Automated Segregation Integrated Conveyor

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Abstract
The paper deals with the design and the fabrication of automated segregation integrated conveyor. The main purpose of this equipment is segregation object based on its shape and colour in material handling sectors. This equipment deals with material inspection, transfer, segregation and its various application. This can be facilitated by using a webcam to sense the colour, shape and segregate automatically by using a DC motor.

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.

The various departments involved in an industry are the design, production, assembly and quality. The major portion of the industries' success depends upon the quality department. They inspect the machined product and separate them based on the acceptable level and rejection. Quality Control and Inspection are the most important things in the factory design. Automation plays a vital role in mass production of a product, the machining operations decides the sequence of machining. The machines designed for producing a particular product are called transfer machines. Conveyor Automation is a specialized activity for a modern manufacturing concern. It has been estimated that about 60-70% of the cost production is spent in material transferring activities.

This project combines the usage of conveyor system and the sensors for inspecting the products that are manufactured in an industry. The sensors sense the dimension of the work piece and sends signals to the control unit which in turn actuates the pneumatic cylinder through the solenoid valve. The control unit controls the actuation mechanism based on the signals received by them from the sensors. This project is a semi-automated system where the partial human effort is also involved. The project can be made fully automated where the construction of the project and the fabrication becomes more complicated.

II.   OBJECTIVES

- To develop a system capable of conveying and automatically detect and segregate finished as well as semi-finished commodities in a production line and serve as a part of automatic storage and retrieval- system.
- To integrate the system with Raspberry Pi.
- To study the feasibility of this in large and small scale industries.
- To develop a better material handling technique with improved efficiency and reduced errors with minimum cost.
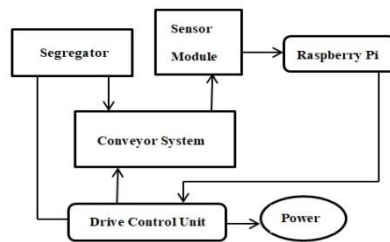

III. PROPOSED SYSTEM

Figure1. Block Diagram of Proposed System

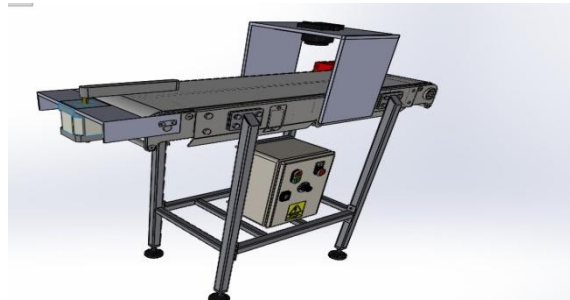This system consists of a conveyor embedded with automated detection assisted segregation mechanism.

Figure2. Conceptual Design

IV. COMPONENTS AND DESCRIPTION

- Permanent Magnet D.C. Motor.
- Raspberry pi.
- Conveyor Belt and Roller.
- Battery.
- Bearing with bearing cap.
- Frame Stand.

4.1 DC. MOTOR (PERMANENT MAGNET)
An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

4.2 RASPBERRY PI
The Raspberry Pi 4 Model B (Pi4B) is the first of a new generation of Raspberry Pi computers supporting more RAM and with significantly enhanced CPU, GPU and I/O performance; all within a similar form factor, power envelope and cost as the previous generation Raspberry Pi 3B+. The Pi4B is available with 1, 2 and 4 Gigabytes of LPD DR4 SD RAM**.**
- Quad core 64-bit ARM-Cortex A72 running at 1.5GHz
- 1, 2 and 4 Gigabyte LPDDR4 RAM options
- H.265 (HEVC) hardware decode (up to 4Kp60)
- H.264 hardware decode (up to 1080p60)
- Video Core VI 3D Graphics
- Supports dual HDMI display output up to 4Kp60

