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Design and Fabrication of Nut, Bolt Sorter Machine

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ABSTRACT: The Design and Fabrication of Nut and Bolt Sorter Machine project aims to develop an automated system capable of sorting nuts and bolts efficiently based on their size and type. The machine will help to streamline the sorting process in industries, workshops, and manufacturing units where nuts and bolts are used extensively. The sorter machine consists of several components, including a conveyor belt, sensors, actuators, a control system, and a sorting mechanism. The conveyor belt is responsible for moving the nuts and bolts towards the sorting mechanism. Sensors are strategically placed along the conveyor belt to detect and measure the size and type of each nut and bolt passing through. The control system of the machine processes the information received from the sensors and sends signals to the actuators to perform the necessary actions. The sorting mechanism uses pneumatic or mechanical methods to separate the nuts and bolts into different compartments or containers based on their size and type. This ensures that the sorted nuts and bolts are easily accessible for further use or packaging. The design of the machine incorporates considerations for accuracy, speed, and reliability. The sensors and control system are calibrated to accurately identify the size and type of nuts and bolts, minimizing the chances of sorting errors. The speed of the conveyor belt and sorting mechanism can be adjusted to achieve efficient sorting without compromising on accuracy. The fabrication of the machine involves the assembly of various components, including the conveyor belt, sensors, actuators, control system, and sorting mechanism. Careful attention is given to the structural integrity and durability of the machine to ensure its long-term functionality in an industrial environment. Once the machine is fabricated, it undergoes testing and optimization to ensure proper operation and efficiency. The sorting accuracy, speed, and reliability are evaluated, and adjustments are made as necessary to improve performance.

The Design and Fabrication of Nut and Bolt Sorter Machine project aims to provide a cost-effective and reliable solution for automating the sorting process of nuts and bolts. The machine will significantly reduce manual labor and human error, improving productivity and efficiency in industries that heavily rely on nuts and bolts for their operations.

I. INTRODUCTION

The need of Automation in every Industry has become very important. Automation is there from long time in industries but now days industries are not only maintaining quality but also reducing cost of production. Fastener industries produces a vast variety of jobs with different physical or chemical properties and also having small variation in size in this case the need of creating affordable and easy to use equipment's is essential. We can see a huge variety in nut as they have various sizes according to diameter of the hole and if they are mixed then separating them is very difficult job. Thus in this case to provide automation we observed that with change in diameter the height of nut also changes and this can be used to detect the dimensional variation by using very simple sorter tray mechanism in accordance to this idea we designed the nut separation machine. Assembling industries are facing problems related to material handling of various parts which are difficult to sort manually and due to this problem we were able to study and design model of nut separating machine. Automation is necessary in sorting fasteners because it is very time consuming if done manually. Fasteners are of various sizes and are also used in almost all mechanical industries. they have a close dimensional variation hence they are easy to mix and if they are mixed it is very difficult job to separate them.

For reducing the various issues in mechanical industries by using automation. To provide a better equipment to industries which are improving material handling systems and reducing human effort. To discover the problems faced by the manufacturing and packaging industries and solving them. Providing solutions to the industries which will remain effective in future also. 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.

II. LITERATURE SURVEY

[1] Ping Zuo et al. Design and application of the falling vertical sorting machine.

In the process of production, it is necessary to pack according to the needs of different customers. A sorting machine is used to pick up the cigarette at present, there is a launch channel machine, a percussible vertical machine, But in the sorting process, the rolling channel machine is different in terms of the quality of smoke and the frictional force. It is difficult to ensure the location and posture of the belt sorting line, which causes the manipulator to not grasp. The strike type vertical machine is difficult to control the parallelism of the smoke. Now this team has developed a falling sorting machine, which has solved the smoke drop of a cigarette to the transmission belt. There will not be no code, can satisfy most of the different types of smoke sorting and no damage to smoke status. The dynamic characteristics such as the angular error of the opening and closing mechanism are carried out by ADAMS software. The simulation results show that the maximum angular error is 0.016rad. Through the test of the device, the goods falling speed is 7031/ hour, the good of the falling position error within 2mm, meet the crawl accuracy requirements of the palletizing robot.

[2] Prof. V.W. Patil et al, Automatic sorting machine.

