Automatic Sorting Machine Using Belt Conveyor

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INTRODUCTION

In today's high speed technological world there is intense competition between organizations to be on top and have edge over one another. Production efficiency is the major factor that decides the success of the organization. Production efficiency includes the speed at which production equipment and production lines work. By introducing automation in the organization we can save a lot of time, labor or manpower therefore increasing its efficiency.

One such problem industries are facing is sorting of materials. Our project aims to solve this problem by sorting the materials based on their color, size, and material. Because of the use of belt conveyor in the project it can be directly used in the production lines. Because sorting is done by automation the materials are sorted more accurately then, the sorting done by the labor.

OBJECTIVE

The main objective of this project is:

- To reduce the time consumption in sorting of the materials.
- Sort the materials based on their size, color, and material.
- The project is built with simple electronic components such as servo motors, sensors….
- To decrease the dependence on labors
- To count the number of materials those are being sorted.
- The error cased due to human negligence is avoided by the use of automated system.

COMPONENTS

- Arduino UNO
- Servo Motors
- Color Sensor
- DC Motor
- Metal sensor
- Conveyor belt

Arduino UNO

Arduino UNO is microcontroller board based on ATmega328P. It contains everything necessary to support the microcontroller.

Fig 1.Arduino UNO board

Specification of Arduino UNO:

Model Type	UNO Rev R3
Microcontroller Chip	ATmega328P
Operating Voltage	5V
Input Voltage (Recommended)	7-12V
Input Voltage (limit)	6-20V
Analog I/O Pins	6
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Clock Speed	16 MHz
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
On Board LEDs	On/Off, L (PIN 13), TX, RX
Dimensions in mm (LxWxH)	68.6 x 53.4 x 12 mm
Weight	25 g

Servo Motors

A servo motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration.

Fig.2 Servo motor

Specification of servo motor:
- Weight: 55 gm
- Dimension: 40.7 x 19.7 x 42.9 mm approx.
- Stall torque: 9.4 kgf.cm (4.8 V), 11 kgf.cm (6 V)
- Operating speed: 0.17 s/60º (4.8 V), 0.14 s/60º (6 V)
- Operating voltage: 4.8 V a 7.2 V
- Running Current 500 mA – 900 mA (6V)
- Stall Current 2.5 A (6V)
- Dead band width: 5 µs
- Stable and shock proof double ball bearing design¬
- Temperature range: 0 ºC – 55 ºC

Color sensor

Color sensors are used to detect the color of the material. It helps in sorting the objects by detecting the color.
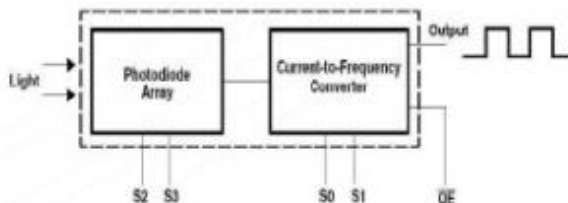

Fig.3 color sensor

DC Motor

Motor – 10RPM – 12Volts geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and variety of robotic applications.

Fig4. DC Motor

Specifications:

- RPM: 10. Operating Voltage: 12V DC
- Gearbox: Attached Plastic (spur)Gearbox
- Shaft diameter: 6mm with internal hole
- Torque: 7 kg-cm
- No-load current = 60 mA(Max)
- Load current = 300 mA(Max)

Metal sensor

Metal sensor is an electronic device which is used to detect the presence of metal in the items that are to be sorted.

Fig5. Metal sensor

Conveyor belt

Conveyor belt serves in moving the items those are to be sorted.

Fig6. Conveyor Belt

Fabrication of Arduino based Automatic sorting machine using belt conveyor

The system is designed is designed in such a way that the items that need to sorted are feed from one side. There are two major parts in the fabrication of this project first part is construction of the belt conveyor and other part is programming the codes for detecting and sorting of the items. The system consists of a conveyor belt which is constructed with the help of frame, shaft, DC Motors, and conveyor belt. Now the code should be coded in such a way that the items can be sorted on the basics of color, metal, and size. Then the sensors are mounted on the belt conveyor as shown in the block diagram.
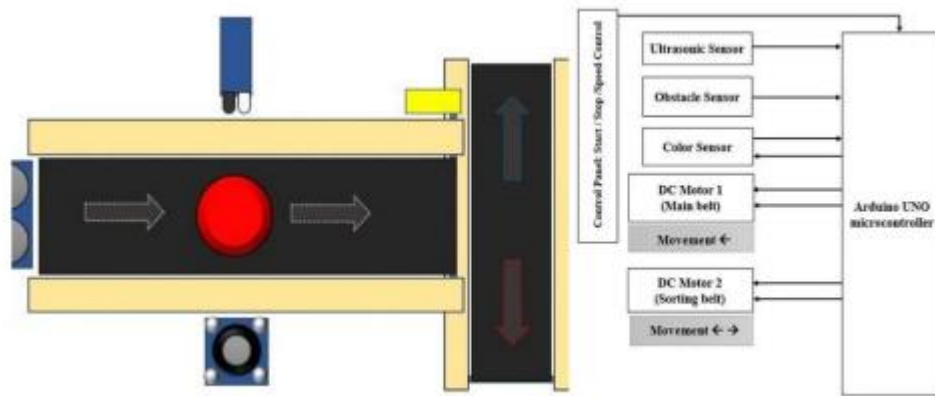
Fig7.Block diagram of sorting machine

WORKING OF THE PROJRCT

The working of the project is so simple the items which are moving on the conveyor get sorted. The objects which need to be sorted are feed from one side of the conveyor. The project has a color sensors to sense the basic RBG color and sort them based on these colors, if the items cannot be sorted on basis of the color then there are sensors which are capable of sorting the items on their sizes, if it is unable to sort on the sizes too then the project detects the presence of metal and then activates the corresponding servomotor to sort them and derail the item to be sorted from the belt conveyor.

RESULTS

From the project we can conclude that this project is good alternative for expensive sorting machines. This project can help the smaller industries for sorting of the items. The project is counts the numbers of items getting sorted. The project sorts the items based on their sizes, colors ,and also sorts the metallic and non metallic items.

Limitations

- Good knowledge of programming or coding is required.
- Limited colors and sizes can be sorted.

Conclusion

The project is effective in sorting the various items with more accuracy and saves lot of money that needs to be spent on the labor. This project saves time that is involved in the sorting the items.

FUTURE WORK

It is very useful in wide varieties of industries along with the help of PLC and SCADA, especially in the packaging section. Automatic sorting machine enhances efficiency, practicality, and safety of operators. It ensures remarkable processing capacity as well as peerless performance including color detection. Of course we need to add high speed DC motors and sensors with appreciable response to speed up the system for industrial application. The model can be improved by making some changes in the program and components. Some suggestions are given below.

a) A load cell can be added to measure and control the weight of the product.
b) Speed of the system can be increased accounting to the speed of production.
c) The system can be used as a quality controller by adding more sensors.
d) The sensor can be changed according to the type of product.
e) The DC motor can be replaced with stepper motor.
f) The PIC can be replaced with PLC.

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