Review on Design of Conveyor

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Abstract— Belt drive systems offer freedom to position the motor relative to the load and this development permits reduction of the conveyor inertia. It also facilitates quick response when employed in robotics applications. The main advantage of conveyor belting we usually use is that, we can avoid material spillage to a considerable extent. This is noticeable once fine-grained materials like sand, cement, cement concrete, coal, etc. are transferred with their help. Other applications in food processing units, bottling plants, and wood log processing companies also make the study on economization of conveyor belt transfer as an important one.
Key words: Conveyor

I. INTRODUCTION

A conveyor system is a common piece of mechanical handling instrumentality that moves materials from one location to a different. Conveyors particularly helpful in applications involving the transportation of serious or large materials. Conveyor system enable fast and economical transportation for a good type of materials. They even have common shopper applications, as they found in supermarkets, an airports, constituting the final leg of item/ bag delivery to customer's.

II. LITERATURE REVIEW

In "An Enhanced Simulation Model for Dc Motor Belt Drive Conveyor System Control" review a belt drive conveyor system (BDCS) is a typical energy conversion system from electrical to mechanical energy. It is widely used in agricultural machines, electric generators, robotic arms, machine tools, and textile machines by Andomachi G. Katsioulaetal[1].This "Development of An Economical Digital Control Method For A Continuously Running Conveyor Belt" paper illustrates the functioning of a stop controlled conveyor belt using an LDR sensing arrangement, an easier and economical way of controlling a normally running conveyor belt. Rubber type conveyor belt is used in this analysis since it is more commonly used and cheaper [2].A simulation model for a belt drive conveyor system is developed and bestowed during this paper. The model is able to take into account the inherent high non-linearity imposed by the real world's system such as friction, vibration and resonance components[1].In this paper discuss the main advantage of a stepper motor is the ability to realize precise positioning and speed control without applying feedback (speed, position) [3].Limited use of stepper motors is power and speed, but in practice their use is fully justified in inexpensive machine tools with a CNC system designed for processing wood, plastics, light metals and other medium speed materials[3].

III. DESIGN OF CONVEYOR

Conveyor systems have become an inevitable part in an automated industry or firm. Conveyor systems find their majority applications in manufacturing industries, transportation sector, workshops, warehouses and many other similar firms, where transportation of bulk quantities is necessary. A belt conveyor system is one of the conveyor systems implemented today. Belt conveyors are the most used powered conveyors since they are highly versatile and less expensive. Conveyor belt, pulleys and electric motors constitute the important parts of a conveyor belt system. Basic schematic of a belt conveyor system is shown in figure 1.

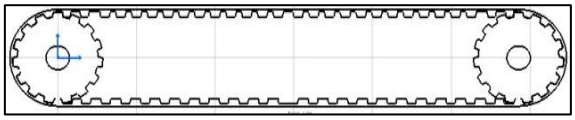

Fig. 1(a): Conveyor Belt

Fig. 1(b): Conveyor Belt

The properties of belt material, its weathering, and other mechanical deformations due to strain under different working conditions are considered. All these require smooth start and stop characteristics.

IV. BELT SELECTION

While it might sound basic, improper belt chaise remains a typical downside in conveyor systems, decreasing belt life and creating potential hazards. Belt conditions such as cupping and camber are often a result of improper specification, which leads to spillage, belt tracking problems, and improper loading.

Belt choice should be based mostly not solely on the system length, width, material conveyed and angle of incline, but also on the parasitic drag of components such as idlers, bearings, belt cleaners and skirt board seals.

In specifying the right belt, thicker is not always better. It should be selected to provide the proper pounds per inch of width that it is intended to carry, the optimum trough angle, aspect ratio and cover material. While many suppliers are simply middlemen who will sell whatever stock belt is best suited to the application, a better match will usually be obtained by using a quality software program to design and select the belt according to specific criteria

The belt is made of steel plates as components, connected together using hinge joints. The applications of such types of belts are in high temperature operation, machine tool chip removal, die-cast operations, packaging operation, stamping

Operation, etc. These types of belts are less expensive and find application in metal working and material handling.

V. SELECTION OF MOTOR

The current trend in the development of electric drive systems is the replacement of mechanical transmissions and kinematic connections by electric ones that is the fusion of an electric motor with a working element (actuating element). The main advantage of a stepper motor is the ability to realize precise positioning and speed control without applying feedback (speed, position). The limitation within the use of stepper motors is power and speed, but in practice, their use is entirely justified in inexpensive machine tools.

For low-power position actuators, depending on the speed of the working element and the amount of movement, one cause either collector motors (single-phase asynchronous, direct Current) or stepper motors.

Stepper motors have low dynamic characteristics. They are widely used in low-budget machines for processing wood, plastic, chipboard, light metals and other materials that do not require high performance. In these applications, the main advantage of stepper motors is important - low price and fairly good accuracy.

Typically, the stepper motor is controlled by an electronic circuit, and its power is supplied from a DC power source. Stepper motors are used to control the speed of rotation of conveyor.

