	15.5
5	2500	15
6	3000	14.5

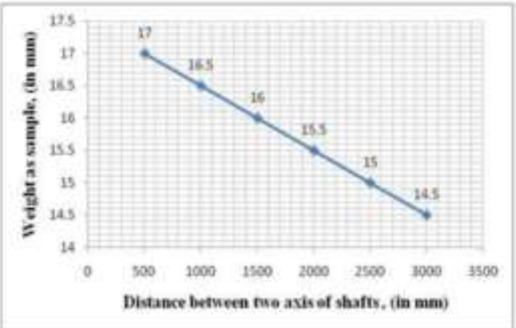

Figure 3. Speed 15 R.P.M. Using of worm drive type gear box based D.C. motor and Torque= 20Kgf

V. CONCLUSION

Today there are different types of conveyor belts that have been created for conveying different kinds of material available in PVC and rubber materials.The belt consists of one or more layers of material. Many belts in general material handling have two layers. An under layer of material to provide linear strength and shape called a carcass and an over layer called the cover. The carcass is often a woven fabric having a warp & weft. The most common carcass materials are polyester, nylon and cotton. The cover is often various rubber or plastic compounds specified by use of the belt. Covers can be made from more exotic materials for unusual

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applications such as silicone for heat or gum rubber when traction is essential. A conveyor belt can be a slide and be controlled by the force of gravity. Material flowing over the belt may be weighed in transit using a beltweigher. Belts with regularly spaced partitions, known as elevator belts, are used for transporting loose materials up steep inclines. Belt Conveyors are used in self-unloading bulk freighters and in live bottom trucks. Belt conveyor technology is also used in conveyor transport such as moving sidewalks or escalators, as well as on many manufacturing assembly lines. Stores often have conveyor belts at the check-out counter to move shopping items. Ski areas also use conveyor belts to transport skiers up the hill.

VI. REFERENCES

[1] Vivek A. Bandebuche "Parts Handling Systems for Machine Shops of Small and Medium Enterprises" International Journal of Engineering Research and General Science Volume 1, Issue 2, December 2013 ISSN 2091-2730.
[2] Devendra Kumar, R.K. Mandloi "Analysis & Prospects of Modification in Belt Conveyors" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622
[3] Imran S.Khan" Study And Analysis Of Roller Conveyor In Material Handling" IJESRT ISSN: 2277-9655 (I2OR), Publication Impact Factor: 3.785
[4] I. A. Daniyan , A. O. Adeodu and O. M. Dada "Design of a Material Handling Equipment: Belt Conveyor System for Crushed Limestone Using 3 roll Idlers Journal Of Advancement In Engineering And Technology
[5] SanketKolte, RohitKhandre, U. V. Patil "Design And Manufacturing Methodology For Conveyor" International Journal of Science, Technology & Management Volume No.04, Issue No. 05, May 2015 ISSN (online): 2394-1537
[6] Aniket A Jagtap "Design Of Material Handling Equipment:Belt Conveyor System For CrushedBiomass Wood Using V Merge Conveying System" Int. J. Mech. Engg. & Rob. Res. 2015 ISSN 2278 – 0149 Books:
[7] V.B.Bhandari "Design of Machine Element," Tata McGraw Hill publishing company, eighth edition (2003).
[8] R.S.khurmi&J.K.gupta "Design of machine elements."Eurasia publishing house(pvt.)Ltd,fivth edition.
[9] R. K. Jain, Machine Design (Khanna publication- 2013).
[10] Conveyor Equipment Manufacturers Association (CEMA). "Belt Conveyors for Bulk Materials" pp. 200-205.
[11] BB-Process Industries (2000). Variable-speed drives for Belt Conveyor Systems. pp. 1-7.
[12] Vanamane, S. S., Mane, P. Int. Journal of Applied Research in Mechanical Engineering. Vol. 1(1) pp. 48-52.
[13] Taiwo, A., Jekayinka, S. O. Mechanical Maintenance and Repairs. Orsome Ventures Ltd, Ibadan. pp. 50-70.
[14] Anath, K. N. Design and Selecting Proper Conveyor Belt. Int. Journal of Advanced Technology. Vol. 4(2) pp. 43-49.
[15] Fenner Dunlop "Conveyor Handbook" (2009). Conveyor Belting Australia. pp 1-70..

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