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# Development of an Automatic Sorting Machine based on product colour and weight characteristics with Conveyor Belt and sensors

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## ABSTRACT

*Sorting of the product on the basis of its colour and its weight is the major task that needs to be done in the final packaging section. To remove drawbacks of 'conventional packaging' using barcode scanning like fake product with original barcode applied on them or like failure of barcode to differentiate between actual product and its fake prototype, our automatic sorting machine can be used instead. Sorting of products in an industry is generally carried out manually. Continuous manual sorting creates quality consistency issues. Therefore we have proposed an efficient method which uses load cell, inductive sensor and TCS 230 colour sensor for identifying and separating products on the basis of their weight and colour. Microcontroller to control the overall process of sorting of objects is used. The system rejects and discards objects that are not of required characteristics by pushing them out of conveyor line using a pneumatic cylinder. A rectangular container, having three partitions is used to collect objects of three different colours. One conveyor belt is used, which is controlled by DC motors. The belt is for placing the product to be analyzed by the load cell and inductive sensor, which also contains a colour sensor and weight sensor panel at the starting of conveyor for of separating object.*

***Keywords: - Colour and weight sorting, conveyor line, DC motor, microcontroller, TCS230 colour sensor***

## I INTRODUCTION

The main task performed here is to sort the products manufactured in the company. The purpose of this project is to save the time for inspection and to reduce the efforts of the workers in material handling. An automatic sorting machine has main task of sorting components according to the weight, colour. A sorting machine is more practical and economical method of automation, which transfers material from one point to another. This also consists of conveyor belt, which reduces the efforts of material handling. Also both processes take place simultaneously i.e. material handling and inspection.

## II LITERATURE SURVEY

Design of the automated sorting machine using conveyor belt used for manufacturing industry in many fields is a very complex process. The system needs to satisfy industry requisitions. This is an industrial automation based application. It shows the concept of normal conveyor belt, but with some intelligence. We can also call it as intelligent conveyor belt, as it has also ability to sort the object of different colour and weight. By developing such sorting system the production rate of the manufacturing industry has been increased since these sorting systems replaced the human resources.

## III COLOUR IDENTIFICATION

There have eleven basic colour names have been identified such as white, gray, black, red, yellow, green, blue, orange, purple, pink, and brown. Most or all colours can be described in terms of variations and combinations of these colours. Due to the fact that human colour vision is accomplished in part by three different types of cone cells in the retina, it follows that three values are necessary and sufficient to define any colour.

## IV COLOUR SENSOR

Colour sensors are based on one of the colour models, most commonly the RGB model. A large percentage of the visible spectrum can be created using these three primary colours. Many colour sensors are able to detect more than one colour for multiple colour sorting applications. we use Colour Sensor to identify different colour which has range near IR- 750 nm TO 2500 nm and far IR- 6.00 to 15.00 micron wavelength ranges and UV colours in the 50to 350 and 400 nm wavelength range.

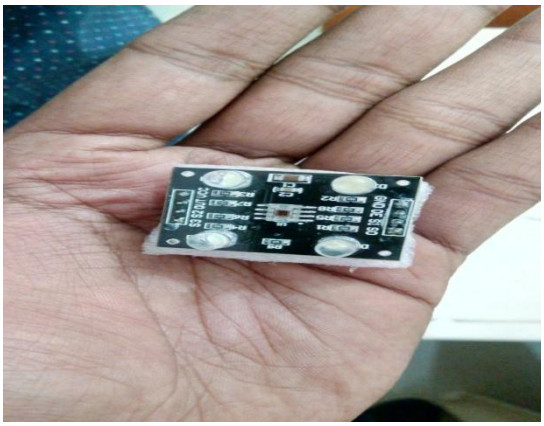

**Fig 1: Colour sensor**

## V WEIGHT SENSOR (LOAD CELLS)

Load cells are very commonly used to weight in industrial environment. They can be installed on hoppers; reactors etc and allow controlling the weight in the capacity, which is often of critical importance for an industrial process. Some performance characteristics of the load cell must be defined and specified to make sure

they will cope with the expected service .we use weight sensor to identify the weight of the product on conveyor belt. In our mechanism weight sensor is use to weighing of 0.50 kg to 1 kg weight of product.

## MICROCONTROLLER

A microcontroller's processor will vary by application. Option range from the simple 4-bit, 8-bit, or 16-bit processors to more complex 32- bit or 64-bit processor. In terms of memory microcontrollers can use RAM, Flash memory, EPROM. Generally microcontroller are designed to be readily usable without additional computing components because they are designed with sufficient on board memory as well as offering pins for general I/O operation so they can directly interface with sensors and other components . We use MEGA 328 microcontroller.

**Fig 2: Microcontroller MEGA 328**

## CONVEYOR BELT

A conveyor belt is the carrying medium of a belt conveyor system. A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys with an endless loop of carrying medium the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called as drive pulley while the unpowered pulley is called as idler pulley. There are two main industrial classes of belt conveyor; those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volumes of resources and agricultural materials.

## DOUBLE ACTING PNEUMATIC CYLINDER

A double acting pneumatic cylinder is a cylinder in which the working fluid acts alternately on both sides of the piston. In order to connect the connect the piston in a double acting cylinder to an external mechanism, such as a crank shaft, a hole must be provided in one cylinder for the piston rod and this is fitted with a gland or stuffing box to prevent escape of the working fluid. Double acting cylinders are common in steam engines but unusual in other engine types. Many hydraulic and pneumatic cylinders use them where it is needed to produce a force in both directions.

