

Automatic Pomegranate Deseeding Machine

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ABSTRACT: Pomegranate is a commonly used fruit in our day-to-day life. They are used for juice making in various fruit stalls and one of the value added ingredients in food and have great medical value. The main objective of the project is to automate the process of deseeding the fruit. The manual process of deseeding the fruit is a time consuming one for the extraction of seeds. The proposed system is automatic deseeded, which consists of the cantilever beam fixed, and electromagnet. Cantilever beam is used to provide the tapping force over the fruit and it gets attracted by energizing of the electromagnet and by de-energizing the electromagnet, the beam gets repelled. This action results in the striking of the cantilever beam over the outer skin of the fruit, which is kept in the inverted position over the designed bowl. This process of energizing and de-energizing the electromagnet is repeated for a specific period of time with a time delay, gives the hammering action of cantilever beam over the fruit. Then, the seeds are collected in the tray. The proximity sensor senses the presence of the fruit and it is interfaced with the microcontroller 89C51 and the process continues as per the program. The maintenance of the system is less and it is a onetime investment.

KEYWORDS: Electromagnet, automation, microcontroller.

I. INTRODUCTION

One of the oldest known fruits, found in writings and artifacts of many cultures and religions, the pomegranate is an original native of Persia. This nutrient dense, antioxidant rich fruit has been revered as a symbol of health, fertility and eternal life. It is used for juice making in various fruit stalls and for preparing salads and one of the value added ingredients in food. The fruit also have great medical value. Manual deseeding of the fruit is still prevalent, in hostels of educational institutions, marriage catering services and even in restaurants, which can cater to a whole set of varying customer tastes and preferences. The amount of fruit to be used for the dishes always remains higher than actually what's consumed. The associated difficulties like time constraint, contamination, etc. make it pretty difficult for any person handling the job. Therein, arose a need to automate the process of deseeding, and here with a proposal, which can aid in easing the load off the people associated with it.

II. PROPOSED METHOD

The proposed method involves the repeated hammering action using cantilever beam over the fruit with the help of electromagnet for the deseeding process. This, when continued for the specific period of time, with time delay results in the deseeding of the fruit. The advantages of the micro controller based pomegranate deseeding machine are

- i. Low cost of deseeding and easy to maintain
- ii. It is well-suited for domestic purpose
- iii. The machine consumes less power
- iv. It is compact and occupies less floor space

III. SYSTEM DESCRIPTION

Proposed System depends upon the work expected from the different section of the project. The repeated application of the force over the outer hard skin of the fruit with accurate time delay results in the deseeding process. As the fruit is placed on the specially designed bowl it ensures the deseeding process without any damage to the edible part, the arils. The hammering action over the fruit is established with the help of a cantilever beam and an electromagnet setup. Once, the presence of fruit is ensured, the electromagnet repeatedly get energized and de-energized with a time delay. This results in the attraction and repulsion of the cantilever beam towards the electromagnet. During the

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electromagnet's de-energized state, with the greater force, the cantilever beam hit the fruit. The above repeated action, for certain period of time, results in the complete deseeding of the fruit. The only thing that the human being has to do is to place the fruit over the designed bowl or place series of fruits in the conveyor setup.

IV. COMPONENTS

S No	Components	Description
1	DC Motor	12V, 0.5-40 kgf-cm,10 rpm
2	Electromagnet	24V,5A
3	Relay(2)	24v
4	Micro controller	AT89C51
5	IC 7805	Voltage regulation to +5 V
6	BC547(2)	Transistor
7	Proximity sensor	Capacitive Type
8	Transformer	230V to 5V,500mA
9	Transformer	230V to 12-0-12,5A
10	Rectifier(2)	Converts AC to DC

V. DESIGN CALCULATION

ELECTROMAGNET DESIGN

Supply Voltage=12v DC

FMAGNET =FGRAVITY

=.5*9.81=5N (approx.)

APOLE AREA = $\pi/4 d^2 = \pi/4 * 60e-3^2=2.83e-3 m^2$

Thus the approximate number of turns =1000

TORQUE CALCULATION FOR DC MOTOR

Weight of the body = mass*gravity

=5*9.81=49.05N

Torque Developed =force*radius of the roller

=49.05*0.05=2.4525Nm

Velocity of the body= $3.14*D*N/60$

0.05= $3.14*0.1*N/60$

Speed of the motor =10rpm.

Power Developed = $2*3.14*N*T/60$

=2.5Watts.

FRAME AND CANTILEVER BEAM

Material: Mild steel

Length of the frame: 400mm

Breadth of the frame: 300mm

Thickness of the frame: 50mm (L angle)

Length of the beam: 3/4 of Base

: $3/4*400 :300mm$

VI. FABRICATION PROCESS

MECHANICAL SECTION

Product Design is the most important stage, which is iterative, and complex in nature till the visualization comes into real picture. This machine is designed using solid works software. Initially the part drawings are made to the dimension specified and then the parts are assembled as shown. The mechanical setup consists of a cantilever beam, a designed bowl, steel frame and conveyor setup. For the frame steel L angled plate pipe of 1.25" is used.