Stepper motors are widely used in much industrial application especially in the applications that need high precise control positions. Stepper motor is used in most application which requires discrete movement. So stepper motor represents one of the simply and economically in most sensitive applications.

Stepper motor can be considered as brushless motor designed specifically for digital signal input then it is accepting pulses directly from the microcontroller or any other electronic circuit and move accordingly. Another advantage for using stepper motors is their ability to hold their load steady once the required position is achieved.

In small stepping mode the stator flux can be considered smoother than other modes like as half or full steps. From experimental work we conclude that this type of control leads to less vibration, and makes noiseless stepping possible down to near to zero Hz.

Also experimentally we notice that the smaller the smaller the step angles leads to better positioning possible. This leads to increase the system performance, and less system complexity and less cost, compared to full and half step driving modes. Also it can be used to damp the noise and resonance problems.

VI. CONTROL OF CONVEYOR

Block diagram of the system that is being developed for the study is shown in figure 6. Comparator, Converter, low speeds motor, conveyor belt, sensing elements is the main parts of the circuit developed.

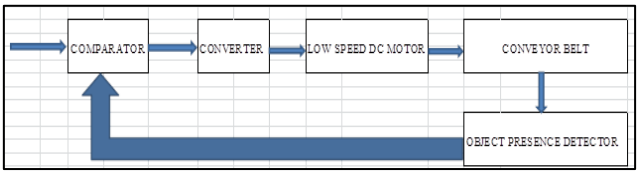

Fig. 2: Block Diagram

The circuit components of the system are discussed in detail. A 5V DC feeds the control side of the system. This includes the electrical relay, an LED acting as a light source, comparator, light dependent resistor based potential divider arm no.1 (PDA1) and potential divider arrangement, armno.2 (PDA2). The comparator used here is LM358 Op-amp IC. The first arm, i.e. PDA1, is a variable divider which changes the amount of voltage available at the inverting terminal to which its central point is connected and the secondarmPDA2 divides the control voltage into two equal halves of 2.5 V each, and this feeds the non-inverting terminal. Arelay acting as the control (on-off) switch is present, whose functioning depends on the excitation experienced by the coil in turn controlled by the comparator output. The power circuit comprises mainly of the low speed dc motor, energized accordingly by a 12V regulated dc supply. Availability of this12 V depends on the energized or de-energized conditions of the relay coil. Fig.

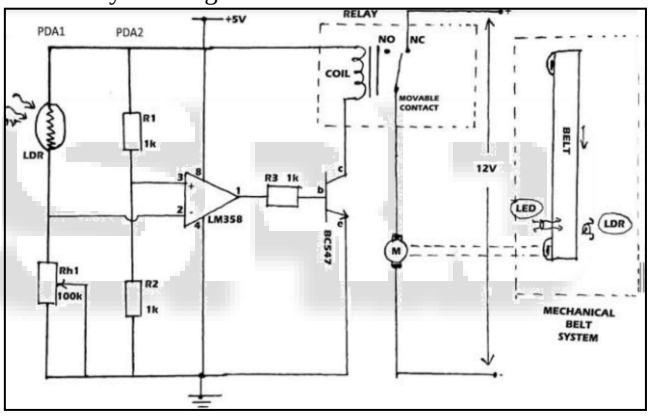

Fig. 3: Light Dependent

PDA1 operates depending upon the light reaching the LDR. The LED and LDR are placed near the belt such that, when an object is conveyed and reaches the final position, the light From LED does not reach the LDR. Both of these elements are also part of the control circuit. The differential voltage amplifier function of the op-amp is utilized here. The circuit diagram for this application is shown in figure 3.

The system is designed such that, the LED remains ON when the conveyor belt is running. This implies that the voltage at the inverting terminal of the OP-AMP is high, making the output voltage of the OP-AMP as zero or allows value. The low or zero value of the OP-AMP output maintains the transistor in the turn-off state. Normally, the position of the movable contacts is closed which makes the supply voltage of 12 V available to the motor terminals. If the object conveyed on the belt approaches the final position in the conveyor belt, the light from the LED will not fall on the LDR. Comparatively lesser current flows throughPDA1 and as a result, the voltage available at the no inverting terminal of the OP AMP is more. The magnetic attraction due to the energized coil pulls the movable contact to the normally open

position, in turn switching the motor off. The prototype for the study is shown in figure 8.

VII. CONCLUSION

Different types of conveyor belt systems employed in industries are studied in this paper. Also an economical digital control mechanism is developed. A low speed motor is good for the use in the conveyor belt system. The control strategy developed in this paper is a simple one since it uses the basic electronic components like OP-AMP, transistor, relays etc. Thus energy cost and maintenance cost can be saved, if a proper control strategy like the one presented in this paper is implemented. This makes the proposed system an economical one. Limiting the use of stepper motors is power and speed, but in practice their use is fully justified in inexpensive machine tools with a CNC system designed for processing wood, plastics, light metals and other medium speed materials.

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