Product Detection and Separation System

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ABSTRACT

During packaging process for cold drink or food products, verification of capping is important to avoid loss of material or packaging of faulty product. This project proposes the design and development of low cost automatic conveyer system to eliminate products with different thickness on production line. This proposed system gives the convenient approach of automatically detecting the thickness of object passing on conveyer. Belt type conveyer will be driven using DC motor and 12V supply. With the help of ultrasonic sensor, arduino will continuously measure thickness of objects passing on conveyer. When thickness is more than predefined value arduino will send signal to servo motor and servo flapper will move the object out from conveyer line. In case of faulty product, arduino will turn on the red LED. Whereas in regular cases, green LED will remain on. DC motor based conveyer system will run continuously & independently. Complete system will be powered through power supply.

KEY WORDS: Conveyer system, Thickness Detection, Production, Arduino nano, motors.

INTRODUCTION

Production is important part of every industry. Where as to maintain quality of product is necessary. Quality of production depends on multiple factors. It can be improve by reducing mistakes or crosschecking the product. Design of verification structure is one of the important task. Today there is more competition in industrial world. To remain on good position in this big competition, any organization has to manufacture high quality, defect free products at optimum cost. Human workers cannot do same work 24x7 like a robot, because of physical and mental limitations. Therefore there are more chances of doing mistakes by humans.

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. In today's fast moving, highly competitive industrial world, a company must be flexible, cost effective and efficient to survive. Industrial automation has acquired importance owing to the ever-increasing demand for more productivity, better quality standard, better accuracy and optimum utilization of available resources and manpower. The main aspect of the project is to automate the process of transportation of the materials to the respective press machines.

Here proposed system will be consisting of a conveyer belt driven by DC motor as shown in figure. There is one ultrasonic sensor connected to arduino. This will measure thickness of object passing on conveyer. If the thickness is bellow predefined value, arduino will send signal to servo motor and motor will separated the object using flapper.

Problem Statement

To maintain quality of production is necessary in every industry. Quality of production depends on multiple factors. Can be improve by reducing mistakes or crosscheck the product. People cannot do same work at every time like a robot, because of physical and mental limitations. Therefore there are more chances of

doing mistakes by humans. With automation, human mistakes can be eliminated. In cold drink or food package industry, product packing is essential for many products. Capping process for product is automatic, so it's necessary to check product thickness and other parameters before packaging to avoid loss of material. Also separation of product is necessary whenever multiple products are running on single convayer.

Objectives of Project

During production and packaging process, verification of product size and shape is important to avoid loss of material or packaging of faulty product. This project proposes the design and development of low cost automatic conveyer system to product thickness verification and separation on production line. Aims and objective of system will be:

- To design conveyer system which can separate the objects of different thickness.
- Thickness setting must be adjustable.
- Eliminate the excessive time required for sorting the product.
- To reduce man power.
- To reduce the overall cost.

Scope of the project

During manufacturing process, same conveyers is shred for transferring different objects from one place to another. But at the end, these products need to be separated. There are multiple parameters which needed to be consider depending on situation or product. Also faulty product detection and separation mechanisms can be clubbed on same conveyers. For this a conveyer with detection and separation mechanism is the solution. Here prototype of conveyer system for material handling and separation is designed

Methodology

This proposed system gives the convenient approach of automatically detecting the thickness of object passing on conveyer. Belt type conveyer will be driven using DC motor and 12V supply. With the help of ultrasonic sensor, arduino will continuously measure thickness of objects passing on conveyer. When thickness is more than

predefined value arduino will send signal to servo motor and servo flapper will move the object out from conveyer line. In case of faulty product, arduino will turn on the red LED. Whereas in regular cases, green LED will remain on. DC motor based conveyer system will run continuously & independently. Complete system will be powered through power supply.

