14th International Conference on Science, Technology and Management (ICSTM-19)
Guru Gobind Singh Polytechnic, Nashik, Maharashtra (India)
2nd March 2019, www.conferenceworld.in
ISBN: 978-93-87793-74-3

The Onion Grading Machine

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Abstract
Agriculture plays a crucial role in the economic development of India. The grading of fruits and vegetables according to size is always necessary for the proper price of any agriculture product. And it is also value adding method or procedure to the product. To make the product more asthetic and improve its processing abilities uniformity in size and shape is very necessary. At present, size grading of most agricultural products including onion, tomato, apple, lemon, garlic, orange are carried out manually by farmers, agents, traders, retailers, whole sellers, and customers also. Most of farmers go to market to sell their products without any sorting. Persons engaging in post-harvest crop handling such as farmers, retailers, whole sellers, and collectors cannot use special purpose and costly grading method or machine. As per a survey in the local market we found that retail market price of the fruits and vegetables is considerably more to separate it according to its size. Fruit and vegetables grading by human is not efficient, labor intensive and gives error. The automated grading system not only saves the time but also minimizes error. There is a huge demand for fruits and vegetables for both import and export in abroad and local markets. For the design of a machine a study is carried out of which can be applied to grade multiple fruits by making some adjustments. Machine should be easy to handle so it can be operated by any illiterate people or any non-technical person also so that farmers can also use it without hesitating.

Keywords: - onion grading, size and shape, market.

1. INTRODUCTION

An onion is one of the most cultivated crops in India. India is been ranked second for the production of onion in the globe. The improvement of quality and value addition of agricultural production has gained higher problem now-a-day in India due to creation of open market for the sale of agricultural products in open market at reasonable rates. Until now almost every place in India, the onion grading is done manually. This manual grading increases the cost of onion tremendously to both customers and producers. This manual grading also needs more labor. There are also lots of human errors while sorting or separating the onions. So we cannot definitely guarantee that the way of grading on present days will be most accurate and precise. Now there is need of automation in the agricultural sector due to tremendous competition from across worldwide. So we have to improve the quality and efficiency of the sorting processes simultaneously. Due to this some of new concepts, we can definitely say that it will help maximum number farmers and traders, to focus back to agriculture and this will lead to new innovations in the agricultural industry too.

The grading of onions according to the sizes is an important value adding process for most agricultural products. Also the price of the many agricultural products are differentiated significantly according to their similarity in size. Evenness in size makes the product more attractive to consumers and also improve its processing standards. In order to achieve uniformity in the size of onion the proper grading techniques are required. With the help of automation that goal can be achieved easily. This type of grading machines allows the farmers to increase production by reduction in the cost and also reduces the need of labor. The research on this field is also very important in the future of agriculture sector to develop new mechanism or techniques which will help the farmers to be capable to manage their crops by their own. The other area is the creation of awareness among all the farmers about this type of innovation to proper application of advanced technology in the farms to improve the production rate of farms. Also the main motive of grading is the esthetics effects of the onion that will attract the customer to buy the onion by giving them huge ample of money. And also it will increase the price of the crop and it can sustain higher rate of testing, when it is coming to export to developed nations where they are paid a very high amount of money for the good quality products. Also, there is very high risk of banning standard having low quality products which is not meeting the standards given by the

ISBN: 978-93-87793-74-3

government even if the onions are fresh and has all qualities of a natural onion. The main difference between the good quality product and the low quality product is their post-harvest processing capability and methods. This gap can be rectified by the few innovations and techniques like onion grading machine.

2. LITERATURE REVIEW

I. Onion is one of the important commercial vegetable crops grown on a large scale in India. As the onion bulbs are to be stored for long period for use during off-season, a considerable loss occurs by way of harvesting, threshing, sorting and grading. Work has been done on grading of onion bulbs with an aim to decide best method to reduce the handling damage. The literature pertaining to physical and engineering properties of onion, importance of grading, fruit and vegetable grading, different types of graders and grading mechanisms, color sorters, mechanical damage, cushioning

I material, performance testing of fruit grading devices, have been reviewed and the research work conducted by different scientists and engineers on the above topics is reported in this chapter.

