



Design and Development of Fruit Sorting Machine

Prof. S. M. Jadhav

Niraj Koli¹, Mayur Chaudhari², Akshay Balchatre¹³, Pratik Gujar⁴

Department of Mechanical Engineering

Smt. Kashibai Navale College of Engineering, Vadgaon BK, Pune

Abstract - An abstract manual fruit sorting machine by size would be a device designed to sort fruits of different sizes by separating them into distinct groups based on their dimensions. This type of machine would be manually operated, without the use of electricity or any other form of power, and would be suitable for small-scale fruit sorting operations. The machine would likely consist of a platform or table with different-sized slots in it, arranged in a specific pattern. The fruit would be placed on top of the platform, and then slide through until they fall through the gaps into different compartments or containers below, sorted by their size. The design of the machine would depend on the type of fruit being sorted, as different fruits have different shapes, sizes, and weights. The operator would need to adjust the size and arrangement of the slots according to the fruit being sorted. The main advantage of an abstract manual fruit sorting machine by size is that it can be operated without the need for electricity or any other form of power, making it ideal for use in rural areas or in situations where power is not readily available. However, it may not be suitable for sorting large volumes of fruit, as it would require significant manual labor and time.

Introduction

This Fruit Sorting machine project is to reduce the manpower required and increase productivity by developing a mechanism for automatic sorting and packaging of the fruits. The machine will be able to sort different types of fruits according to their shape and size. This project was conceived by the observation during the packaging of fruits and vegetables in Markets, where the agricultural produce has to be individually packed, sorted, weighed, and labeled. This project aims to decrease the manpower required to accomplish this manual labor and increase the speed and efficiency of the entire process. Existing machines do not have sorting features for different types of fruits. There is also no provision in existing machines for sorting products in a single unit. Manual labor for sorting has to be reduced whereby staff can be utilized for other tasks. Time taken for sorting also should be reduced to increase customer satisfaction.

Literature Review

1. Design and Development of Fruit Sorting And Packaging Machine:(Deepak Devasagayam, AjinkyaShende, Aldrick Gonsalves, Kaustubh Padalkar, Vinit Rodrigues)

The Project has achieved which includes: sorting five different types of fruits, packaging five types of fruits, and weighing and labeling the fruits.

2. 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)

The objective of this project was to develop an embedded system with quality control and process automation for sorting fruits either ripe, unripe, or defective. The developed system has proven to be simple, efficient, and user-friendly.

3. The Design Of Fruit Automated Sorting System:

(Pingju Ge *, Qiulan Wu, Yongxiang Sun)

The paper introduced the design thought of fruit automated sorting system, which consists of hardware, work principle, and the design of the software. The final application of the system can bring about large social benefit and economic benefits to agriculture production and management.

4. Development and Testing of a Low-Cost Belt-and-Roller Machine for Spheroid Fruit Sorting. (Vahid Farzand Ahmadi 1,

Peyman Ziyadeh 1, Pourya Bazayr 2, and Eugenio Cavallo 3,*)

Sorting is one of the most critical factors in the marketing development of fruit and vegetable and should be performed without any damage to the product. This article reports the results of the development and testing of a prototype of a low-cost mechanical spherical fruit sorter based on a belt-and-roller device built at the State University of Tabriz, Iran.

Problem Definition

Farmers cultivate a variety of vegetables while various fruits are produced by farmers practicing horticulture and sold to customers by various means. The produced fruits and veggies do not have a uniform size. They may have below-average size, average size, or above-average size. The quality and price are quantified according to the size, thus the farmer needs to sort out his products according to size to earn accordingly. The sorting process is carried out manually, this makes the process slower, more labor intensive, and not as effective as required. Thus, there is a need to mechanize this process to make it quick and effective. It is required to mechanize the sorting process but not necessarily automate it.