Figure3. Raspberry Pi 4

4.3 CONVEYOR BELT AND ROLLERS

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.
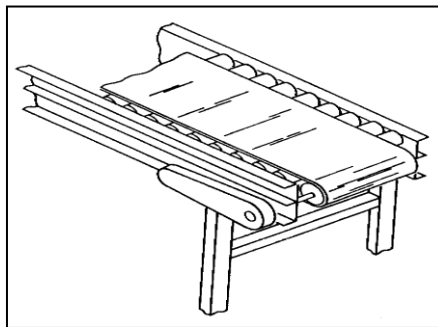

Figure4. Conveyor System

4.4 BATTERY

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern. The battery used here is the specification of 12V, 9000Ah lead acid maintenance free.

Figure5. Battery

4.5 BEARING

A ball bearing usually consists of four parts: an inner ring, an outer ring, the balls and the cage or separator. To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting. The bearing used here is bearing no: 6202, inner bore: 15 mm, outer diameter:35 mm.
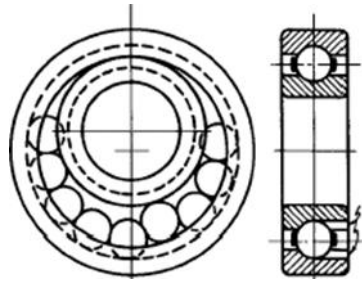
Figure6. Bearing

4.6 FRAME STAND

This is made up of M.S L-Angle material. This is used as a body of the vehicle. The front and rear wheels are fitted bellow this bottom frame with the help of end bearings.

V. WORKING PRINCIPLE

The Automated Segregation Integrated Conveyor which we fabricate is easy to construct and simple in operation. The 12 volt battery is used to drive the permanent magnet D.C motor. The two conveyor roller is fixed to the two ends of the frame stand with the help of an end bearing (6202) with bearing cap. The conveyor roller shaft is coupled to the D.C. permanent magnet motor with the help of spur gear mechanism. This total arrangement is used to transfer the material from one place to another place with the help of conveyor. This sensor is used to check the incoming material is coming or not.

If the material is coming this signal is given to the raspberry pi control unit. Raspberry pi control unit is automatically stop the conveyor and scan the color of the work piece with the help of webcam. If the colour and shape are checked by the webcam and if wrong color and wrong shape that will be rejected by the dc motor rejection mechanism is fixed in the bottom of the webcam arrangement. This rejection piece is collected by the collecting tray. If the colour and shape are checked by the webcam and if correct color and correct shape that will be allowed to move the conveyor and these pieces are collected by another tray.
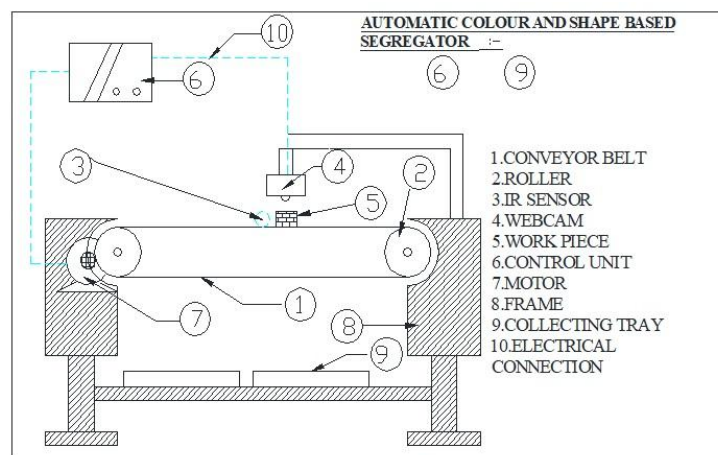

Figure7. Automated Segregator Integrated Conveyor

VI. CONCLUSION

The Automated Segregation Integrated Conveyor system is working with satisfactory conditions and it helps to easily identify the products with defects. By using more techniques, they can be modified and developed according to the applications. This equipment can be developed into a fully-fledged system with a number of sorting criteria to meet with more complex product varieties. The control system can be enhanced with feedback system.

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