

Automatic Box Sorting Machine

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Abstract— This paper contains the design and use of box sorting machine It saves the sorting time and reduces cost. Automatic box sorting machine uses pneumatic actuation to sort boxes. Boxes are sorted by barcode which is decoded by raspberry pi. Raspberry pi gives signal to motor driver to stop and start motor accordingly. There are proximity switches with every cylinder to sense the box position which again send signal to raspberry pi. Relay is used to interface between motor driver and motor. Relay used is of solid relay type. Raspberry pi uses 5 MP camera to capture the image which has to be decoded. The main objective of this system is to save the time and labour cost.

Key words: Sorting Machine,

I. INTRODUCTION

Now a day it is a trend in globalization to have automation in almost all industries. Automation in sorting systems increases accuracy, saves labour cost and time. Sorting systems are of various like conveyor system, pick and place robotic arm etc. The sorting explained in this paper is conveyor sorting system which uses raspberry pi to sort the boxes. Raspberry pi uses the camera with 5MP to capture the image and decode it.

II. PROBLEM STATEMENT

In all types packaging and manufacturing industries it necessary to sort out different types of material according to its weight, size, shape etc.

To overcome this problem in industries conveyor sorting system is came into picture. In conveyor sorting system the material to be separated is kept on conveyor line and inspected using sensors with respected sorting system like if the material is to be sorted by weight then strain gauge should be there to test the weight of material and sort it. In most industrial situations where a sorting process is needed, so the manpower is required. It is very hectic to do the same work with whole concentration full day, there may be some chances of error.

III. OBJECTIVES

The objectives of this project are

- 1) To increase accuracy in sorting system.
- 2) To increase speed of sorting.
- 3) To make system cost effective.
- 4) Methodology

Figure 1 illustrates the procedure of box sorting which uses raspberry pi as controller in the system. It gives step by step procedure of box sorting. Automation includes reading of barcode from cover of box with camera of raspberry pi, pneumatic actuator which sort the boxes, solenoid valve to control pneumatic cylinders.



Fig. 1: General Block Diagram

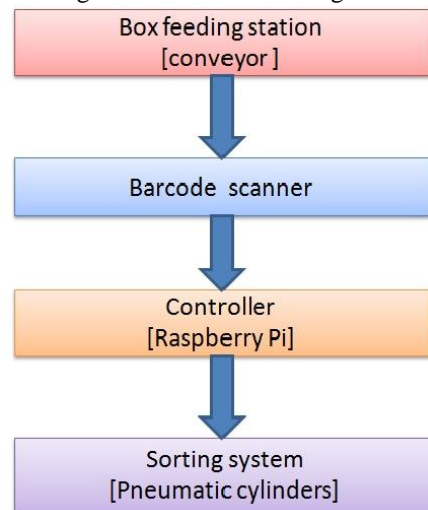


Fig. 2: Flow Chart of Process

Figure 2 illustrates the process of box sorting, as first the box is on the conveyor is scanned by camera of raspberry pi and sends it to micro-controller. Then the microcontroller (raspberry pi) decodes the barcode and send signal to solenoid valve of the pneumatic cylinder 1,2 or 3. Depending upon the programme out of three one pneumatic cylinder gets actuate and box is sorted.

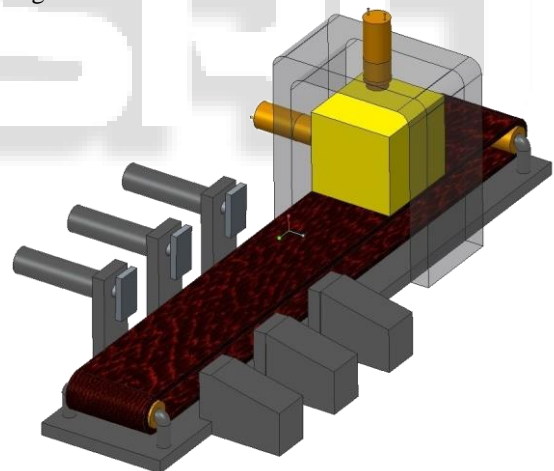


Fig. 3: 3-D Model of Setup

The figure 3 shows the 3D model of the setup. It is the first stage of the project in which three dimensional modeling is done. It consist of three systems, first is sensors, barcode scanner second controller and third is pneumatic system. At first station the barcode from the box is scanned and send signal to controller which decodes the image and activates pneumatic system to sort boxes.