The automatic sorting system has been reported to be complex and a global problem. This is because of the inability of sorting machines to incorporate flexibility in their design concept. This research therefore designed and developed an automated sorting object of a conveyor belt. The developed automated sorting machine is able to incorporate flexibility and separate species of non-ferrous metal objects and at the same time move objects automatically to the basket as defined by the regulation of the Programmable Logic Controllers (PLC) with a capacitive proximity sensor to detect a value range of objects. The result obtained shows that various materials were sorted into their respective and correct position with an average, sorting, time of 9.903 s to 14.072 s. The proposed developed model of this research could be adopted at any institution or industries, whose practices are based on mechatronics engineering systems. This is to guide the industrial sector in sorting of object and teaching aid to institutions and hence produce the list of classified materials according to the enabled sorting program commands. Belt conveyors a kind of the machine that is used to transfer material continuously. The belt works under the effect of frictional force. The belt conveyor is simple in structure, easy to maintain, its transfer capacity is high, transfer distance is long they are widely used in mining, metallurgical and coal industries. The main objective of this project is to build a unique kind of algorithm to achieve a new kind of approachability in the field of automation in industry. These machines can do different work at different places without man. We in our project designed an automatic object rejection system to reject the defective object when it comes by the conveyor system.

[3] T. Sireesha et al, Automated sorting system based on color and thickness of waste management.

The increase on amount of waste daily due to lack of waste management and enforcement by the government, has created unpleasant views of overflowed waste at the landfill. The past model intended for programmed arrangement of items dependent on the shading. A sensor was utilized to identify the color of the item and a microcontroller is utilized to control the arrangement and the primary disfavor is that can't perceive the thickness of the object. The goals of the future work is to assemble a prototype with a sensing mechanism that is capable of type recycle waste (including metal, paper and plastic) and automatically sort the waste correctly to specific partition according to their color and thickness. In addition to providing a detailed information for the composition of the waste management, that shows that impurities represented 28% (moist weight) of the plastic waste, and that about 75% of the plastic waste become characterized as Low-Quality applications, indicating some legislative restoration restrictions. The system can be used as a quality controller by adding more sensors. The outcomes of this work show that the recyclable waste management prototype is able to sort the waste successfully especially the plastic waste and it is highly potential to be utilized in the future.

[4] Dr. S. N. Bhadoria, Nut Bolt Sorting Using Image Processing by Robotic ARM.

The main intention of this project is to elaborate and simplify how different products manufactured in a factory can be put on a single conveyer for its proper distribution and data logging in a random sequence. To upgrade this process, images captured by the webcam can be processed with image processing techniques using software like MATLAB. This image processing technique and color detection techniques are applied for the taken image and the appropriate



output is obtained in this project. The goal is to develop a conveyor belt which will play a vital role in small scale as well as large scale industries for and logging the data, consequently reducing the cost of labor and multiple conveyors. The system leverages a conveyor belt with 2 motors, a mechanism to sort the products and a Webcam in proximity of the apparatus. The webcam is mounted in parallel to the assembly line focused on the products on the conveyors in order to have known the product and its sequence. The apparatus sends image processed readings and measurements over wires to a microcontroller for further processing. Code running on the microcontroller in conjunction with a code in MATLAB generates an output on the appropriate pins configured by user by a program, which controls the speed and direction of the conveyor belt. This quality in MATLAB image processing toolbox and Arduino has made it possible. This research thus implements an industrial assembly line with methodology in image processing.

III. DESIGN CALCULATION

Material = C 45 (mild steel) Take factor of Safety =
 $2 \sigma_t = \sigma_b = 540 / \text{factor of safety} = 270 \text{ N/mm}^2$
 $\sigma_s = 0.5 \sigma_t = 0.5 \times 270 = 135 \text{ N/mm}^2$

Design of motor:

Power of Shaft = P = 15 watt

Power transmitted by shaft,

$$P = \frac{2\pi NT}{60}$$

Where, N → Rpm of motor shaft = 18

T → Torque transmitted

$$15 = \frac{2\pi \times 18 \times T}{60} \times 10^3$$

$$\underline{T = 7.95 \times 10^3 \text{ N-mm}}$$

Design of shaft :

Now, T_1 is the maximum torque among all shafts, so we will check shaft for failure here.

$$T = \frac{\pi \sigma_s d^3}{16}$$

$$7956.7 = \frac{\pi}{16} \times 135 \times d^3 \quad \underline{D = 6.69 \text{ mm}}$$

But we are using 20 mm shaft, so our design is safe

Selection of bearing

For 20mm Shaft diameter we take standard breaking no. P204

P = pedestal bearing

2 = spherical ball or deep groove ball bearing = 04 = 5 × 4 = 20mm

Bore diameter of bearing,

Weight lifting capacity by motor

T = Force × length frame

$$7956.7 = F \times 130$$

$$F = 61.2 \text{ N}$$

$$F = 61.2 \text{ N}$$

$$\frac{61.2}{9.81}$$

$$F = 6.23 \text{ Kg}$$

This is less than Drum and frame combine weight

Battery Calculations

Charging Time:

Battery - $6V/2.5 \text{ Amp} = 15 \text{ watt}$

2 batteries = $15 \times 2 = 30 \text{ watt}$

Solar Panel - 10 watt

Current (I) = P/V

$I = 10/15$

$I = 0.66 \text{ Amp}$

Charging Time = (Battery Watt/Panel Watt)

= $(30/10) = 3 \text{ Hrs.}$

Discharge Time = (Battery watt/Total watt Consumed)

= $30/30$

$\approx 2 \text{ Hrs}$

= 120 min

Design of transverse fillet welded joint.