II. Shyam et al. (1979) developed a power operated oscillating sieve type potato grader capable of sorting potatoes in 4 or 5 different sizes or grades and tried different combinations of sieve speed, stroke length and sieve slope for satisfactory operation and high screen efficiency. Sieves of size 60 cm x 120 cm with round perforations of 50.4, 44 and 35 mm diameter were used. The machine yielded the throughput of 37 q/h at of 462 stroke/min speed, 31.5 mm stroke length and 14.5% sieve slope.

III. Smita and Patole (2013) represents about the automatic sorting m/c based on the machine sight. In this project, Author protests on the quality requirement of onion when it is exporting to foreign nation. The idea of onion grading machine used in the project based on the color and texture of onion. The onions will be rejected as defective one if it does not satisfy the requirement. The viewer introduces to light as an electromagnetic quantity, and to the mechanisms with the help of light which connects with objects. The process of producing colors by subtraction and addition of light is propagated. Then the idea of human color perception and color description is considered. The onion will be separated by the machine on the basis of this recognition.

IV. Doraiswamy (2000) developed a sieve type grader for grading groundnuts into three different sizes. The output capacity was 600 kg/h and was powered by a 1 hp 3- phase electric motor. Re-orientation of pods in sieve holes was observed which required modification in shaking system. After reviewing the literature, it could be concluded that sieve type graders faced some problem of sieve holes blocking.

V. El-Rahman and Mugda (2011) gives out the onion sorting machine for grading of onion which was invented from a small cylinder type grading machine to suit sets crop. The project also considered for optimum performance in two parameters. Those parameters are rotating speed and feed rate. On these parameters four levels of increase in rotating speed and feed rates The studied parameters included, rotating speed 35, 45, 55 and 65 rpm (0.366, 0.471, 0.576, and 0.680 m/s), and feed rates (75, 100, 125 and 150 kg/h).

Grades of Onions in Bulb grade	Bulb diameter (mm)	%Proportion in a good crop harvest
A	>80	30-40
B	60-80	40-50
C	40-60	10-20

Table 1. Grades of Onion

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The government of South Africa has given this chart about the onion grading

Category	Size
Extra Large	Over 80 mm
Large	60-80 mm
Medium	40-60 mm
Small	30-40 mm
Prickle	10 -30 mm