Proposed Solution

For mechanizing the sorting process we have proposed a simple, non-powered, and effective machine, the working principle of this machine is that a pipe is placed at a certain angle relative to another pipe so that axial distance goes on increasing and both of them are inclined on the same side at a specific angle, any fruit or vegetable is gravity fed between these pipes. They roll down the pipes until their width is more than the axial distance between the pipes after that they drop through the pipes and fall on a collection tray and get collected separately. This simple mechanism with more pipes connected in the same manner can be used for sorting fruits and vegetables of nearly spherical shape.

The proposed machine was envisioned and modeled using CAD software, and the complete machine was assembled, the following table provides data regarding the same;

Sr. no.	Part Name	Quantity	Material
1	Frame	1	Stainless steel
2	Adjustable end	1	Stainless steel
3	Pipe	7	GI/PVC
4	Hopper bracket	2	Stainless steel
5	Hopper	1	steel
6	Hopper plate vertical	1	GI sheet
7	Hopper plate horizontal left	1	GI sheet
8	Hopper plate horizontal right	1	GI sheet
9	Hopper support rod	1	Steel
10	Collection tray	1	GI sheet

Vegetables that can be sorted Onions,
potatoes, tomatoes, lemons, etc. Fruits

that can be sorted

Oranges, apples, etc.

Unique features

Various adjustable elements – because this machine would be used for a variety of fruits and vegetables with their unique sizes it required various adjustable features to make it suitable for effectively sorting any fruit or vegetables. All adjustable features are listed below:

- Pipe positions – pipes are bolted at both ends on grooves thus the pipes can be re-configured to change the angle between the pipes, this adjusts the increase in axial distance as we move down and facilitates variable sorting of various produces.
- Pipe inclination – the inclination of all the pipes can be changed simultaneously to achieve variations in rolling velocities.
- Output from hopper – fruits and vegetables would be dispensed from the hopper on the pipes, this rate of dispensing can be adjusted by vertical hopper plate.
- Output width of hopper – the width along which the hopper needs to dispense the veggies or fruits depends on how the pipes are positioned thus the hopper needs to dispense only on the pipes, this is achieved by horizontal hopper plates on both sides.

Possible Modifications

Different configurations of the sorting machine using the same working principle are possible, the following list evaluates all possible modifications for the sorting machine

- The number of pipes can be reduced from 7 to 5 or 3 as required and proportionately reducing the width of the frame.
- The inclination angle can be fixed at a certain value and would no longer be adjustable.
- Length measuring scales can be provided at both bolted ends to ensure equidistant spacing between each pipe.
- The design of the collection tray can be changed to dispense fruits or vegetables directly into packaging bags or boxes.
- The material used for manufacturing collection trays can be GI sheets or Fibre Glass.
- Pipes can be made of PVC or GI pipes.
- The frame can be designed to be non-rectangular i.e. shorter in width at the hopper side and greater width at the other end.
- Fruits or vegetables need to be unloaded into the hopper, this process can be mechanized by the use of conveyors.
- Installing a conveyor system to feed the fruits or veggies on the pipes.
- Conveyor systems would necessitate a power supply and require the installation of an electric motor and starter circuitry.