SYSTEM DESIGN

Conveyer System Design

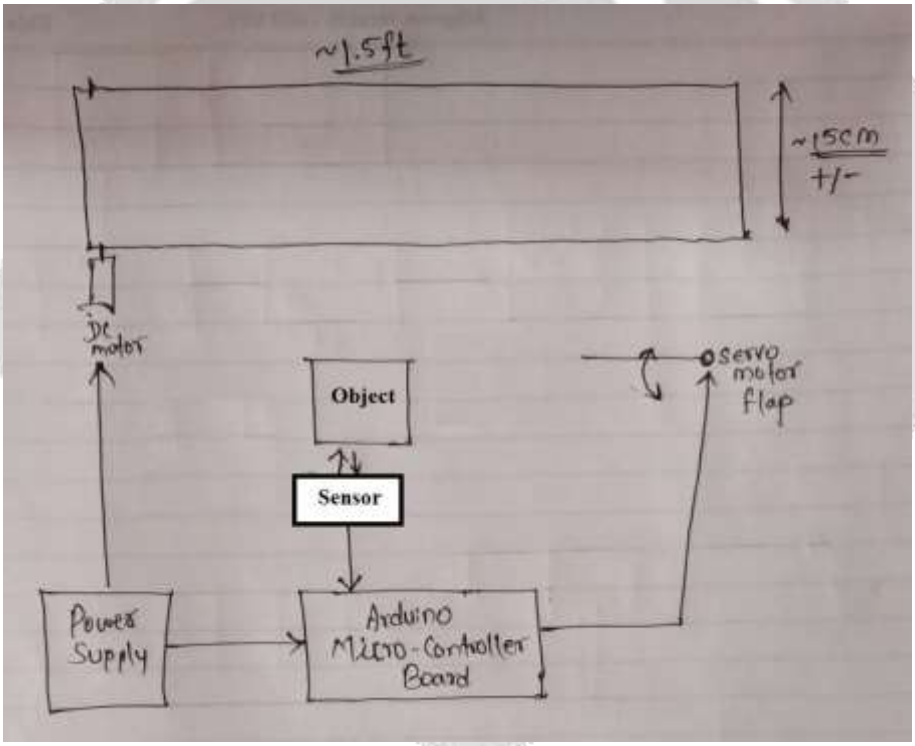

Figure 1: Basic Structure of Conveyer

System will be consisting of a conveyer belt driven by DC motor as shown in figure. There is one ultrasonic sensor connected to arduino. This will measure thickness of object passing on conveyer. If the thickness is bellow predefined value, arduino will send signal to servo motor and motor will separated the object using flapper.

