



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 4, April 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)

# Design and Development of Fruit Sorting Machine

Nagnath Dange<sup>1</sup>, Raturaj Gomare<sup>1</sup>, Satyajit Deshmukh<sup>1</sup>, Rutik Suryawanshi<sup>1</sup>, Prof. N.A Mulani<sup>2</sup>

U.G. Student, Department of Mechanical Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India<sup>1</sup>

Associate Professor, Department of Mechanical Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India<sup>2</sup>

**ABSTRACT:** In daily use, workforce is needed for sorting and bundling of diverse types of fruits. The aim of our project is to use less workforce and expand the fertility by creating a mechanism for automatic sorting of the fruits. The fruits will be initially loaded in a hopper, then these fruits will be transferred by downward to the next station where the image processing sensor will be used to identify and classify the fruits. The learning includes the better process of sorting machine for ball-shaped fruits. Fruits are today sorted with low effectiveness in any country. Thus we have an innovative fruit sorting machine. With the assist of gravity, these fruits drop below in the machine. The leading aim of this machine is to assist the farmer to reduce the time of fruit.

**KEYWORDS:** sorting, fruits.

## I. INTRODUCTION

In recent years, fruit has become one of the most dependable products produced by farmers across the world. This is due to its expectation as it serves not only for straight utilization, but also as a raw substance for other products. Product sorting is an essential course of action for farmers, which impacts the real products standard, examine and transport to market. Even with the reality that the sorting can be and has regularly been completed by human, it is moderate, tedious and open to error, hence the need to progress a smart fruit sorting machine system. After this point, another well-known method as optical sorting, is the motorized procedure of sorting solid products using sensors. Such sensors utilize product-driven knowledge of the picture preparation system, by detecting the color of fruits, shape and other auxiliary properties. The sensor compares fruits based on need to sort and expect defective fruits from the creation line or to isolate the result of various evaluations. In this design, an image handling algorithm was utilized. India is an agricultural country with the biggest agricultural produce. A lot of variety of fruits and vegetables are produced over the year. All the agricultural produce has to be sorted and categorized, and mostly of it is completed through manual labor. Manual labor generates various problems like instinctive grading, tedious work, incompatible, and less productivity. All of the above problems can be reduced using machine vision.

## II. RELATED WORK

We selected this project to contribute to a sustainable machine. This work presents a new technique for sorting and grading of fruits using a pure mechanical approach. This technique begins with sorting the fruits using regular size & grade proposed by Sagar P. Walhekar, Kapil Rajendra Tungar, Shubham Narayan Thorat, Rohit Nivrutti Mundhe, Shubhangi Devidas Gaikhey [1]. The possible outcome of this machine is an automated system based on color error detection technique that will encourage and enhance the quality production of products. Similarly, local industries having tight budgetary constraints can also benefit from this outcome by implementing this automated sorting system proposed by Y. Adamu, A. Adamu, S. I. Kolo, A. W. Nnanna [2]. The tests performed on the prototype of the sorting machine show that in increasing the feeding belt speed and decreasing the transport belt speed, the efficiency of sorting of both apple varieties declined. For all products, the purity index decreases, and the error index increases when the feeding belt speed increases, and vice versa as proposed by Vahid Farzand Ahmadi, Peyman Ziyaei, Pourya Bazayr and Eugenio Cavallo [3]. Results of the analysis, design and implementation that has been done above, some conclusions are obtained as follows: TCS3200 color sensor can detect the orange fruit color very well. In this study, the color sensor is very influential on the surrounding light, so it is necessary to do three stages of automatic calibration in the color reading stage. Poltak Sihombing, Faddy Tommy, Sajadin Sembiring, Nogar Silitonga [4]. Design and development of an Arduino-based automatic color sorting machine. This system is able to recognize four different types of colored skittles using RGB.



values of the skittles in order to sort them based on the respective color. It takes 1.5 seconds time to sort one skittle which is less than the manual sorting. With this automatic sorting machine we can save time and labor cost very effectively. Though this system has some limitations, by having done some modification this concept can be implemented in a wide range of applications such as in fruit industries. Mr. Nikhil J. Surwade, Chaitanya Kshirsagar, Ketan Biradar, Piyush Zaware, Shreyash Kulkarni [5] the project is realized in that the design is completed which results in an equipment capable to sort and pack different types of fruits. The objectives are also achieved which include: Sorting of five different types of fruits, packaging of five types of fruits and weighing and labelling of the fruits. The next step in this research would be the fabrication aspect, which would include procurement of the above mentioned components, fabrication of components like the lifting fork, frame, etc. And then finally assembling all the components. The assembly will then undergo experimentation and complete analysis to ensure complete adherence to the objectives set in the initial part of the project. Any modification and upgrades can be realized after this analysis is completed and applied to the entire setup.