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Figure 1. Fabricated model

They are cut in to specific dimensions and are arc welded. One end of the designed cantilever beam is fixed at steel frame by bolt joint. The designed bowl is fixed at base of the frame, at a certain distance below the free end of the cantilever beam. The Electromagnet setup suspended by the appropriate mountings. It is held by adjustable 3/8" screw mountings. The Screw with the vertically suspended electromagnet is attached in such a way that its position can be adjusted horizontally as per the requirement. The fabricated real time mechanical setup is shown in the Figure 1, which comprises of the electromagnetic setup connected to the power supply unit. The Figure 2 shows the Solid Works model of the developed system in a 3 Dimensional manner.

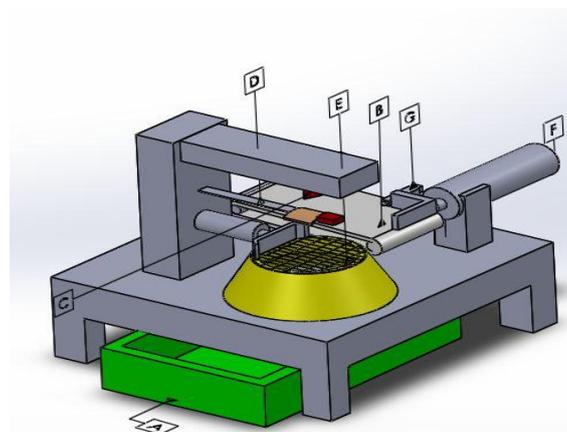


Figure 2. Solid Works Model

ELECTRICAL SECTION

The electrical section involves the software simulation using Proteus professional software and the fabrication of PCB and rectifier circuits. Figure 3 shows the schematic view of the electrical circuit which is being developed in the Proteus simulating software before being made into hardware.

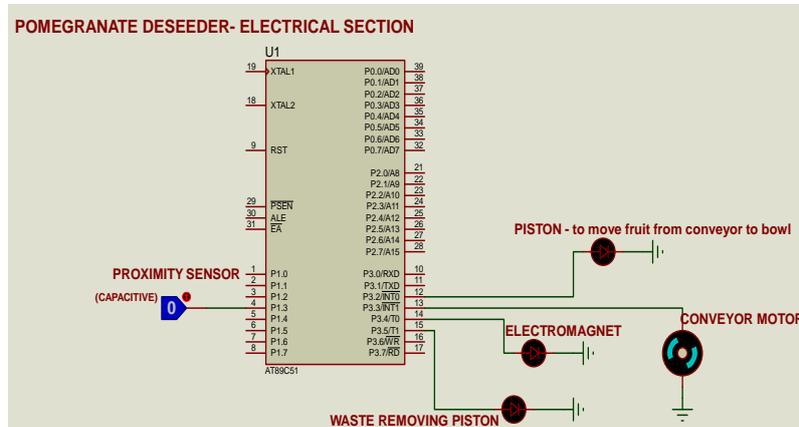


Figure 3. Proteus Diagram

After the completion of the simulation the circuit is being fabricated with the help of relay and the microcontroller the entire circuit works. The Entire electrical circuit is being supplied with the help of the transformer, which converts the AC supply to the required DC supply for the electronics components to operate. Figure 4 gives the hardware implementation of the simulated circuit, which is being developed by using Proteus.

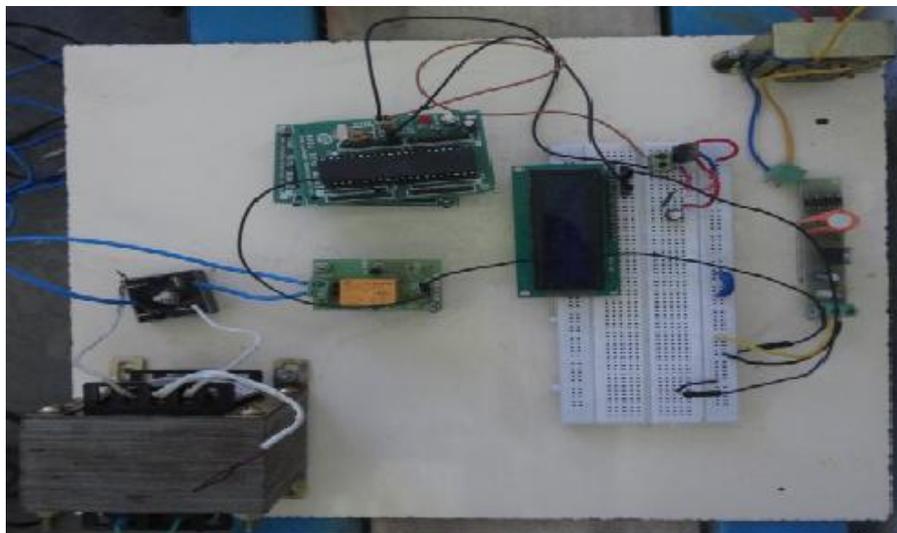


Figure 4. Electrical Section

VII. CONCLUSION

The design of the machine is theoretically calculated, with the reference of these calculated values the further implementation and fabrication of the machine is done. also programming in microcontroller 89c51 is very sophisticated and highly secured, but at the same time it is very flexible because a slight modification can be made for the efficient function of the system. thus a new system for pomegranate de-seeding is developed. the complete automation of the system is achieved and the system proves to be cost effective as well. also, the objective of this system, portability is satisfied with the designs that have been developed.

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