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Design and Development of Juicer/Slicer for Lemons

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Abstract: ***Juicing of lemon is manually done by citrus squeezer or using a food processor with a juice component which is un-hygienic. It is observed that plenty of lemon crops are occurred in India. Many times farmers used to throw plenty of lemons on roadside as they don't get enough prices which are equivalent to return transportation cost from market to their place. Machine has a unique Carrier roller and crushing roller arrangement that it can either juice the lemon or slice the lemon as per our requirement. There are two gear trains used for the squeezing of lemon so that the productivity for producing juice of lemon increases hygienically without human contact.***
Keywords: Juicing machine, Spur & Bevel gear, crushing-carrier roller arrangement.

I. INTRODUCTION

These machine also has two way mechanism one for juicing the lemons and slices the lemon for pickles. Cutting and juicing of lemon pickles are performed by using sharp knife blade. This operation is done by using mechanism of gearbox. The Spur gear is used in gear mechanism. Shaft was provided for transmitting the power to gear. Crushing rollers are attached to the spur gear shaft. The motor is used to drive the gear system. The motor power is provided to the machine via motor shaft which has internal groove teeth mesh with spur gear teeth. Slices of lemon are done by removing the roller arrangement .Cutting of lemons by using sharp knife blade which is carried out from feed chute which is attached to the feeding basket at top of the machine. These slices are collected by using collecting platform. Because of using this blade (cutter) Slices are made hygienic. It can be operated by one person. This machine is Design to optimize safety. Similarly the juicing operation is carried out by incorporating the crushing-carrier roller arrangement in the system.

II. LITERATURE REVIEW

Gunjal A.V et.al explained existing slicing machine of lemon having following limitation such as high man power, contamination, high investment and time consumption process. This system uses compressor as well as solenoid. Solenoid plays vital role in machine as solenoid consumes electricity for working. The main advantage of the system is to increase productivity and eliminate accidents [1]. Zhouying et.al explained about Dc motor as Dc motor convert electrical energy into mechanical energy as compared to Ac motor. Main advantage of Dc motor having less maintenance, simple construction. The setup is designed with Dc motor control system based on microcontroller.

They used STC89C52 microcontroller as kernel controller as well as they used TA7267BP as driver chip. They analyse microcontroller is brushless and it has good market value [2].

Tahir M. Lazimov et.al studied about circuit breaker which is depending on chopping current and dielectric strength. Circuit breakers have recommendation which is based on level of voltages and induced e.m.f in secondary circuit. Choosing of circuit breakers they find out two condition is to be proposed first of all co-ordination of level of switching over voltages and second is co-ordination of level of induce voltages in secondary circuits [3].

A.Hrishikesh Tavanandi et.al they designed lemon cutting machine using stationary cutters. Lemon is cut into four pieces of similar shapes. They use six numbers of rotating centralizing slit plates. The machine has capacity of over five thousand lemon per hours with a power consumption of 0.11 KW.

Centralized disc is centrally located the lemons having cone angle of 90 degree [4].

A. Gopichand et.al studied about spur gear they found some error about point of contact, interference, break contacts, friction, noise so, they decided to use MATLAB software because of it has following advantages like accurate and also has a number of built in functions which makes it versatile. It also gives accurate safe dimension and design of gear becomes simple and errors free [5].

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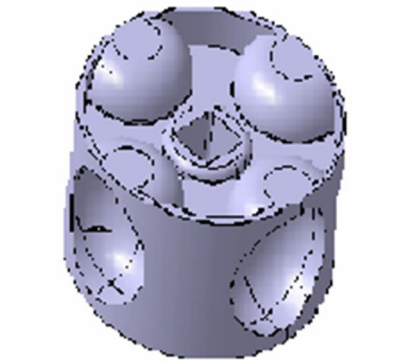
III. INTEGRATED PARTS

