Smart System for Sorting Defective Parts and Distribution Line   using PLC

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Abstract — *With the advancement of technology, the researchers are working in this domain at a faster pace to eliminate various tiresome tasks of mankind to make life simpler. In the era of automation, among all kinds of industries, autonomous cost-effective sorting systems with better accuracy have become a necessity. We are designing and fabricating a prototype – "smart system for sorting defective parts". It is a compact low cost system which eliminates time and energy consuming sorting process in industries where production is on large scale. The main aim is to make a cost effective and energy efficient system for the industries in such a way that it can be used for various products. The automated object sorting system is very much useful in packaging industries. The system will be programmed with ladder logic which will enable it to decide and choose the defective objects amongst the products manufactured.*

1. INTRODUCTION

Automation delivers convenience and saves a lot of time. This system will automate the entire sorting process. In old days, using manual labour for sorting was easy and convenient. But due to advancement in technology and increase in production, it becomes necessary to automate the entire process by using sensors so as to avoid the human errors as far as possible.It aims to reduce the time, effort and manpower needed for sorting the objects. This way industry can increase its manufacturing rate.

1.1 Motivation

In day to day work in industry many men and women spend their time for sorting different objects and separting out the defected ones. This task can be done by an automated system..The system is to be cost effective.The target are the small scale industries who can also afford it for daily work. Another aim is to make a system effectively programmable which reduces human intervention and avoids accidents in the industry. . To save time and efforts along with wastage of energy put in this tedious work, the idea of smart system was suggested.

1.2 Background

Nowadays sorting process takes a lot of time and effort and is a very tedious process. A large man power is required in industry to sort and find the defected objects. To reduce the number of errors and increasing accuracy, industries usually involves many people at each subsequent stage in production to check whether a particular product meets the design requirements or not.

There are many sorting systems designed for such purposes but the main drawback is that they are very expensive and power consuming which are not affordable to all types of industries. Though there are other systems available in the market, they would be manually controlled or if automated and cheap, it would not give us precise output. To develop an autonomous, cost effective design giving precise output and using minimal amount of energy is proposed.

2. LITERATURE SURVEY

For automated sorting, proximity sensors or camera along with controller can be used. But using these components doesn't justify the smartness.[1] the camera can be used instead of sensors to use machine vision or image processing as a criteria to sort the objects along with raspberry Pi which makes it more compatible. [2] Mostly these type of systems are designed for the industries where reliability and efficiency should be more. For this purpose PLC can be used along with the sensors to achieve a particular task since PLC has several advantages over controller to sustain in industrial environment. Some of them are

High reliability, strong anti-interference ability, could withstand harsh industrial environments and ladder logic is used for programming. Moreover to keep the record of production, HMI can be used. [3]To detect the presence of object, photo electric sensors are used along with PLC. For sorting the objects, single acting cylinders are used, DC motors used for pushing the object from conveyor belt to sorted bin. Height of object is used as a criteria for sorting.[4]Sorting of objects is

done on the basis of three criteria, two different weighing non metallic objects available in different colours. To push the objects, flipper mechanism is used for which DC motors are used in order to make it faster and smarter

3. METHODOLOGY

3.1 Block diagram

The following figure shows the basic block diagram of the design.
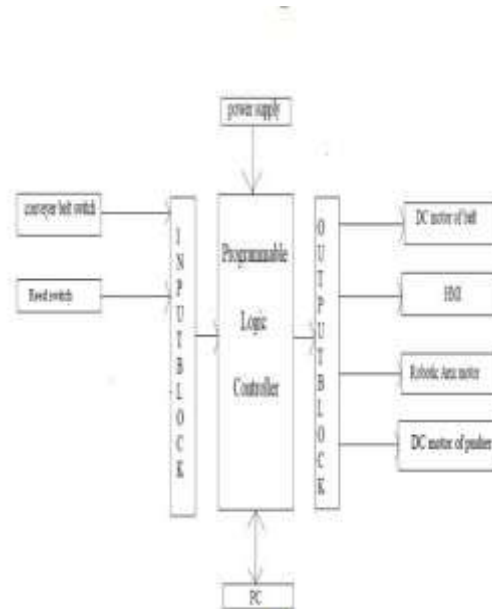
Fig-1: Block diagram

Reed switches(sensors) are connected at the input side of PLC which sense the presence of object on the belt. Output of the sensors mounted on the first conveyor belt is given to DC motors of subsequent belts to rotate them accordingly. There are 3 sensors connected to PLC which will drive 3 motors whereas the sensors mounted on the pusher assembly will control the movement of pusher arm and stopping of conveyor belt on correct object detection.

As soon as the pusher arm receives the input from the sensors mounted on the first belt and that on the pusher assembly, it decides whether to stop the conveyor belt and push the object or not to sort accordingly. Rotation of pusher arm is restricted to single rotation only so as to reduce energy consumption.

3.2 Flowchart
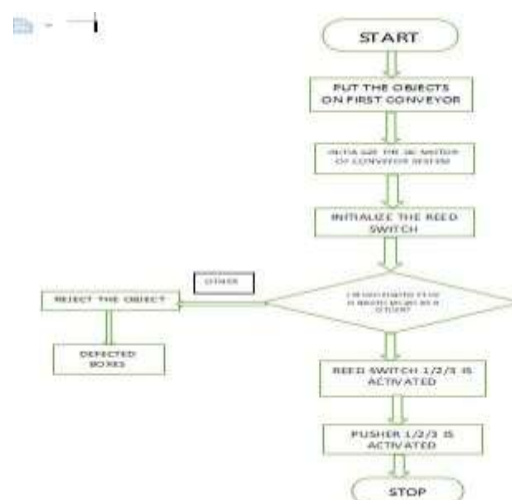
Fig-2: Flowchart

Once the PLC is turned ON, objects are placed on the belt and motor of first conveyor belt is started. For example, consider first reed switch gets activated if object height is H1, its output is given to next belt which starts rotating. The object is detected by the reed switch mounted on pusher assembly of belt 2 which sorts the objects of H1 height. Similarly for objects of height H2 and H3.If the object does not have H1,H2 or H3 height then none of the pusher arm gets activated and the particular object is considered to be defective.

4. RESULT

Fig-3: Result

5. ADVANTAGES AND APPLICATIONS

5.1 Advantages

1. Reduces manual work

2. Less power consumption

3. Autonomous system

4. Increases accuracy

5. Production is increased

5.2 Applications

1.Brick manufacturing process: At construction sites, bricks of similar size are preferred. While manufacturing, this can be achieved by using dimensions of brick as criteria for sorting the defected ones.

2. Airport: This system can be used to sort the bags according to weight..

3. Food processing industries: It can be used during making of bottles, packaging of food in boxes where dimensions and quantity plays important role

6. CONCLUSION

An autonomous and power efficient system which can sort the objects without any human intervention. A system which will effectively sort the objects by using reed switches which in turn increases accuracy and reduces error as compared to proximity sensors. The components and modules used will be such that they consume minimal power. All the components used will adhere to the function of sorting and will be as affordable as possible which can be used by small scale industries as well.

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Related Sites

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