Hence, selecting weld rod size = 3.2 mm

Area of Weld = $0.707 \times \text{Weld Size} \times L$

= $0.707 \times 3.2 \times 25 = 56.56 \text{ mm}^2$

Force exerted = ---N

Stress induced = Force Exerted / Area of Weld $\sigma = F / 56.56$

$F = 1187.76 \text{ N} = 121.07 \text{ kg}$

Maximum Allowable Stress for Welded Joints = 21 N/mm^2

IV. DESIGN & ANALYSIS

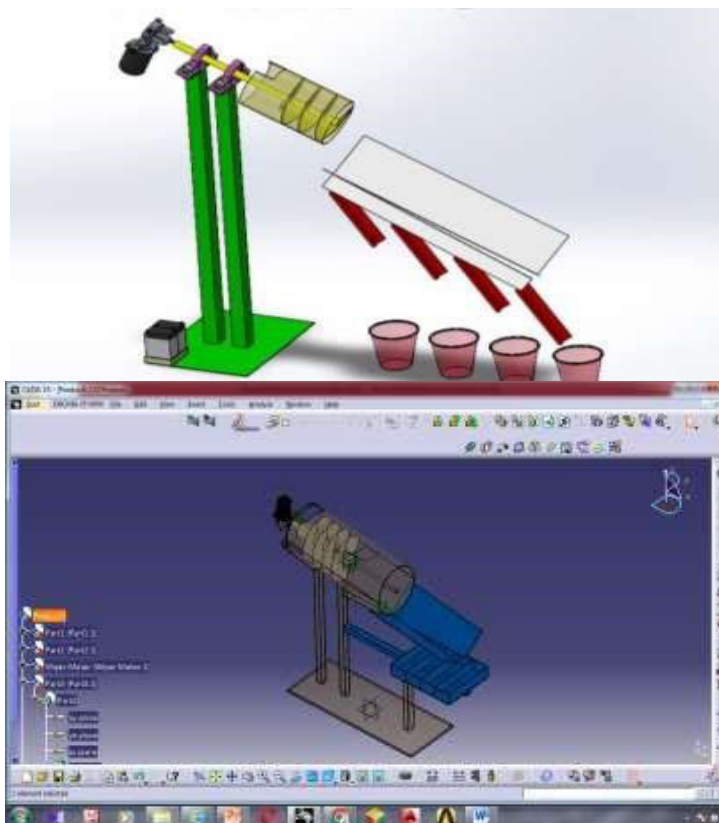
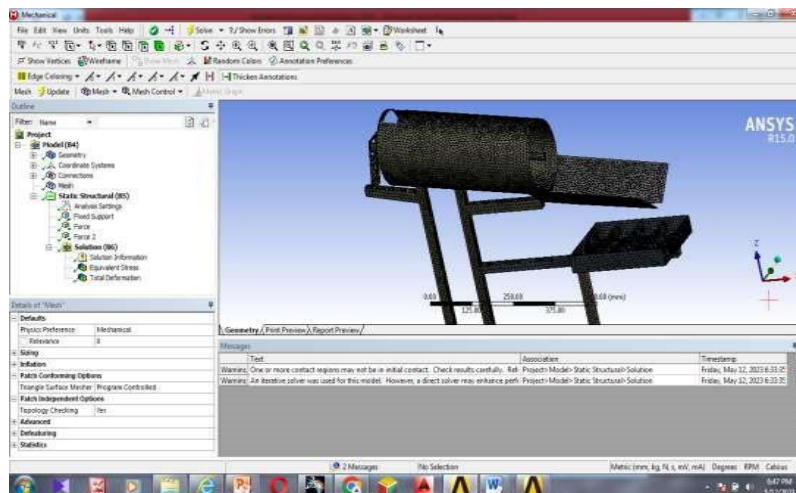
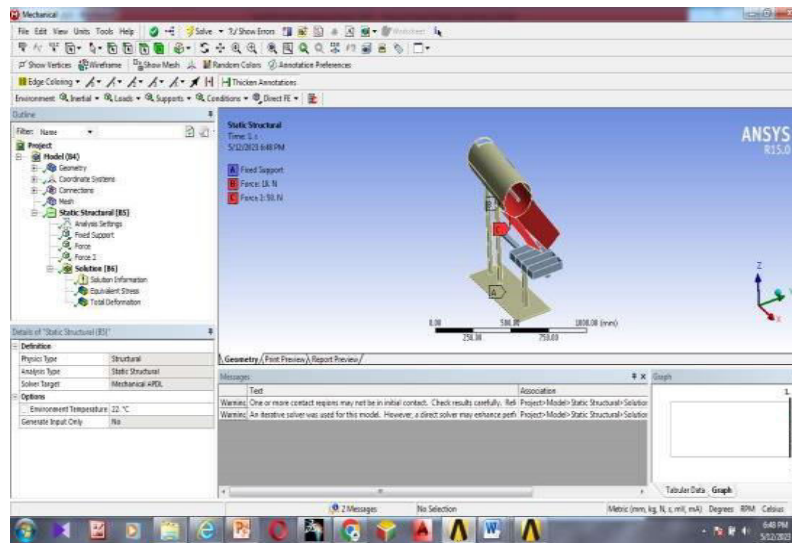
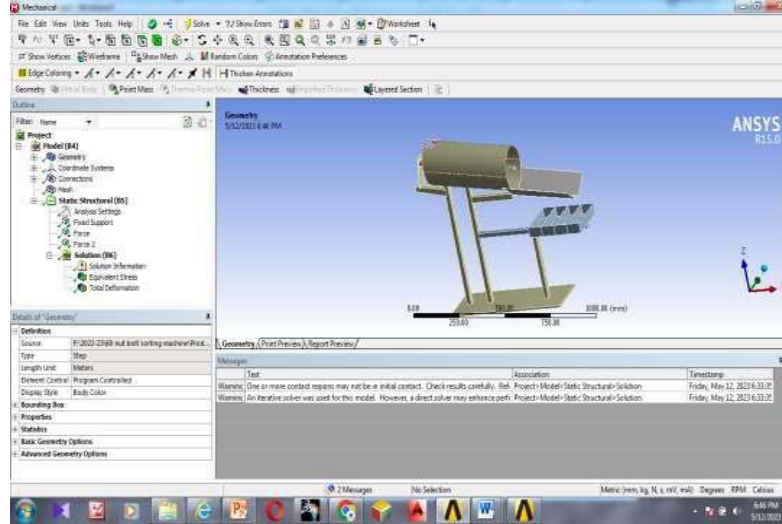