A. Carrier Roller

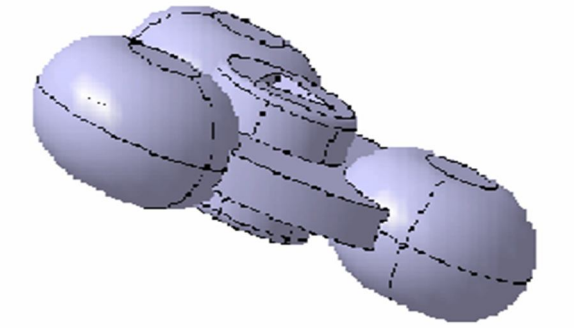
The function of the carrier roller is to carry the lemon fruit to cutting blade. Carrier roller is attached to the spur gear shaft. Spur gear shaft is designed in square shape. Carrier roller design is based on equivalent diameter of lemon. There are four internally circular grooves made on the peripheral surface of the carrier roller which are 90 degree respectively. These grooves are made with VMC machine which carries the single lemon in single groove. These grooves are mesh with circular ball of crushing roller. There are two identical carrier rollers which is used in this machine. Carrier roller carries the lemons from feed chute.



3.1 3D Model of Carrier Roller

B. Crusher Roller

Crusher rollers are made of Teflon plane (Poly tetra Fluoroethylene). There are two identical crusher rollers which are used in this machine. Three solid circular balls are continuously meshed in the grooves of carrier roller while it is rotating. This circular ball is 120 degree respectively. Crusher roller is attached to the driven spur gear shaft which is designed in triangular shape. Triangular shaft is design by 20×20×20 mm. The diameter of these circular balls is 52 mm respectively.



3.2 3D Model Crusher Roller

C. Sharp Knife Blade (Cutter)

This cutter is made of stainless steel. It is used for slicing of lemon. The thickness and length of blade is 0.4 cm and 17.5 cm. The dimension of cutting blade is calculated on the basis of diameter of lemon and space available between two carrier rollers.

D. Spur Gear

Spur gear is made of EN36A.Spur gear have straight teeth and parallel to the axis of the shaft. Four Spur gears are used in gear mechanism. Which of this two gear are driver and two gears are driven. Driver spur gears are attached to the Carrier roller and driven gears are attached to the crushing roller. Driver spur gears have 47 teeth as well as driven gears have 36 teeth. Driver spur gears are mounted on square shaft and driven spur gear are mounted on triangular shaft. This assembly is done by using bearings and bearing housing. Bearings are also mounted on this shaft. Bearing is used to enable rotational movement, while reducing frictional and handling stresses. Bearing no.6205 and 6206 are used. These bearings are attached to the front and back side of the spur gears.

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3.4 Spur gear

E. Bevel Gear

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone. Two bevel gears are used which give rotary motion to the net bucket. Bevel gears have 15 and 10 teeth respectively. Diameters of bevel gears are 29.5 mm and 26.5 mm.

3.5 Bevel gear

F. Experimental Setup Of Juicer/Slicer Machine For Lemons

The innovative machine can be effectively used by any food processing industry such as cool drinks production companies and liquids filling process. Large quantities of lemon to the required shape and size can be act in a continuous fashion, better quality of slices/juices produced. Slices of produced are of uniform nature and are neatly and conveniently recollected and recovered. Pickles manufacturing is very labor intensive industry. The major reasons attributed to this could be a prevailing small scales and the process preparation of pickles, which is an aggregation of small, specialized tasks. By using these machine there are various advantage over conventional machine like it consumes less time and the peel wastage of lemons is comparatively far less than the conventional machine .

The objective of present work is to “Design and Development fabrication model Design and Development of juicer/Slicer machine for lemons ’’made up of steel, with constant and variable thickness and constant width throughout its length. Also design, fabricate and experimental testing and analysis of machine the result of machine (with constant and variable thickness lemon) previous technique comparing with each other and from that selected machine for part loading.

3.6. Experimental setup of Juicer/Slicer machine for lemons

IV. RESULT AND DISCUSSION

Human efforts can be reduced by using slicing/juicing machine for lemon. It is possible with arrangement of gear mechanism and cutting blades. Due to this the lemon which are going to waste can be utilize in pickles/liquefied filling process. It can be operated by one person. The machine is design to optimize safety. With this machine, the slices of fruits produced are of uniform nature, and are neatly and conveniently collected and recovered. Another feature of the constant lemon cutting machine is that it is easy in operation and maintenance.