Pneumatic system consist of compressor, pneumatic cylinder, direction control valve and flow control valve. Pneumatic cylinder used are double acting and the solenoid direction control valves are used to operate these cylinders. Manually operated flow control valve is used to monitor the flow of compressed air. Figure 4 shows pneumatic circuit.

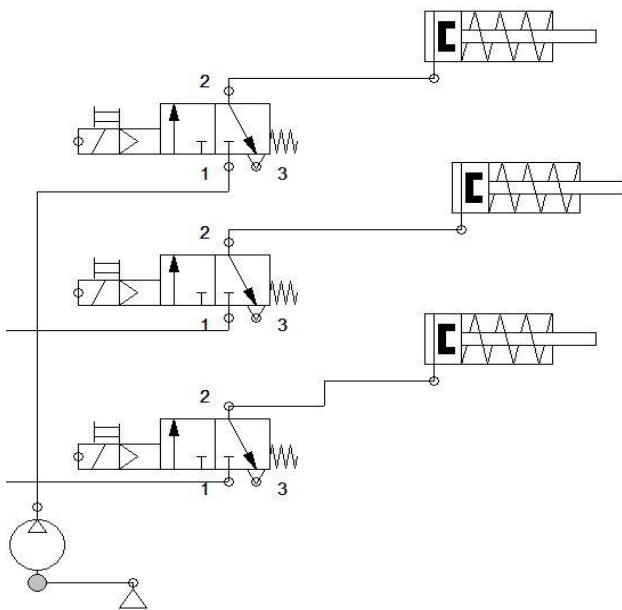


Fig. 4: Pneumatic System

IV. EXPERIMENTAL RESULTS

The figure below i.e. fig.5 shows the prototype of box sorting system. Test has been taken on system and also ensured that all components are functioning properly and installed properly. Based on the experimental results and recorded data, five trials are done to measure the amount of time for each sensor to activate. The time recorded for each trial to sort the boxes.



Fig. 5: Experimental Setup

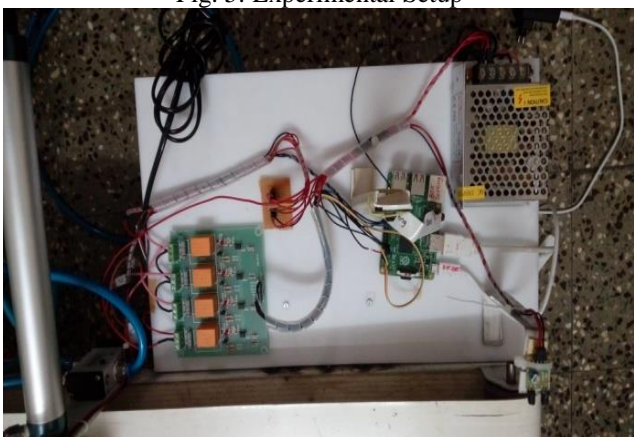


Fig. 6: Controller Setup

Experimental results of sensors are listed below.

Trial	Proximity sensor	Camera (Barcode scanner)	Controller (raspberry pi)	Time
1	On	Off	On	10
2	Off	On	On	11
3	On	On	On	9
4	On	On	On	9
5	On	On	On	7

Table 1: Sensor experimental result

Variation can be seen in the time along with every trial. Time reduces with every trial taken as every equipment works properly.

V. CONCLUSION

In most of the industries the sorting system run by PLC which is expensive and only can be used in large industries. This system is less expensive as microcontroller is used. The system is compact and quick in operation so can be used in small scale industries, ware houses, carrier services. Raspberry pi is used so the controlling is easy and effective. The response time of raspberry pi is less so image detected and decoded in short period of time. The sorting speed is 12 box/min i.e. 720 box/ hour, it is faster than existing system.

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