

# Weight Sorting Machine

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**ABSTRACT**— Sorting of the objects is an essential operation used in various fields of day to day life for the sake of convenience. Until few years ago, sorting was mainly performed manually and was based on human judgments. Sorting system is more practical and economical method of automation. Main aim of sorting system is to save man power and improve quality and efficiency of the product. In the current scenario, most of the sorting systems employ the criteria like color, dimensions, material type etc.

However, they carry their own setbacks like environment sensitivity, high cost and complexity respectively. The proposed sorting system in this paper uses weight as a sorting criterion. The fabricated machine aims at using the mechanical and the electronic components by their mutual coordination. Load cell arrangement has a preeminent position in the system. This sorting system presents a precise, reliable, consistent and quantitative sorting based on weight of the objects.

## I. INTRODUCTION

A machine designed to execute one or more tasks automatically with speed and precision. We need machines because machine are often cheaper to use over humans, in addition it is easier to do some jobs using Machine and sometimes the only possible way to accomplish some tasks! Auto system has been widely used in manufacturing. Machine can perform many advantages and used as the countermeasure for some job that cannot be conduct by the human excellent Machines are used in different fields such as industrial, space exploration. Generally Machines are designed, built and controlled via a computer or a controlling device which uses a specific program.

Programs and machines are designed in a way that when the program changes, the behavior of the changes accordingly resulting in a very flexible task achieving Machines.

An automatic sorting machine has main task of sorting packets according to the sizes. This

also consist both processes take place simultaneously viz material handling and inspection.

A sorting machine is more practical and economical method of automation, which transfers material from one point to another. The design is quite simple and of flexible use, means only conveyor belt can be used for material handling.

It is important to know that The conveyor belt could be automated by allowing the objects to move to the detection position through the dynamics of the running motors. Using the sensor signal to control in this project we have designed the special pneumatic system to automatically reject and pass the object. In this project we use one motorized conveyor belt for material movement line. It is very useful for production industries and material handling department etc.

## II. LITERATURE REVIEW:

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 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. PROPOSED METHODOLOGY

Automatic Sorting using Weighing Mechanism In every manufacturing industry have a conveyor system. All the goods are transported in the conveyor system. Quality checking is a vital process in every industry to yield a good product. Usually the quality of the products is checked in the conveyor itself. After checking the products,

the goods are sorted separately .  
Arranging items systematically is known as Sorting. There are two kinds of sorting process: Ordering and categorizing.

Categorizing is a process of grouping items with similar properties separately. The categorizing process is carried in the conveyor itself to reduce the time consumption. Combining the two processes in simultaneously is efficient. Sorting is done with different properties. In growing Industrial sector, every industry are seeking to maximize the production to compete with the other industries.

Sorting process, that is categorizing the products based on their properties or characteristics.

Our aim is to categorize the packets of clothes based on the weight of the packets. So the weight of the product is measured and set the product weight. This value is to differentiate the good product from the defect one.

Now the weight of every product is measured then the measured value is sent to the RaspberryPi. The measured value is compared with the preset product value . When it meets the value, it is considered as the idle product. If it does not meet then it check for next size again it checks if does not match upto 6XL size then it is considered as the defect.

The challenge of this system is to reduce the time. The weighing system is incorporated in the conveyor system. The weighing mechanism is built within the conveyor beneath the belt of the conveyor system. The weight of the product is measured by the system during the transportation of the product . The sorting process is carried out after the measurement based on the weight. As the weigh property of the product is used for the sorting process, it is simpler than the previous techniques.