Sr. No.	Lemon pickle machine	Convention machine
Total weight	5kg	5 kg
Total liquid weight	3500ml	3200 ml
Wastage	1400gm	1900gm
Total cycle time	15min	35mi
Total Time production (hour)	3500x4=14000ml 14lit	1900x1.7=3249ml 3.25lit
Total Time production (shift)	112li	26lit
Differences	112-26=86lit/shift	
Amount of save		86x12=1032

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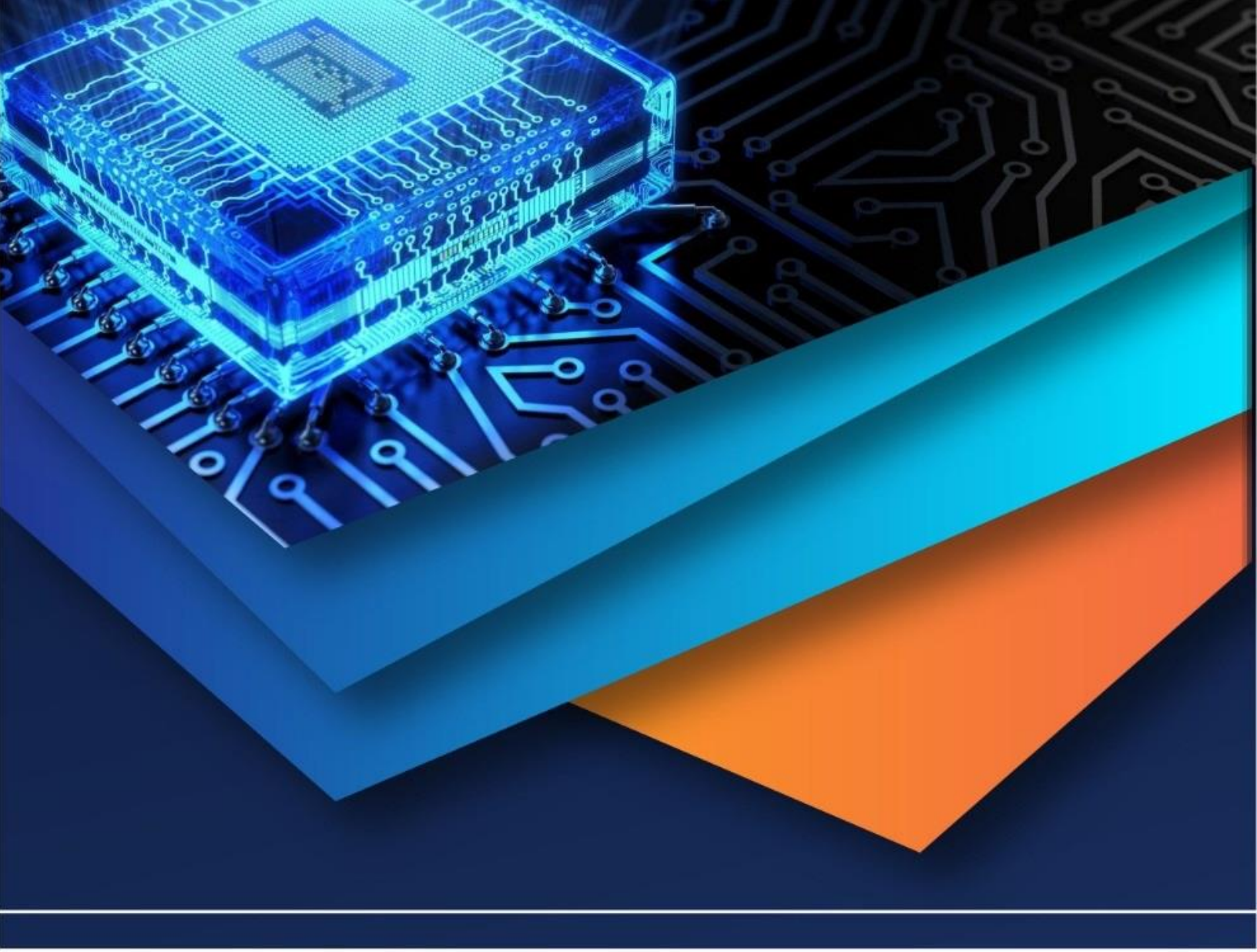

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