Table 2. Onion Sizes

Fig. a: Grade Onion-I

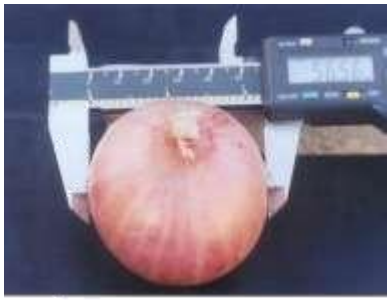

Fig. b: Grade Onion-II

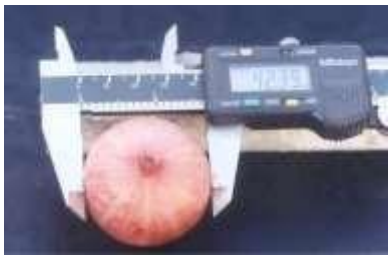

Fig. c: Grade Onion-III

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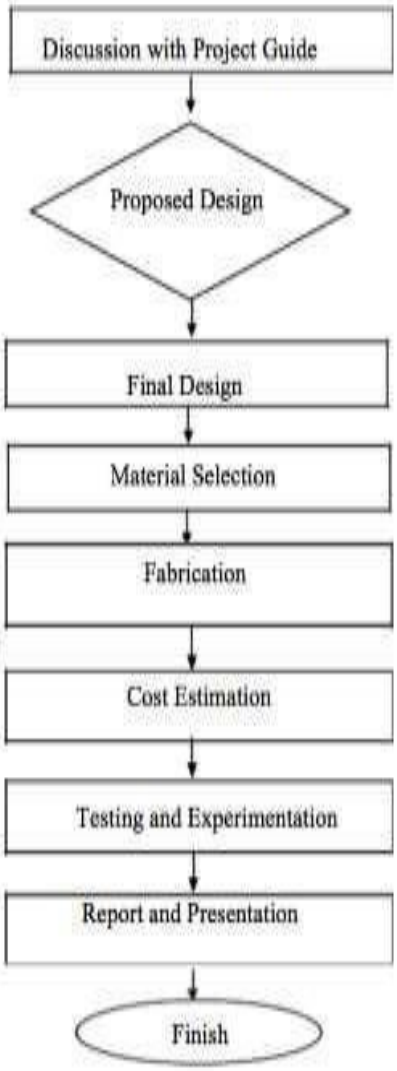
3.STRATEGY CHART:



4.CONSTRUCTION

Motor:

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly has of two basic components, an outside stator having windings supplied with AC supply to produce a RMF, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

Less common, AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.

The two main types of AC motors are induction motors and synchronous motors. The induction motor (or asynchronous motor) always has on a small lag in speed between the stator RMF and the rotor shaft speed called slip to induce rotor current in

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the rotor AC winding. As a result, the induction motor cannot produce torque near synchronous speed where induction (or slip) is irrelevant or ceases to exist. In contrast, the synchronous motor does not depend on slip-induction for operation and uses either permanent magnets, salient poles (having projecting magnetic poles), or an independently excited rotor winding. The synchronous motor produces its rated torque at exactly synchronous speed. The brushless wound-rotor doubly fed synchronous motor system has an independently excited rotor winding that does not depend on the principles of slip-induction of current. The brushless wound-rotor doubly fed motor is a synchronous motor that can function same at this frequency.

Other types of motors include eddy current motors, and AC and DC mechanically commutated machines in which speed is dependent on voltage and winding connection.

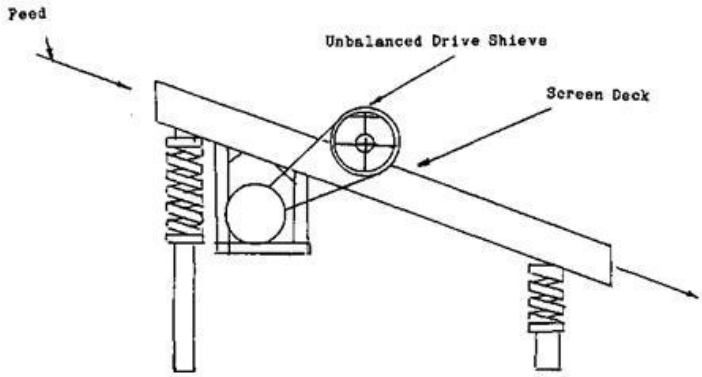
Electric Motor

Shaft:

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it.

Unbalanced weight:

Unbalanced weight is a disc having eccentric hole. Generally, MS is used as the material. It is a dead weight mounted on the both the ends of shaft. Due to this unbalanced load on rotating creates fluctuations. This is the main element for creating vibrations.



Grading Screen

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Grading Screen:

Onion sorting is the main aim in this machine. Grading screen is made of steel wire. The grading screen is vibrating to make the bigger sized onion and sort the low standard sized or small sized onion away from each other. Three types of standard sizes are graded. There is a Fixture to change the screen according to the Onion sorting is the main aim in this machine. Grading screen is made up of Steel wire. The grading screen is vibrating to make the bigger sized onion and sort the low standard sized or small sized requirement.

Belt and Pulley Drive:

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel.

In a two-pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts). As a source of motion, a conveyor belt is one application where the belt is adapted to carry a load continuously between two points.

Two types of belt drives, an open belt drive and a crossed belt drive are shown. In both the drives, a belt is wrapped around the pulleys. Let us consider the smaller pulley to be the driving pulley. This pulley will transmit motion to the belt and the motion of the belt in turn will give a rotation to the larger driven pulley. In open belt drive system, the rotation of both the pulleys is in the same direction, whereas, for crossed belt drive system, opposite direction of rotation is observed.