### III. METHODOLOGY

Step 1: - We started the work of this project with literature survey. We collect a lot of research papers which are applicable to this subject. After going through these papers, we learnt about fruit sorting.

Step 2: - Later that the elements which are essential for our project are selected.

Step 3: - 3D Model and drafting will be done with the help of Solidworks software and done FE analysis with help of ANSYS

Step 4: - Then we will start for manufacture the model we required as per need with required best material with required manufacturing processes

Step 5: - Then we will do testing and trials of the assembly machine with compared to the design and analysis.

- Identification of problem
- Idea of project
- Collection of data
- Literature survey
- Design of CAD model
- Material selection
- Fabrication work
- Testing
- Conclusion
- Submission of project

### IV. DESIGN CALCULATIONS

1. Frame load calculations

Size of section: 25x25 mm

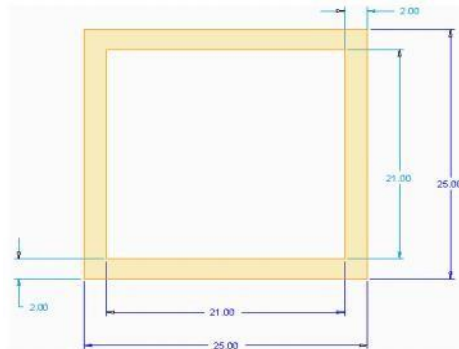
Thickness of section: 2 mm Total length of rectangular bar section in design is 12.849m

As per standard the weight of square hollow section bar is 1.43kg/m

Weight of the frame =  $1.43 \times 12.849 = 18.37\text{kg}$

$x = y = 12.5\text{mm}$

Area of cross-section is  $A = BH - bh = 184\text{mm}^2$



(Fig 4.1.1 Square Bar)

Weight of frame = 18.37kg = 180.20 N  
 Weight of hopper = 5kg = 49.05 N  
 Weight of fruits = 25kg = 245.05 N  
 Total load acting on frame = weight of frame + weight of hopper + weight of fruits  
 = 180.20 + 49.05 + 245.05

Total load acting on frame = 474.3 N  
 But we considered total weight acted on frame is 60 kg  
 = 60\*9.81 = 588.6 N Considered stress on frame  
 = 588.6/184 = 3.19 N/mm<sup>2</sup>  
 Actual stress on frame = 474.3/184 = 2.57 N/mm<sup>2</sup>

As the load is distributed on the pipe which is subjected to the load as simply supported beam with uniformly distributed load the bending moment on the pipe is calculated as

$$M / I = b / Y$$

where M is the moment, I is the moment of inertia for pipe section

Therefore, for a single hollow pipe,

$$I = BH^3/12 - bh^3/12$$

Where, B= Outer breadth of rectangular cross section of pipe = 25mm

H= outer height of rectangular cross section of pipe = 25mm

b= Inner breadth of rectangular cross section of pipe = 21mm

h = inner height of rectangular cross section of pipe = 21mm

$$I = 32552 - 16206 = 16346 \text{ mm}^4$$

$$Mb = WL^2 / 8 = 474.3 \times (0.790) / 8 = 19.89 \text{ N-m}$$

Where, Mb is bending moment L= Length of pipe

W = weight acting on pipe

$$b = \text{Bending stress } Mb = 19897 \text{ N-mm}$$

$$46837 / 16346 = b / 12.5 \quad b = 35.81 \text{ N/mm}^2$$

Therefore, bending stress is b= 35.81 N/m<sup>2</sup>

Considered Total load that frame will carry = 588.6 N = 60 kg

## 2. Fruit mover part calculation

Motor is used to rotate this part.

Torque required to do so =?

