Design and Manufacturing of Sweet Lemon Sorting Machine

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ABSTRACT

In the up growing technology and industry 4.O sorting of different is carried out differently. Every fruit has different method to sort it. Taking care of fruit while sorting is very important because it must not get damage. Fruits are sorted by its weight, color etc. Now-a-days visual inspection is carried out using size as a particular aspect. Mostly all big companies which buy and sell sweet lemon on large scale use visual image inspection technology for sorting fruit on weight and quality. It has many advantage of but one disadvantage of visual inspection is it requires very high developed technology machines which are costly and investment is risky and it is not affordable for small companies who sort it. Our sorting system in this paper is an economical solution for sorting sweet lemon. In this process we have designed a mechanical machine which can used by small industries or farmers or trades who requires sorting. While sorting we target sorting of sweet lemon on weight. This process of sorting sweet lemon is simple, portable and specific.

Keywords: Sweet Lemon fruit, portable weights, inspection, small industries.

1. INTRODUCTION

In Indian agriculture sector plays an important role in India's economic development. Since India is known as an agricultural country as it exports a huge amount of fruits. In India, mostly in Maharashtra sweet lemon is cultivated in major amount. As per survey it has been found that Guava, Pomegranate, and Sweet Lemon is cultivated mostly across Maharashtra. Sweet Lemon production is increasing every year according to national reports and surveys. Indian ranks 6th in the production of sweet lemon in world, 3rd in India and Maharashtra after mango. Sorting of sweet lemon is a basic need because its color and size says almost everything about its quality.[1]Very small and big size says it is not grown properly and ripen to much. Sorting it according to its weights make the vendor to buy fruit in quantity and sell it properly without taking doubt on quality. Sorting of sweet lemon is necessary in evaluating cultivating, meeting its quality according to standards and increasing market value. Because of this it become easy to pack and dispatch. Sorting in big industries it uses machines which contains senors so that they can sense the quality of fruit. Our machine mainly focus on sweet lemon sorting but one can sort many fruits by changing dimensions of weights as per requirement. On can use many chutes to sort sweet lemon with the help of lever mechanism.[2]

2. EXPERIMENTAL

Below is complete procedure how to run machine and perform experiment of sorting. Figure 1 shows the 3D representation of sweet lemon sorting machine and figure 2 shows actual sweet lemon sorting machine.

- Firstly sweet lemons are aligned to hopper.
- When hopper filled with sweet lemons, motor is started.
- The gear motor is used to reduce speed and maintain and attain the required speed for sorting.
- The conveyor is connected to gear motor.
- Conveyor passes single sweet lemon at a time to chute for sorting.
- Then the sweet lemon passes through chute, and it passes through different stages.
- The definite weighed fruits falls in buckets as per the weight in collecting net bags.

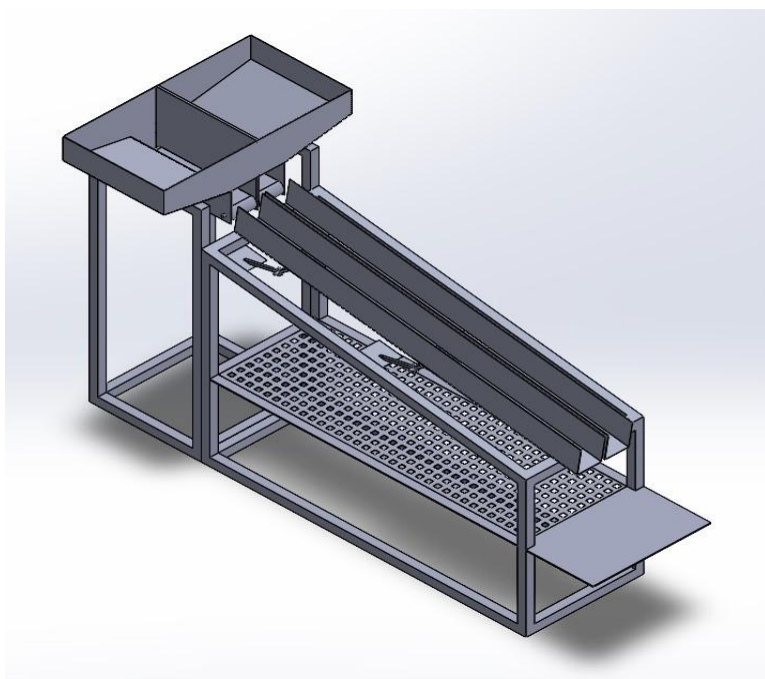As the bags fills next bag is attached manually and sweet lemon is sorted as per weight.