#### IV. CONSTRUCTION

There are two types of components:

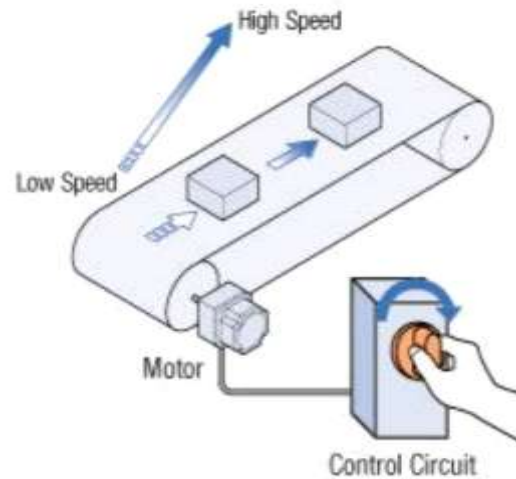
- 1.Mechanical Components.
- 2.Electronic Components.

##### 1.Mechanical Contents:-

##### CONVEYOR BELT:

A conveyor system is used to transport objects throughout the area in industries. Conveyors are most generally used in material handling applications. The system consists of a belt of fabric stretched between two pulleys, with at least one pulley operating under power. The belt is the transport medium which is wrapped around the pulleys which allows it to rotate around them. The

powered pulley is known as driver pulley and the other pulley is known as idler pulley. The design of the system is modeled by using modeling software



**Fig.Conveyor Belt.**

The above described diagram shows a belt conveyor which are most widely used in the industries. But there are different types of conveyor used for different applications based on the needs. The types of the conveyor are selected based on the type of product that is going to be handled, sometimes changes due to the location of conveyor. The conveyor belt is automated by DC motor system. Automatically the object is moved to the detection process by using DC drive system

- The frame: The system's framework holds all of the moving parts together for safe and secure operation.
- The belt: A long stretch of thick, durable material upon which materials are transported from one place to another.
- The conveyor belt support: Rollers assist the belt to stay on course and swiftly maintain movement. Rollers keep objects in place and prevent the belt from sagging.
- The driving unit: Motors may use either variable or constant speed-reduction gears to power the conveyor belt. An efficient driving unit must continually assist the belt with continuous running, smooth reversing and repeatedly adjusting direction.
- The pulleys: The conveyor belt should loop over two or more strategically positioned pulleys. The pulley controls the belt's movement and performs critical functions such as driving, redirecting, turning, tensioning and tracking the belt.
- The clamping straps: Clamping straps are used on various machines to hold down fixtures and work components.

- Add-on modules: Most additional parts are installed for further reinforcement. While rollers support the belt from within the system, stands and lateral guides support the outer framework.

### Mechanical System –

Outer frame was made by cast iron and aluminum material. After the case was constructed the main parts were joined together. The roller, shaft and the belt units were joined on the case. The rolling unit is fixed to above and below of the aluminum holder. Frame unit were attached to the ground firmly and holes are made in the board for the installation of electronic component. This frame unit material is selected based on literatures. The mechanical parts of the system are fabricated on step by step process. Each steps need to be performed with high concern in-order to yield a good furnished system. The pictures of the fabrication status are included below.



digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo.[5][6] The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software.[1] The Uno board is the first in a series of USB-based Arduino boards;[3] it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases.[4] The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer [3].



**Fig 3.1: Arduino Uno**

The ATmega328 is a single-chip microcontroller created by Atmel in the megaAVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core.

## 2. Electronic Components.

### Arduino UNO:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.[2][3] The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14



**Fig 3.2: Atmega328P-PU**

### Stepper Motor :-

A stepper is a DC electric motor that divides a full rotation into number of equal steps. The motor's position can then be commended to move and hold at one of these steps without any feedback sensor, as long as the motor is carefully sized to the application in respect to torque and speed.



**Fig.Stepper Motor**

### IR Sensor (Infrared Sensor):-

These IR sensors are used to detect the presence of objects on conveyor belt in this project. The basic concept of an Infrared sensor which is used as obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.



**Fig.IR Sensor**

### USB PL2303:-

USB to UART solution with Type A Connector.



**Fig.USB PL2303**

### Features:-

- PL2303TA Onboard
- Supports Windows XP/7/8/10/11
- 3 power Mode: 5V Output,3.3V.(3.3v-5v)
- 3 LED's TXD LED,RXD LED,POWER LED

### Load Cell:-

A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally. The most common types of load cell used are strain gauges, pneumatic, and hydraulic.