V belts solved the slippage and alignment problem. It is now the basic belt for power transmission. They provide the best combination of traction, speed of movement, load of the bearings, and long service life. They are generally endless, and their general cross-section shape is roughly. The "V" shape of the belt tracks in a mating groove in the pulley (or sheave), with the result that the belt cannot slip off. The belt also tends to wedge into the groove as the load increase ,the greater the load, the greater the wedging action, improving torque transmission and making the V-belt an effective solution, needing less width and tension than flat belts. V-belts trump flat belts with their small center distances and high reduction ratios. The preferred center distance is larger than the largest pulley diameter, but less than three times the sum of both pulleys. V-belts need larger pulleys for their thicker cross-section than flat belts.

V-belt and pulley drive

Compression Springs:

A spring is an elastic object that stores mechanical energy. Springs are typically made of spring steel. There are many spring designs. In everyday use, the term often refers to springs. Compression spring – is designed to operate with a compression load, so the spring gets shorter as the load is applied to it.

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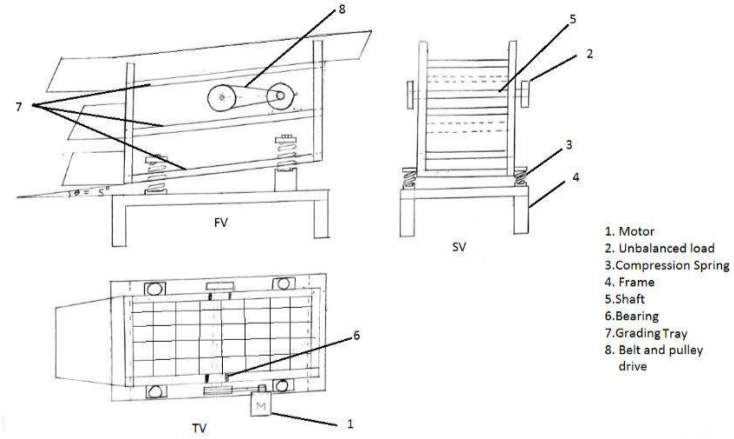
Frame:

An angle frame is made to support the mechanism. The whole load of machine is taken by the frame. Therefore, it is strong enough to absorb the shocks damped by the springs.

5.WORKING OF MODEL



2-D Diagram of Onion Grading Machine

6. WORKING:

As the motor starts, it rotates the shaft through the belt and pulley drive. An un-balanced load is mounted along the both ends of shaft which also rotates. Due to these vibrations are created in the system. These vibrations are used to separate the onions.

When the onions are poured on the uppermost portion of grading screen or screen the bigger size onions remain up and the other falls down. The upper onions are rolled out from the upper outlet. The Medium size onions remains on the second screen or screen and smaller onions fall down. All the onions roll and come from the respective outlet. The remaining prickles and soil is collected under the machine.

7. ADVANTAGES:

- This is an automatic system and requires less labor.
- Separation process speed is very fast.
- It is highly accurate and precise process.
- It is very Reliable.

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- Simple to use.
- Initial and maintenance cost is very low
- Running cost is very low.
- It has high flexibility
- It can also be applied to grade other fruits and vegetables like: potato, apple, oranges, pomegranate, garlic, tomatoes, etc.

8. APPLICATIONS:

- The machine has very low cost which can be bought by a normal farmer also.
- This machine can be applied on field or farm, market yards, store rooms, food industries, etc. by any person.
- This can be used in food industry , process industry,etc.

9. CONCLISION

An efficient, fast, precise and automatic system for Grading of different varieties of onions. It can be an alternative to the traditional methods with better productivity and effectiveness. We have developed and implemented a working model of onion grading machine successfully with very effective performance. From this model of onion grading machine we have studied many the mechanical concepts which comes under this project.

10. REFERENSES

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