Figure 1. Schematic 3D representation of sweet lemon sorting machine

Figure 2. Actual representation of sweet lemon sorting machine

Analysis of product -

We gathered an information overall weight of sweet lemon. This all information is shown in table no 1

SR. NO	Weight (in gm)
1	142
2	152
3	148
4	144
5	142
6	166
7	146
8	148
9	148
10	180
11	182
12	116
13	152
14	200
15	142
16	116
17	140
18	140
19	122
20	126

Table no 1 :- Dimensional Analysis

We analyzed the dimension and weight of the sweet lemon, and observed that maximum weight of sweet lemon is 200 gm and minimum weight of sweet lemon is 100 gm. According to that sweet lemon are divided into three different weight categories.

- Stage 1:- 200gm-185gm
- Stage 2:- 184gm-125gm
- Stage 3:- 124gm-100gm

3. RESULTS AND DISCUSSION

Frame:-

Stand 1 :

Length of frame (L) : 610 mm

Width of frame (W) : 610 mm

Height of frame (H) : 1040 mm

Area of stand 1 = L * B * H

= 610 * 610 * 1040

= 386984 * 10^3 mm^2

Stand 2 :

Length of frame (L) : 1200 mm

Width of frame (W) : 610 mm

Height of frame (H) : 920 mm

Area of stand 2 = L * B * H

= 1200 * 610 * 920

= 67344 * 10^4 mm^2

Hopper:-

Volume of hopper = (1/3) * (length * height + Length * Height)

= 1/3 * (240 * 135 + 480*100)

=26,800 mm^3

Lever Mechanism:-

Material- Plain Steel 30C8

syt=400N/mm2

f(s)=5

σb = syt/f(s)

   =400/5

σb=80N/ mm2

Permissible Stress for lever pin

  τ = 0.5*400/5

   = 40N/ mm2

Determine Effort P

  Lw*w= p*lp

  P= w*lw/lp

   = 1962*95/190

   = 981N

Find out fulcrum reaction

  Rf=√P2+W2

   =√(981)2+(1962)2

  Rf=2193.58 N

Dimension of fulcrum pin

1) Bearing pressure

Rf= lb*d*Pb

lb= 1.25d

2193.58= 1.25d*d*Pb

Pb= 2193.58/1.25*(15)2

Pb= 7.80N

2) Direct shear Stress(τ)

Rf=2(π/4)d2*τ

=2193.58/353.43

= 6.206N/mm2

T<40 N/mm2

Conveyor:-

- Area of Belt= l*b

    =450*220

    = 99000

    = 0.099m2

Speed of Belt(V)=d*π

    =0.023*3.14

    =0.072m/sec

ρ=1522kg/m3

BC=3.6*A* ρ*V

    =3.6*0.054*1522*0.07

    =21.36 kg /sec

Mass of material= BC/(3.6*v)

    =21.36/(3.6*0.072)

    =0.45kg

Result of experiment performed :-

We took 20 sample of sweet lemon. We observed that sweet lemons greater in weight than 185gm fell into first bucket. Sweet lemons between 125 gm to 185 gm fell into second bucket and sweet lemons less than 125gm fell into third bucket.

4. CONCLUSION

While designing and manufacturing Sweet lemon sorting machine we mainly focused on safety of fruits. Keeping market demands in mind and distributes compatibility in sorting fruits in short time without wasting more money. Fruits are sorted easily without getting damaged and collecting of fruits according to their respective weights is carried out.

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