DESIGN AND FABRICATION OF MARIGOLD FLOWER SEED SEPARATING MACHINE

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ABSTRACT:- The paper describes about our project based on above topic. In this project, a marigold flower seed separating machine has been fabricated. The machine is fabricated for separating flower in two different parts, upper part consist of petals and lower part consisting of seeds. This project focuses in design fabrication of mechanical part of machine and the system of petal and seed separating machine. To achieve this project objective, the machine body structure and the mechanical system need to analyses some other criteria such as performance, strength, safety, and ergonomic design.

Key words: machine, cutting, seeds, slotted disc, roller.

I. Introduction

Marigold flower has a very important and prominent place on any occasion of celebration, marriage ceremony, festival or any other function. Because of this major part of the flower, waste is generated especially from the temples. When this flower are collected in large quantity, it make very difficult to manage such large quantity of flowers. These flowers are collected and utilize for better purpose, they are needed to be converted into compost by separating seed from it. In addition, oil is extracted from the seeds of marigold flower and is used for medicinal purpose.

In this project, we describes the design based on the separating operation of the seeds and petals of marigold flower. Slotted disc operated by the rotor of induction motor is used to align the flowers and cutting blade separates the seeds and petals. This machine can provide above 95% of cutting efficiency. For this, we work on cad model of machine with the help of cero parametric 3.0. Machine uses the slotted disc mechanism. Slotted disc is rotated with the help induction motor at the speed of 15 rpm. Rubber roller is used above the slotted disc to press the flowers, which are inserted in the slots of disc, as it is essential to press the flower while cutting. Other purpose of roller is to stop rolling of flower in backward direction while the blade cuts the flower. The roller here is a power roller which powered by the 12V DC geared motor. After finalizing the mechanism, we attempted various experiments on the machine. During the process if any flower comes out of the machine uncut, the machine, resulting in the increase in accuracy of the machine, can still report it. The aim of this project is economically feasible and we are under the impression that it can be further reduced, when it produced on large scale.

II. LITERATURE REVIEW

Shrimp-cutting machine for cutting intermediate joints\

A. Derrell Sawyer [1]

An apparatus for cutting a shrimp body, the shrimp body having a tail portion that includes a plurality of tail sections connected by joints. A motorized driving mechanism mounted inside a housing drives a cutting mechanism mounted outside the housing. The cutting mechanism includes a rotating cutting disk and a holding and carrying mechanism configured to securely hold the shrimp body and carry the shrimp body past the rotating cutting disk. The holding and carrying mechanism is configured to position the shrimp body in relation to the rotating cutting disk so that when the cutting disk cuts the shrimp body, the cutting disk leaves intact, a first joint at a head end of the tail portion and a last joint at a tail end of the tail portion, while cutting at least one intermediate joint between the first and last joints.

Automatic boning system of upper half of slaughtered edible fowl

B. FUJIWARA YOSHIMITSU [2]

An automatic boning system of the upper half of a slaughtered fowl is provided, in which the number of processing steps is decreased, integrated control using cams is adopted instead of individual control of prior art using hydraulic actuators, and an improvement in yield is achieved. The automatic boning system of the upper half of a slaughtered fowl comprises a main intermittently stepwise feeding section (11), a group of eight stations, and a cam mechanism (14). The main intermittently stepwise feeding section (11) comprises a rotary disk (12) which is rotated intermittently stepwise at an angle of 45° by means of a stepwise driving device (12a), and eight attachment cones (13) located on the peripheral part of the disk (12) at a spacing of an angle of 45°.

Design and Fabrication of Automatic Cutting Machine

C. ANKIT PATNALA and MANAS RAJAN PATRA,[3]

The project undertaken is about the design and fabrication of a machine known as the motor driven cutting machine for food items. This machine was made with the intention of helping the fish sellers or also making the household task easier. This machine mainly comprises of two mechanism, i.e., Crank-Rocker mechanism and the Scott-Rusell mechanism clubbed together. A motor input was provided to drive the crank. The Scott Rusell then came into the picture with the desired blade movement that led to the subsequent cutting of the food items. This project was actually designed to benefit the fish sellers by increasing their productivity. There, it takes a long time to cut fishes so this mechanism would prove to be both handy as well as affordable for the fish sellers to cut the fish quickly and appropriately. Since the machine as fabricated in wood, it was light weight and portable.