Fig. 3.3: 50kg Load Cell

#### 7inch Touchscreen :-

This touch screen display module is a 7inch display compatible for Raspberry Pi boards.

The viewable screen size of the 7inch display is 155mm x 86mm. This touch screen display module for Raspberry Pi has a screen resolution of 800 x 480 pixels. The type of touch used in the raspberry pi display is a 10 finger capacitive touch.



Fig. 7inch Display

#### Keyboard:-

A computer keyboard is a peripheral input device modeled after the typewriter keyboard which uses an arrangement of buttons or keys to act as mechanical levers or electronic switches. Replacing early punched cards and paper tape technology, interaction via teleprinter-style keyboards have been the main input method for computers since the 1970s, supplemented by the computer mouse since the 1980s.

Keyboard keys (buttons) typically have a set of characters engraved or printed on them, and each press of a key typically corresponds to a

single written symbol. However, producing some symbols may require pressing and holding several keys simultaneously or in sequence. While most keys produce characters (letters, numbers or symbols), other keys (such as the escape key) can prompt the computer to execute system commands. In a modern computer, the interpretation of key presses is generally left to the software: the information sent to the computer, the scancode, tells it only which physical key (or keys) was pressed or released.



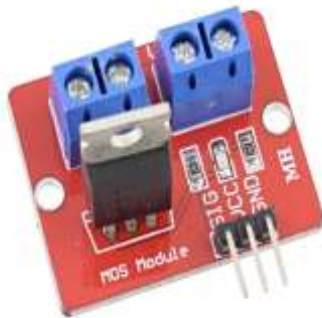
Fig 3.5: Keyboard

#### MOSFET Driver: -

The IRF540N is an N-Channel Power Mosfet. The Mosfet can switch loads that consume up to 9.2A continuous current and operate below 100V. It also has a decent on-state resistance of 0.27 Ohms which increases the efficiency of the Mosfet since it will dissipate less heat as loss.

This Mosfet has a low gate threshold voltage of only 4V, this means that the Mosfet can be turned on even with 5V from the GPIO pin of microcontrollers like Arduino. But this does not mean that the Mosfet will turn on completely with just 5V, it needs around 10V supplied to the gate pin to turn on completely and supply 9.2A collector current. So if you are looking for a Mosfet to be used with microcontroller then you should consider the logic level Mosfet like 2N7002 etc.

Alternatively you can also use a driver circuit to provide 10V to the gate pin of this Mosfet using a transistor. Added to this the mosfet also has good switching speeds and hence can be used in DC-DC converter circuits also.



**Fig. 3.7: MOSFET Motor Driver**

Features:

- N-Channel Power MOSFET
- Continuous Drain Current (ID): 9.2A
- Drain to Source Breakdown Voltage: 100V
- Drain Source Resistance (RDS) is 0.27 Ohms
- Gate threshold voltage (VGS-th) is 4V (max)
- Rise time and fall time is 30nS and 20nS
- It is commonly used with Arduino, due to its low threshold voltage.
- Available in To-220 package

**L293D Driver:**



**Fig. 3.6: L293D Driver**

The L293D is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the same time; also the direction of these two motors can be controlled independently. So if you have motors which has operating voltage less than 36V and operating current less than 600mA, which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates or even Microcontrollers like Arduino, PIC, ARM etc.. this IC will be the right choice for you.

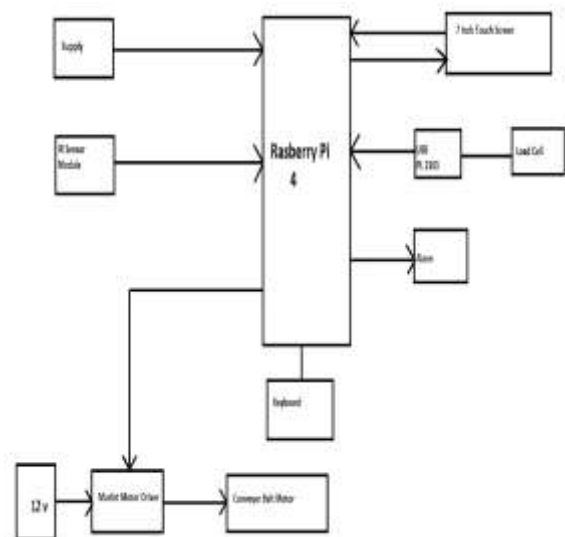
**Buzzer:-**

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.