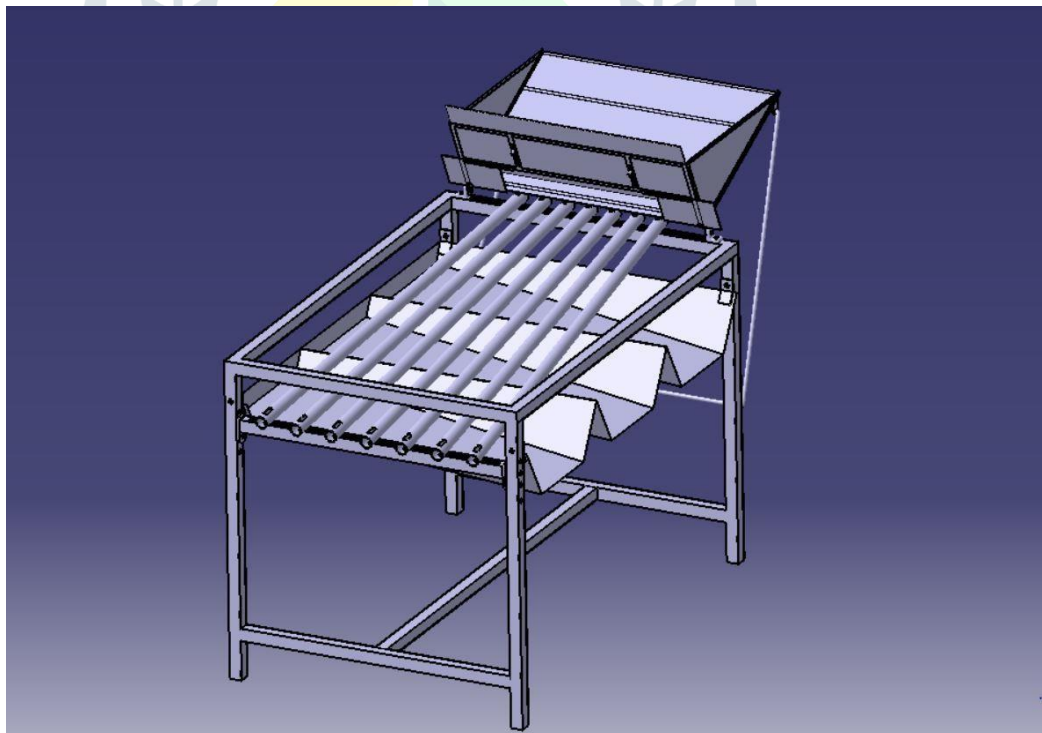


Fig 1. Fruit Sorting Machine CATIA Model



Fig 2. Actual Model

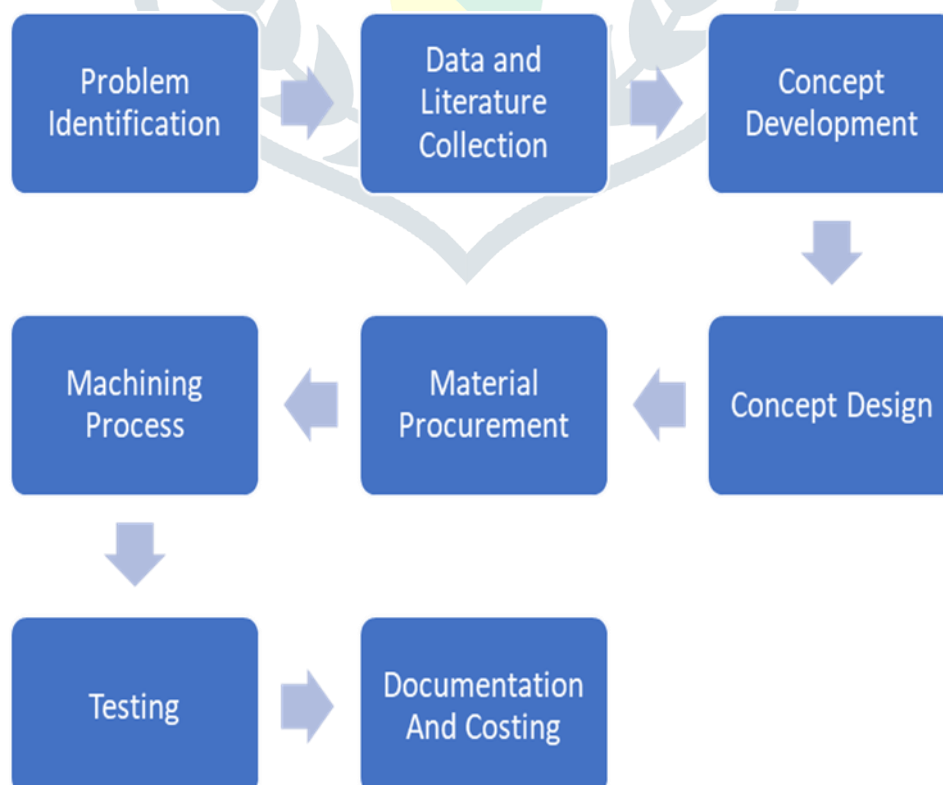
Objectives Of Project

- To sort different types of Fruits and Vegetables with their sizes and shapes.
- To decrease manpower required for sorting different types of fruits and vegetables.
- To be available in small-case sorting for farmers and small-case markets.
- To shorten the timing and cost of the sorting process.
- It also helps in sorting different products or fruits in a single unit. It also helps to increase customersatisfaction.
- To eliminate the power consumption during Fruit & vegetable grading.
- To maintain the accuracy in Fruit & vegetable grading.
- To develop a machine, so that m/c can easily be adopted in today's automated Fruits
- The project also aims to improve customer satisfaction by ensuring that the fruits and vegetables sold to customers are of consistent size and quality. By eliminating the power consumption during grading and maintaining accuracy, the machine can provide a reliable and sustainable solution for fruit and vegetablegrading
- Overall, the project's objectives aim to improve the efficiency and accuracy of fruit and vegetable sorting while reducing the manpower required and the cost and time associated with the process. This can help farmers and businesses to increase their profitability and competitiveness in the market, while also improving customer satisfaction and ensuring sustainable and reliable solutions for fruit and vegetable grading.

Scope Of Project

- If it can be manufactured on a large scale so it will be helpful to reduce the production cost.
- We can even change the material if we get proper and efficient material at a low cost or if we develop any Alloy for this task.
- It can be distributed on the commercial level at a low cost as well.
- In this design, we can add artificial intelligence and machine learning to eliminate human effort.
- The scope of this project is vast and can be expanded to include various aspects that can improve the efficiency and functionality of the fruit and vegetable sorting machine.
- The scope of this project is vast and can be expanded to include various aspects that can improve the efficiency and functionality of the fruit and vegetable sorting machine.