FIG.CAD MODEL



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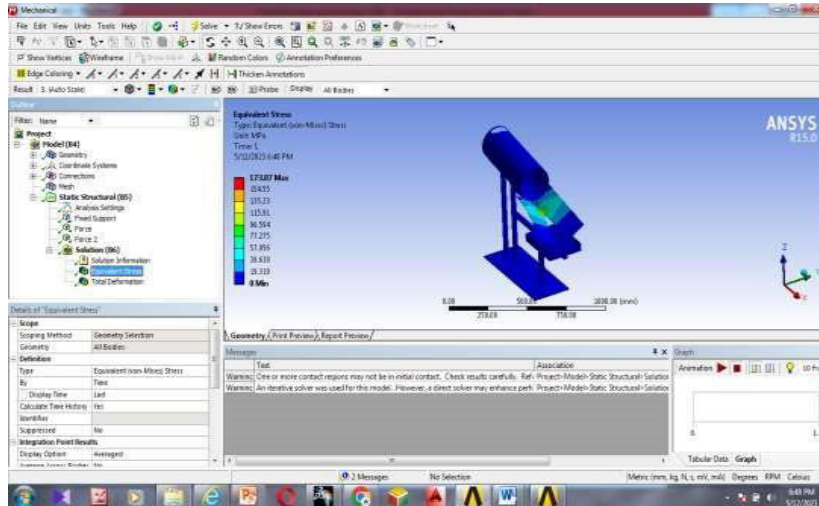


FIG. ANSYS OF MODEL

V. RESULTS AFTER TRIAL

1. We taken a 10 no. of bolts which has in different size as well as taken 15 no. of different size nuts. We are drop that nut and bolts which are in different sizes into the machine and start the machine.
2. It separates that material 80% which we inserted to sort in machine.
The results after the machine trial are as follows.

VI.CONCLUSION

This chapter expects to through a light on the various conclusion with scientific justification drawn out of your project work.

1. The project is aimed at developing a low-cost nut, bolt washer sorting machine for industrial use.
2. Thorough study is carried out to choose right strategy for execution.

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