III. DESIGN METHADOLOGY

1) Design Of Model In Software:
   After making the experimentations & calculations as per our requirements, we tried to imitate the real product in CREO PARAMETRIC 3.0.
2) Motion Verification:
   Using kinematics and stimulation section in CREO we were able to verify whether the path traced by the disc is meeting our requirement or not.
3) Fabrication:
   After getting the desired output in step 2, we started manufacturing each part of desired shape in mild steel material. We fabricated the pressure plate according to our requirements.
4) Assembly:
   Proper assembly of the fabricated parts produced in step 3 with the help of bolts, nuts, washers and more.
5) Modification:
   Some fallacies were observed after the assembly while in motion due to dynamic instability. In order to make it stable we had to modify our design either by changing equipment or by adding a new part.
6) Completion:
   After various modification we have got the 100% success in cutting the seed portion and petal portion.

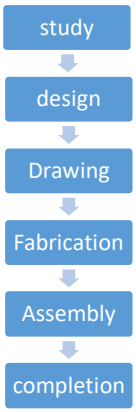


Fig: Flow chart for fabrication of Marigold flower seed and petal separating machine

IV. DESIGN AND CALCULATION

For this project, design and calculation were made to determine dimensional and mechanical properties such as torque, stress, strain and cutting forces so as to withstand the effect of different loads on machine components.

1. Power Required To Rotate Disc

$$\mathbf{P = \frac{2\pi NT}{60}}$$

Now weight of disc can be given by,

$$\mathbf{m \times g = \rho \times g \times v}$$

$$\mathbf{m \times 9.81 = 8050 \times 9.81 \times A \times W}$$

$$\mathbf{m \times 9.81 = 8050 \times 9.81 \times \frac{\pi}{4} \times d^2 \times 5 \times 10^{-3}}$$

$$\mathbf{m \times 9.81 = 8050 \times 9.81 \times \frac{\pi}{4} \times (60 \times 10^{-2})^2 \times 5 \times 10^{-3}}$$

$$\mathbf{m = 108\ N = 11.009\ kg \approx 11\ kg}$$

Torque required to rotate the disc,

$$\mathbf{\tau = I \times \alpha}$$

Where,

I = Mass moment of inertia α = Angular Acceleration

$$\mathbf{I = \frac{mr^2}{2}}$$

$$\mathbf{I = \frac{11 \times (30 \times 10^{-2})^2}{2}}$$

$$\mathbf{I = 0.45\ kg\ m^2}$$

Also,

$$\mathbf{\alpha = \frac{\Delta\omega}{\Delta t} = \frac{\omega_f - \omega_i}{\Delta t}}$$