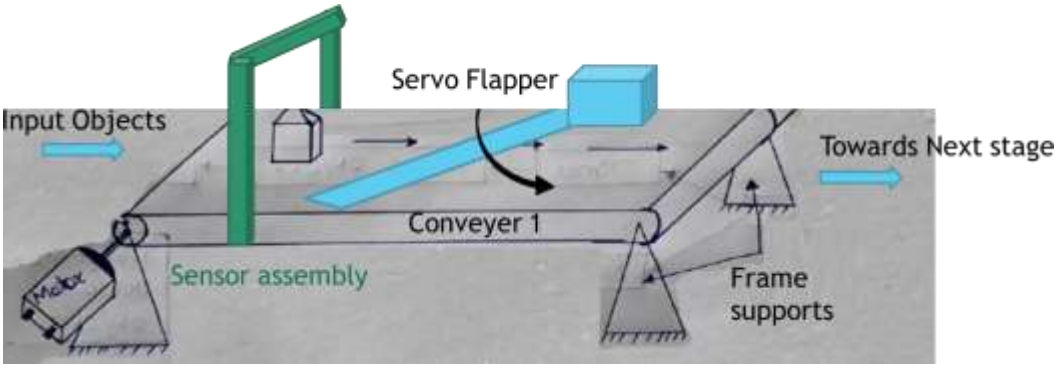

Figure 2: Mounting of Sensor Assembly and Servo Flapper

Electronic System Block Diagram

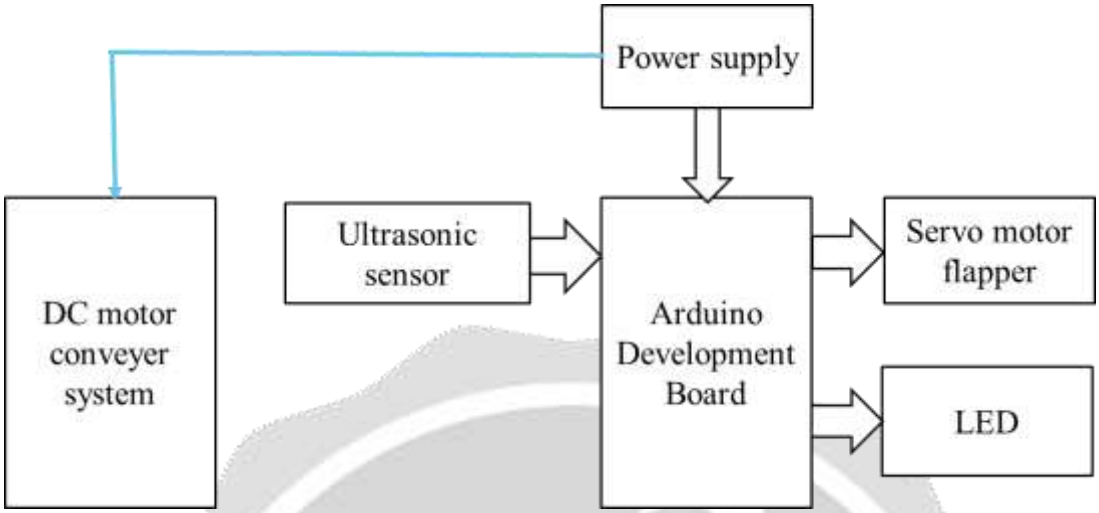

Figure 3: Electronics System Block Diagram

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EXPERIMENTAL VALIDATION & CALCULATIONS

Test Object Details

Figure 4 Test Object Used

Test object used are paper boxes of different height and width. Instead of measuring width by side, it is measuring from top side. Threshold set is 50mm. So the objects with height above than 50mm will be push out of conveyer. Whereas objects with height less than 50cm will be continue.

Belt Capacity Calculation

By considering a roller diameter of 5cm, circumference of roller will be

Circumference of roller = 2 x pi x r

= 2 x 3.14 x 2.5

= 15.7cm

So at a speed of 30rpm and circumference of 15.7cm, distance cover by roller is,

Distance per sec =(rpm x circumference)/60

=(30 x 15.7)/60

= 7.85cm

Let consider the average length of product as 7cm. So at a production speed of 1 product per 2 sec, distance between two products is

Dist. Between product= Total distance travel in 1 sec- width of 1 product

= (2x 7.85) – 7

= 8.7 cm

So by considering average spacing between two products as 8.7cm, and product width is 7cm & length of belt is 45cm So maximum number of products belt can carry will be,

No. of products = Belt length/ (Product width+ Spacing between products)

= 45/ (7+5.56)

= 2.86

So belt will carry maximum 2 products at a time. Now, to calculate total weight on belt,

average weight of test objects is 20gm. So total weight on belt will be,

Total weight on belt = Number of products x Wight of each product

= 8 x 20gm

= 160 gm.

So from above calculation, to carry weight of 160gm along 45cm, motor of 30rpm and 2kg/cm torque is suitable.

CONCLUSION

Conclusion

To maintain quality of product is important for every manufacturing industry. To make quality check automatic & time efficient, design of sensing structure is one of the important task. With the help of this project, product capping in packaging industry will be verified on running conveyer system. This will save the time for quality checking.

In this phase of project, we studied different systems designed till now.

By studding need of market, we decided specification and system components. This project will increase the accuracy and reduce the wastage of raw material by sending faulty products back to production. Though this system need to be faster and there is need to work on sensing method to make system more reliable.

The performance of the project with different thickness of objects is verified and ensured. Objects with higher thickness are identified and thrown out of conveyer and objects with thickness less than set value are passed. Time required to sorting of object is saved, Also by automation the man power required is decreased.

Advantages

- Improve speed of production by making testing automatic
- Make the verification process automatic.
- Low cost & reliable system
- Automatically remove faulty jobs and collect perfect jobs
- 24*7 automatic operations.

Applications

- In packaging section
- On maintenance line
- On replacement line
- In pharmaceutical industry

Future Scope

In this project, product thickness inspection system is implemented. Though product separation parameter can be different and more than 1. This project can be made better with some other verification methods like colour, weight, material type.

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