**Fig. Buzzer**

**V. BLOCK DIAGRAM:**



**Fig. Block Diagram**

**VI. WORKING:**

In these project we are going to sort the cloth packets form small size upto 6 XL size.(i.e. S size to 6 XL Size ).Each size has fixed weight.(i.e. small size cloth packet has 320 gm weight).Our load cell accuracy is up to ± 0.1g.

1. When switch on the circuit conveyor belt start the moving .
2. When the conveyor belt starts its motion, cloth packets are moving on the belt.

3. When IR Sensor sense the cloth packet the belt will stop for a second .
4. In that period of time the weight load measure the weight of packet.
5. The system has an automatic zero calibration function.
6. If the small size cloth packet and the weight is exactly matches then the packet goes to the small size packet container.
7. If the weight and the small size value of the packet is not match then it will check for the Medium size packet, if match then it will go to Medium size container.
8. Like that way it will check upto 6 XL size.
9. If the Weight is not match with any size packet it will consider as faulty piece.
10. If the any size(S to 6XL) container contains 50 packets then the buzzer started to buzz the sound.

#### Working of Components:

##### 1. Raspberry Pi:-

- \* In these project we are connected 7 inch touch screen for input and display.
- \* It checks the given weight and actual weight of packet which is measure by load cell. And decide in which container packet should be placed.
- \* It takes input from IR sensor and stop the belt the according to input .
- \* It provides the signal to Motor driver.
- \* It takes 5 v supply.

##### 2. Conveyor Belt :-

To weigh the cloth packets, and help to sort.

##### 3. Stepper Motor :-

12 volts supply provide to the motor. It helps to move the shafts of conveyor belt. Motor moves according to signals of motor drivers.

##### 4. MOSFET Motor Driver:-

Driver gets the signals from the Raspberry Pi. According to that signals the Conveyor Belt and Motor works.

##### 5. IR Sensor :-

IR sensor is used to sense the cloth packets. Send the signal to raspberry pi.

##### 6. 7 Inch Touch Screen :-

It is used to Input and Display .Here we are providing Graphical User Interface so it easy for operating the machine.

##### 7. Load cell :-

For weighing the cloth packets load cell is there.

##### 8. USB PL 2303:-

It provides input to Raspberry Pi .

##### 9. Keyboard:-

It is used to give the inputs to Raspberry Pi.

##### 10. Buzzer:-

It start to Buzz when the container contains 50 packets of Clothes.

#### VII. FUTURE SCOPE:

The machine can be modified to serve as per the requirement for various applications. For the quicker sensing of an object proximity sensors can be used. Accuracy of the machine can be further improved. With little changes, this machine can be used for the sorting of smaller objects like capsules or industrial parts. It can also be used for the sorting of highly valuable objects like diamonds with an increase in accuracy and precision.

#### VIII. CONCLUSION:

Thus the Sorting machine using weighing mechanism can be used in all the manufacturing industries for automatic sorting of the products. Thus reducing the time. The production becomes more fast through this concept. This concept can be more useful for the industries that consider the weight of the product as an important property. The sorting machine using weighing mechanism would able to provide a cost effective and efficient process for industrial purpose.

- o 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.
- o The machine also reduces the efforts of the workers by reducing the time spent for material handling.
- o The application area of this machine is very wide in industries where automation is built. We have proposed a system which would increase the production rate and accuracy of material handling system.
- o The system would separate objects based on their weight as per requirement by the user. And we can modify the system according to the requirement.

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