Hence,

Torque = Force (load) x Radius of rotation

Load = Weight of fruit + weight of Rotating part x 9.81 m/s

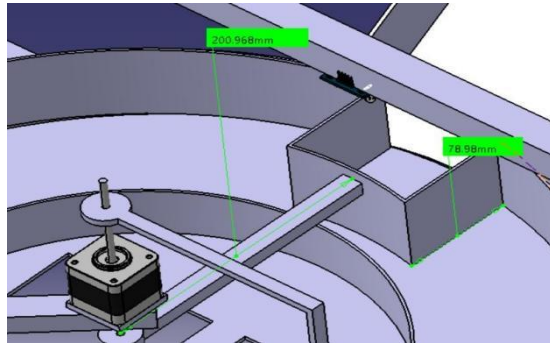
$$= 0.3 \text{ Kg} + 1. \text{kg} \times 9.81 \text{ m/s} = 1.3 \text{ kg} \times 9.81 \text{ m/s}$$

$$= 12.75 \text{ N}$$

Radius of rotation = length of bar + ( length of fruit holder/2)

$$= 200 + 78/2 = 239 \text{ mm} = 0.24 \text{ m}$$





(Fig 4.1.2 Fruit Mover)

$$\text{Torque} = 12.75 \times 0.24 = 3.06 \text{ Nm}$$

Hence we selected the motor according to this requirement.

Servo motor 12 v DC

3 Motor Power:120W Speed:55RPM V:12V DC

$$P=2*3.14*55*T/60$$

$$120=2*3.14*55*T/60$$

$$120*60/2*3.14*55=T$$

$$T=20.83\text{NM}$$

Motor Selected For Fruit Mover Is Under Permissible Limit hence design is safe.

## V.CONCLUSION

In conclusion, the automatic fruit sorting machine proved to be a highly efficient and reliable solution for sorting fruits based on their size and weight. The machine was able to accurately sort a large quantity of fruits in a short amount of time, reducing labor costs and increasing productivity. The use of advanced technology such as sensors, and algorithms enabled the machine to make precise decisions and minimize errors. The optimization of the machine's design and the level of mesh refinement in the model played a crucial role in achieving optimal performance. Overall, the automatic fruit sorting machine is a valuable tool for the fruit industry, providing a cost-effective and efficient solution for sorting fruits.

## VI.RESULT

Result of fruit sorting machine is depend on the fruit shape if fruit spherical in nature then this fruit sorted easily. The fruit was successfully sorted. The different fruits that was successfully identified.

## REFERENCES

1. Model Design And Simulation Of Automatic Sorting Machine Using Proximity Sensor bankole i. Oladapo a, v.a. Balogun a, a.o.m. Adeoye a, c.o. Ijagbemi b , afolabi s. Oluwole a,i.a. Daniyan a, a. Esoso aghor a, asanta p. Simeon a a afe babalola university, ado-ekiti, nigeriab the federal university of technology, akure, nigeria,[elsevier] ,may 2016
2. Fruit Sorting Machine, Sagar P. Walhekar, Kapil Rajendra Tungar, Shubham Narayan Thorat, Rohit Nivrutti Mundhe, Shubhangi Devidas Gaikhey [IJARSCT],MAY2022
3. Development of an Automated Fruit Sorting Machine using an Embedded System (Arduino Mega Based),Y. Adamu, A. A. Adamu, S.I. Kolo, A. W. Nnanna [ISSN] June-2019
4. Development and Testing of a Low-Cost Belt-and-Roller Machine for Spheroid Fruit Sorting Vahid Farzand Ahmadi, Peyman Ziyae, Pourya Bazayr and Eugenio Cavallo , [MDPI]Dec 2020



5. Automatic Fruit Sorting Machine, Prof. Taware O. H, Ghorpade Amol Krishna, Ghorpade Mayur Ganpat, Deokar Ajay Vyankat [IJRPET] May -2017
6. Automatic Color Sorting Machine Using TCS230 Color Sensor And PIC Microcontroller Kunhimohammed C. K, Muhammed Saifudeen K. K, Sahna S, Gokul M. S and Shaez Usman Abdulla [IJRIST]2015
7. The Citrus Fruit Sorting Device Automatically Based On Color Method By Using Tcs320 Color Sensor And Arduino Uno Microcontroller, Poltak Sihombing, Faddy Tommy, Sajadin Sembiring, Nogar Silitonga [Journal of science]2019.
8. Design And Development Of Arduino Based Automatic Color Sorting Machine, Mr. Nikhil J. Surwade, Chaitanya Kshirsagar, Ketan Biradar, Piyush Zaware, Shreyash Kulkarni, [IRJET] May 2019.
9. Design and Development of Fruit Sorting and packaging Machine, Deepak Devasagayam, Ajinkya Shende, Aldrick Gonsalves, Kaustubh Padalkar, Vinit Rodrigues, [researchgate] . December 2019
10. Arduino Based Color Detection for Visual Impaired, Bindu S Pagad, Namratha D Gaddad, Asst. Prof. Chaitanya K Jambotkar [IJIRT] February 2019



Impact Factor: 8.423



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details