

Design and Development of Multi Vegetable Sorting Machine

Tushar Bhand

Department of Mechanical Engineering,
Savitribai Phule Pune University,
Pune, Maharashtra - 411007, India.

Rahul Zarkar

Department of Mechanical Engineering,
Savitribai Phule Pune University,
Pune, Maharashtra - 411007, India.

Rajkumar Zodge

Department of Mechanical
Engineering,
Savitribai Phule Pune University,
Pune, Maharashtra - 411007, India.

Shubham Kunjir

Department of Mechanical
Engineering,
Savitribai Phule Pune University,
Pune, Maharashtra - 411007, India.

Prof. Paresh. P. Khairnar

Department of Mechanical
Engineering,
Savitribai Phule Pune University,
Pune, Maharashtra - 411007, India.

ABSTRACT:

In the economic development of India, agriculture sector plays a key role. For the proper price of an agriculture product, grading according to size is necessary. And it is also a value adding technique to the product. It makes the product more attractive and improves its processing qualities. Uniformity in size is important. At present, size grading of most agricultural products including lemon, garlic, onion, tomato, Orange, mandarin, apple are carried out manually by farmers, agents, whole sellers, retail sellers and customers also. Most of the farmers market their products without any grading. Persons engaged in postharvest crop handling such as collectors, whole sellers, retail sellers, and farmers cannot use high technical and costly grading techniques. And also by the local market survey it is found that the retail market price of the fruits is significantly varied according to its size. Fruit grading by human is inefficient, labour intensive and error prone. The automated grading system not only saves time but also minimizes error. Improvement in quality and value addition of agricultural produce has gained higher concern in recent times. There is a great demand for fruits in both local and foreign markets. The study is carried out for the design of a machine which can be used to grade multiple fruits by making adjustments. The machine should be simple to use so it can be operated by any illiterate person also so that farmers can also use it.

I. INTRODUCTION:

Apart from quantitative losses, quality deterioration and hence a reduction in the market value due to use of improper post harvest techniques [3] are common in agricultural commodities in Sri Lanka. Improvement in quality and value addition of agricultural produce has gained importance in Sri Lanka in recent times due to the creation of new opportunities for the sale of agricultural commodities in the open market at competitive prices.

This situation has resulted in a growing awareness and increased demand for better market quality among consumers. Improvement in product quality by grading according to size will become even more important in the future for Sri Lanka, as well as most of the other countries, entering into international as well as regional trade agreements and thereby opening its market to the outside world. The price of many agricultural produce varies significantly according to their uniformity in size.

Uniformity in size not only makes the product more attractive to consumers but also improves its processing qualities [2]. Therefore, size grading of agricultural commodities to achieve uniformity in size is an important value adding technique to increase their market value.

Cite this article as: Tushar Bhand, Rahul Zarkar, Rajkumar Zodge, Shubham Kunjir & Prof. Paresh. P. Khairnar, "Design and Development of Multi Vegetable Sorting Machine", International Journal & Magazine of Engineering, Technology, Management and Research, Volume 6 Issue 6, 2019, Page 1-4.

Big onion (*Allium cepa*) is one of the major spice/vegetable cash crops, grown in. The level of big onion production and prices shows an immense potential for increasing incomes of local farmers. Profit from big onion is greater than other major cash crops such as chilli and potato¹. Generally, it can be observed, that there is an appreciable difference in the market price of big onion according to the size of bulbs. Graded big onion bulbs according to their size fetches a higher price than the un-graded onions². Local farmers sell their produce to the market without grading. Hence, farmers are getting lower value for their produce. However, manual size grading of most crops are practiced by collectors, whole sellers and retailers and thereby, they make higher profit than farmers. In persons engaged in post harvest handling of crops have less chance to use high cost size separation techniques [1-4]. Hence, this research study attempted to design, development and performance optimization low cost machine for size grading of big onion bulbs.

II. LITERATURE REVIEW:

1.El-Rahman and Magda (2011): presents the onion grading machine which was developed from a small cylinder type grading machine to suit grading of onion sets crop. On these parameters four levels of increase in revolving speed and feeding rates The studied parameters included, revolving speed 35, 45, 55 and 65 rpm (0.366, 0.471, 0.576, and 0.680 m/s), and feeding rates (75, 100, 125 and 150 kg/h). The grading efficiency (%), grading productivity (kg/h) and the mechanical damage percentage, were also considered on the effect of machine parameters. This project was successful based on the obtained results in which the maximum grading efficiency was higher on the third set of parameters (55 rpm and 125kg/h).

2.Tripathi (2006): presents about the need of the onion grading. The demand of graded onion and how much is the need of onion. In this paper, the classification of onion based on size was described. The size of the onion were classified to three that are A, B and C. The global production rate of onion was also described. The onion

grading prototypes which were used around the country also included in this presentation.

3.Gunathilake et al (2016): introduces a new prototype for onion grading machine. In this new prototype, the inclined angle against the horizontal axis was within a range of 2 . The revolving speed of the grader was from 10rpm to 20 rpm. The optimum result was obtained at the revolving speed 15rpm and at an inclined angle of 3 .The capacity of the grader under optimum operation conditions was 630Kg/hr. The grading efficiency/qualities of small, medium and large grades were 84.47%, 93.46% and 90.14 respectively [5].

4.Moreda et al., (2009): presents the size of fruits and vegetables is an essential physiological property that can be described by different parameters such as volume, weight, length, and diameter Size determination isoftenmandatory to the sorting of many fruits and vegetables for various reasons, such as requirements of processing machine, regulatory rules of sorting standards, and consumer preferences. Size is also an important quantitative factor to evaluate for phenotypingoffruits and vegetables [6]. Many machine vision methods have been proposed to nondestructively measure the size of various fruits and vegetables including apple, citrus, pear, tomato, etc.