- Another aspect of the project's scope is to explore the possibility of using different materials that are more efficient and cost-effective than the current ones. By identifying and using efficient materials or developing new alloys, it will be possible to improve the overall functionality and durability of the machine.
- The scope of the project also includes the distribution of the machine on a commercial level at a low cost. This will help ensure that farmers and small-scale markets can access the machine and use it to improve their fruit and vegetable sorting process.

Methodology



Conclusion

1. The machine has a flexible design that allows the sorting of different-sized varieties of fruits. The machine was tested to sort large-sized fruits such as oranges, and apples, and small-sized fruits such as plums.
2. The sequential fruit-size sorting machine was designed and implemented according to some of the physical and mechanical properties of the sorted fruits.
3. We selected this project to contribute to sustainable machines. This work presents a new technique for sorting and grading fruits using a purely mechanical approach.
4. This technique begins with shorting the fruits using regular size. The features are efficiently extracted from the mechanical arrangements. The size of the fruit determines its class.
5. The proposed technique accurately classifies and grades the fruits. The results are good for the five chosen fruits of the same sizes. This kind of system can be employed in Agriculture Produce Marketing Corporation, etc.
6. The machine designed in this project has the potential to revolutionize the fruit sorting and grading industry. With its ability to efficiently and accurately sort different sizes and shapes of fruits, it can save time, reduce labor costs, and increase productivity for farmers and fruit suppliers.

References

1. TOMRA Sorting Solutions: <https://www.tomra.com/en/sorting/food/solutions/fruit>
2. Key Technology: <https://www.key.net/products/processing/sorting/veryx/>
3. Greefa: <https://www.greefa.com/solutions/fruit-sorting-machines/>
4. Aweta: <https://www.aweta.com/solutions/sorting/fruit-sorting/>
5. Raytec: [Vision: https://www.raytecvision.com/fruit-sorting/](https://www.raytecvision.com/fruit-sorting/)