Where, $\mathbf{\omega_i = 0}$

$$\mathbf{\omega_f = \frac{15}{60} \times 2\pi = 1.5707\ rad/sec}$$

$$\mathbf{\alpha = \frac{1.5707}{2} = 0.78535\ rad/sec^2}$$

Thus,

$$\mathbf{\tau = 0.7853 \times 0.45}$$

$$\mathbf{\tau = 0.353\ N\ m}$$

Also,

$$\mathbf{F = \frac{0.353}{(30 \times 10^{-2})} = 1.17\ N}$$

This is the force required to bring the disc in motion

2. Force Acting On Flower Stem

$$\mathbf{F = \tau \times A}$$

Where,

$$\mathbf{A = \frac{\pi}{4} \times d^2}$$

$$\mathbf{A = \frac{\pi}{4} \times (1.45 \times 10^{-2})^2}$$

$$\mathbf{A = 1.6512 \times 10^{-4}\ m^2}$$

Also,

$$\mathbf{P = \frac{2\pi NT}{60}}$$

$$\mathbf{745.7 = \frac{2\pi \times 15 \times T}{60}}$$

$$\mathbf{T = 474.727\ Nm}$$

Thus,

$$\mathbf{F_1 = \frac{474.727}{8 \times 10^{-2}} = 5934.09\ N}$$

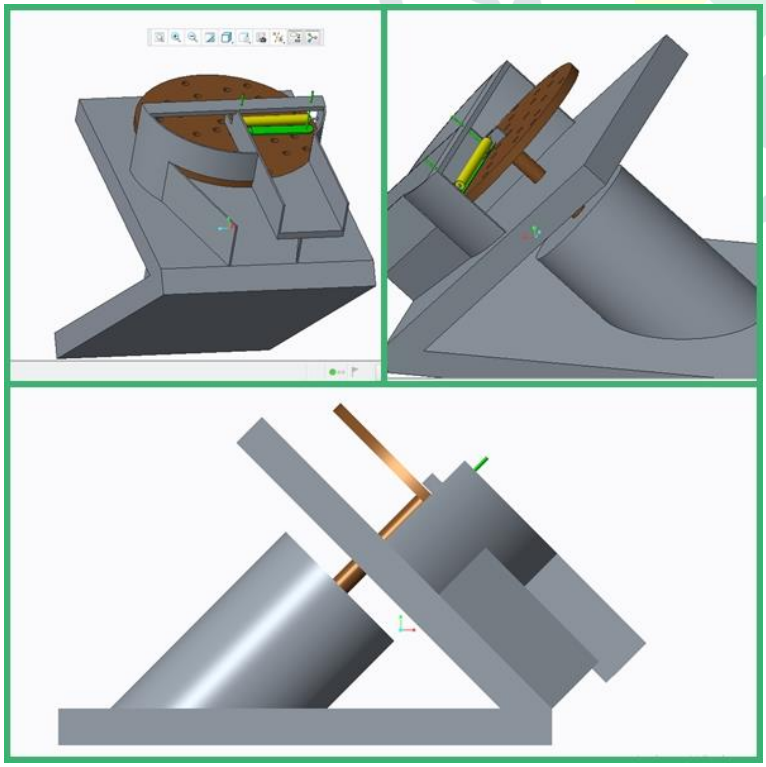
$$\mathbf{F_2 = \frac{474.727}{15 \times 10^{-2}} = 3164.84\ N}$$

$$\mathbf{F_3 = \frac{474.727}{0.2} = 2373.63\ N}$$

$$\mathbf{F_4 = \frac{474.727}{0.25} = 1898.908\ N}$$

These forces are calculated at various position from the center of the disc which are acting on flower stem

CAD MODELLING



The above shown figure is marigold flower seed and petal separating machine the machine cad model. This model is made with the help of cero parametric 3.0. Machine uses the slotted disc mechanism. Slotted disc is rotated with the help induction motor at the speed of 15 rpm. Rubber roller is used above the slotted disc to press the flowers which are inserted in the slots of disc as it is essential to press the flower while cutting. Other purpose of roller is to stop rolling of flower in backward direction while the blade cuts the flower. The roller here is a power roller which powered by the 12V DC geared motor.

Cutting blade is placed just above the slotted disc with a gap of approx. 1mm and is placed between the slotted disc and roller. Two separate sections are also made so that when flower gets separated, the petal and stem portion should get in two different containers. A cover is also provided over the roller for the safety purpose. In this machine, flowers are inserted in the slots of the disc by labor by hands. Inserted flowers moves towards the cutting blade with the disc. As flower moves, it first gets under the roller and then it get cut into two parts as it passes over the cutting blade. These parts are then collected into two different containers.

Fabrication

A slotted disc is operated by 1 HP induction motor. Cutting blade is fixed at one side of thr rotating disc. Rubber roller is used to align the flowers in desired position. The roller is fixed just above and before the cutting blade. 12V DC motor is used to operate the roller. Seperating sliders are used to separate the seeds and petals after the flower is operated by the cutting blade. A storage container is placed below each separating slides to collect the separated seeds and petals.

Induction motor

An induction motor or asynchronous motor generates the rotating moment in the rotor by the electromagnetic induction from the magnetic field of the stator winding. The induction motor used is 3 phase 1HP 1440 rpm geared motor. It operates on the required 15 rpm speed to provide ample time to the machine to operate the flower.

DC Motor

A DC motor is the mechanical device which uses direct current to produce rotating motion in the rotor. 2 phase 12V 2 Amp 100 rpm DC motor is used to drive the rubber roller. The DC motor is fixed outside the main body of machine by means of MS Steel frames. High torque low rpm DC motor is required for the machine operation.

Rubber roller

Rubber roller is the mechanical component operated by DC motor used to obtain the rolling operation in various machine. A MS Steel hollow spline shaped rod covered with hard rubber is used to align the flowers during the operation. It is mounted exactly above the edge of the cutting blade.