METHODOLOGY

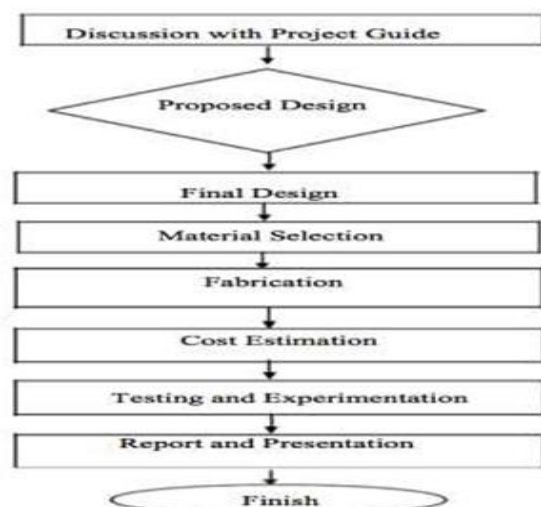


Fig. 1 Methodology

III. PROBLEM STATEMENT

1. Onion is one of the important crops cultivated in India. India is the second largest producer of onion in the world.
2. Manual grading need more time.
3. This manual grading is increase the cost of onion tremendously to customers and to producers.
4. Labour availability is less for grading.
5. As manual grading need more time so there is risk of decay of onion.
6. After harvesting grading should be done within less time to avoid the decay.
7. For the proper price of any agriculture product, grading according to size is necessary.
8. Also by the local market survey it is found that retail market price of the fruits is significantly varied according to its size.

IV. PROPOSED SYSTEM

Onion grading machine consist of belt conveyor system in which eight buckets are attached to carry onion. These buckets are attached equidistant in the conveyor belt. At a time, four buckets are loaded and four will be in unloaded position. The loading of one bucket is happening at the same instant where the other bucket is unloading the onion into the grading tray.

V. DESIGN

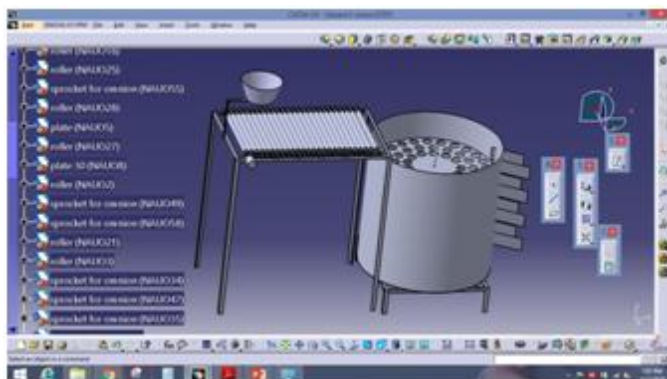


Fig. Design.

Frame

1. Mild steel angles are used to support the whole mechanism. These angles are welded together in order to

form a frame which will support the rollers and the assembly.

2. We design a basic frame for a prototype by mild steel channel (L beam),
3. L Channel- MS Angles are L-shaped structural steel represented by dimension of sides & thickness.

Motor

An AC motor is an electric motor driven by an alternating current. It commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft that is given a torque by the rotating field. There are two main types of AC motors, depending on the type of rotor used. The first type is the induction motor or asynchronous motor; this type relies on a small difference in speed between the rotating magnetic field and the rotor to induce rotor current. The second type is the synchronous motor, which does not rely on induction and as a result can rotate exactly at the supply frequency or submultiple Of the supply frequency. The magnetic field on the rotor is either generated by current delivered through slip rings or by a permanent magnet.

Hopper

1. A storage container used to collect granular materials designed to easily dispense these materials through the use of gravity.
2. Part of an agricultural aircraft to store the chemicals to be spread
3. Part of a combine harvester
4. Part of a wheel tractor-scraper to store the soil load
5. Hopper (particulate collection container), a large container used for dust collection.

Chain and sprocket:

A sprocket or sprocket-wheel is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never

meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

ADVANTAGES:

- The system is automatic. Speed of the separation process is high.
- Accuracy of the process is high.
- Highly Reliable.
- Easy to use.
- System is cost effective.
- High Flexibility.

VI. CONCLUSION

Fast, automatic and precise system for Grading of different types of onions. The system can replace the conventional methods with better efficiency. We have successfully developed a model of onion grading machine with better efficiency. From the existing prototype we have studied all the mechanical process which comes under the project.

REFERENCES:

- [1] G.P. Moreda, J. Ortiz-Canavate, F.J. García-Ramos, M. Ruiz-Altisent, (2009) 'Non-destructive technologies for fruit and vegetable size determination – a review', Science direct, 92, 119–136.
- [2] Abd El-Rahman, Magda M, J. Soil Sci. and Agric. Eng., Mansoura(2011). Development and performance evaluation of a simple grading machine suitable for onion sets. Univ., Vol. 2 (2): 213 – 226.

[3] SmitaShelke, A.P Phatale, (2013), International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering An automatic grading system based on machine vision. vol. 1, issue 4.

[4] Weilin Wang, Changying(2014), Size estimation of sweet onions using consumer-grade RGB-depth sensor Science Direct. Li, 142, 153–162.

[5] D.Gunathilake, W. Wasala, K. Palipane, 'Design, development and evaluation of a size grading machine for onion', Science direct, 6, 103 – 107 (2016), .

[6] Nikhil V. Kamthe., Akshay M. Kapare 'International Journal of General Science and Engineering Research (IJGSER)' ISSN 2455-510X, Vol 3(2), 2017, 118-121.