**Fig 3 Pneumatic Cylinder:**

**DC MOTOR:-**

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

**SPECIFICATIONS OF AN AUTOMATED SORTING MACHINE:-**

- Conveyor belt:-
  We use flat belt and roller type conveyor belt which has length 1700mm, width 200mm. roller has diameter 50mm and length is 250mm.
- Pneumatic cylinder:-
  We use double acting pneumatic cylinder which has diameter is 20mm, and length 100mm.
- Electric motor:-
  We use DC motor which is 500rpm speed and 12v voltage.
- Sensor:-
  We use colour sensor which has range of IR- 750 nm TO 2500 nm and far IR- 6.00 to 15.00 micron wavelength ranges. And weight sensor which use for weighing of 0.50 kg to 1 kg weight of product.
- Microcontroller:-
  We use microcontroller which has 28-pin count PDIP, 8 bit AVR CPU type, Ram is 2 kb, Rom is 1kb, maximum operating frequency is 20mz, and maximum I/O pins are 23.

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## VI WORKING OF THE MACHINE

- The product will be put on the conveyor belt.
- Then the switch will be made on which will start the conveyor belt and the product will flow to other end.
- During its travel, sensor will sense the colour and weight of the product.
- The signal will be then given to microcontroller.
- So according to the signal the corresponding LED will glow indicating the weight of the product and identifies colour of the product.
- After that the pushing mechanism will be activated and defective products will be pushed out from the conveyor, while non defective product will flow over the conveyor.
- After sorting of the product, conveyor will automatically switch off
- The sensor and microcontroller will give input to pushing mechanism to activate respectively as per the given data of component.
- After this activation of pushing mechanism the defective part such as weight is higher or lower than the given or required weight as well as colour difference of product or another colour will sense by the sensor then activated pushing mechanism push the product from conveyor to rejection box and valid product moves along the conveyor towards final packaging unit.

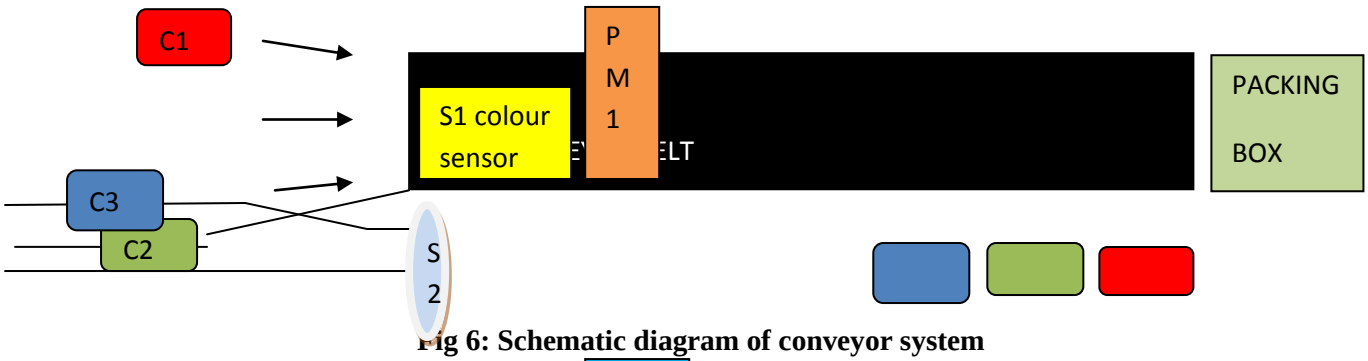


**Fig 6: Schematic diagram of conveyor system**

Where;

C 1, 2, 3 – Are the colour product.

PM1 -Pushing mechanism.

S 2 – Weight sensor (load cell).

SR1- Sorting box

## VII APPLICATION

It has application in material handling systems and manufacturing industries like

1. Food industry.
2. Agricultural products scaling and grading.
3. Pharmaceutical industries.
4. Handling biomedical waste.
5. Assemble all colour products in one packing box.

Actual application of this project can be done in various industries where distribution of product of different colour in one single box is required; these can be done by our mechanism.

## VIII CONCLUSION

- The automatic sorting machine using conveyor belt is basically useful for sorting the products in the industry specifically large scale industries where mass production is carried out.
- The machine also reduces the efforts of the workers by reducing the time spent for material handling.
- The application area of this machine is very wide in industries where automation is built.
- We have proposed a system which would increases the production rate and accuracy of material handling system.
- The system would separate objects based on their colour and weight as per requirement by the user. And we can modify the system according to the requirement.

## IX FUTURE SCOPE

- Replacing DC motors by stepper motors to increase accuracy.
- Sensors can be replaced by cameras for digital processing which is done using 'MATLAB'
- Robotic arm can be used instead of flippers and containers to place the object at desired locations, thus making the process of sorting more effective.
- Modifications can be done to inspect cracks, defects on the surface of the object etc.
- Also we can use such system with some modification for various types of inspection such as holes diameter, Height, Thickness, Surface defect.
- Segregation based on size can be done by installation of sieves of various sizes.
- Some rubber gripers can be used. It increases surface resistance which helps to avoid slipping of conveyor belt.

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