Slotted Circular disc

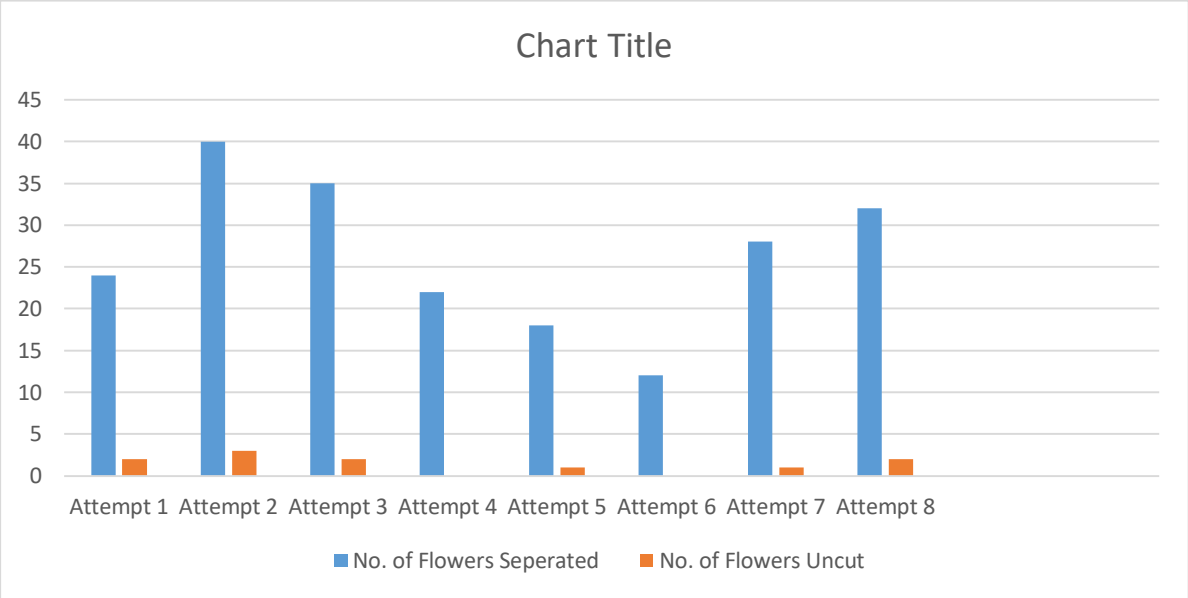
A slotted circular disc is used to insert, hold and carry any size marigold flower to the cutting mechanism for machine operation. The disc consists of randomly made circular slots of 14mm,16mm,18mm diameters. The slotted disc used in the machine is made of MS with 60cm diameter and 5mm thickness. The slotted disc is mounted on the output shaft of the induction motor, which is angled 55° from the horizontal plane. The diameter of the slotted disc were designed from the following readings of various dimensions of flowers :-

Sample No	D_1(mm)	D_2(mm)	L_1(mm)	L_2(mm)	L_3(mm)
1	4.2	1.3	3.3	1.2	0.4
2	5.1	1.3	3.8	1.4	0.4
3	3.4	1.3	2.5	1.3	0.7
4	3.9	1.6	3.2	1.5	0.7
5	4.2	1.5	3.2	1.3	0.2
6	3.8	1.5	2.8	1.3	0.6
7	5.5	1.3	4.2	1.6	0.2
8	5	1.4	4	1.3	0.3

Cutting blade

A cutting blade is used for separating the seed and petal part of the flower. The blade is made of stainless steel and is of 10cm length 2cm width and 1mm thickness for precise cutting operation on the flower. The blade is positioned 2mm above the slotted disc so that the seed portion of the flower is cut completely.

Trial & Experimentation



After finalizing the mechanism, we attempted various experiments on the machine. Above graph shows the reading of the flowers operated versus the reading of flowers that remained uncut after processing. During the process if any flower comes out of the machine uncut, it can still be reoperated by the machine, resulting in the increase in accuracy of the machine. After the experiment above 90% flowers get processed successfully and nearly 5% to 8% flowers remained uncut.

V. CONCLUSION:

1. The fabrication of marigold flower seed seperating machine was successfully completed as per the design specification.
2. It is easy to operate and handle. This project has been designed to performed the required task taking minimum time.
3. This project is economically feasible and we are under the impression that it can be further reduced, when it produced on large scale.
4. For operating the machine there is requirement of one person so it increase employment for one person .
5. This project is very useful for farmers. It improves the quality of compost by separating oil from it and it is superior for better crop quality.

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