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Design and Fabrication of Economical Groundnut Decorticating Machine for Indian Farmers

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Abstract: ***Most of the Indian Landis used for agricultural production producing raw agricultural products or goods. Production of Groundnut is one of source of income for the farmers. In India Groundnut is grown on small scale. Price of kernel on average is approximated double the pods price. Due to limited sources for the processing of groundnut like groundnut decorticating equipment's, is a main hurdle for the effective and economical production of groundnut. Earlier day's peanut shell was removed with the help of hands of workers reducing the output which did not fulfill the demand of market because of more time consumption for removing the shell of groundnut. The thorough research-work of designing, fabrication, and performance evaluation of a Groundnut Decorticating which constitutes shelling unit, feeding hopper with control flow arrangement, separating unit and prime mover system is conducted and results are discuss further. The machine performance was evaluated in terms of shelling efficiency, material efficiency throughput capacity and mechanical damage. For expressing the relationship existing among the Decorticating performance indices, moisture content of pods and feed rate were formed using regression analysis. The presented paper through light on the manufacturing of various components of groundnut Decorticating machine. In short, the undertaken work involves processes like design, fabrication and assembling of different components of decorticating machine. This work is dedicated to the designing of machine with more production capacity &operating on less power input like 1 HP than manual work. This machine will be helpful for the small and medium scale farmers as well as new star ups by investing less capital.***

Keywords: Fabrication, assembling, evaluation Groundnut, Decorticating machine, efficiency, Design.

I. INTRODUCTION

In this paper our effort is to make understand the designing and fabricating the different mechanism of groundnut decorticating machine. The designed model is nonhazardous to the atmosphere and makes use of mechanism like peanut sheller, blower and automation of separating system etc. Force for crushing is provided to squeeze the groundnut. This model is designed, fabricated and automated by considering various important parameters. With the help of new and improved decorticating machine we are trying to maximize the farmers profit as he can sell ready groundnut in the market. In this model of groundnut decorticating machine various designing parameters were studied deeply by considering different calculation of forces and their analysis. The research consist of the making software model, designing the different mechanism and fabricating the parts of the decorticating machine considering different forces on the components and aesthetic factors. This work rightly focuses on generation of a new concept of groundnut Sheller which would be portable enough to crush groundnut at any place. The conceptual work is transformed as the working model.

II. PROBLEM IDENTIFICATION& FORMULATION

The process of removing groundnut shell manually is very time consuming and less efficient. So from the research review it was so obvious that to increase the productivity new model need to be developed which will reduce the manual efforts. Following problems were identified and considered for the formulation of the problem statement.

A. Present process of shell removal is pedal operated.
B. After crushing (shelling operation) husk and nuts gets mixed.
C. Time consuming and less productive.

Considering the different operating and productivity issues a broader plan of modeling and fabricating machine which help to address the different short comings raised from previously available machine and the manual work is reduced and giving high production rate, earning maximum profit to the formers.

Hence our main aim is to solve following problems for better production of ground nut.

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1) Reducing the amount of crushed groundnut.
2) More efficient.
3) To lower the time of production &the human efforts.
4) To develop a low cost machine for farmers to convert pods intoshelled nut.
5) Maximizing the profit.

III. WORKING PRINCIPLE

Groundnut decorticating machine is operated on the action of shearing &separating the groundnut. At first the raw groundnuts are supplied through a hopper. Then raw pods of nut are fed to these micircular net and shaft of the roller. The net is stationary while shaft is revolving element. As raw groundnut passes over the stationary net and rotating shaft shearing of ground nut begins. Because of crushing, the groundnuts are sheared into the peanut and outer shell. Between the net and roller shaft the clearance is provided to decide the size and shape of groundnut to be decorticated. After decorticating the nut and shells gets dropped in downward direction from the semicircular net, later the blow of fan is imparted on the mixture of groundnut and shell due to uneasiness of shell, nuts are thrown and can be collected at the rear side of the machine. Due to different sizes of the groundnuts, some unshelled raw groundnuts gets dropped through the shelling chamber in the tray (7% to 10%). To reduce this tendency of frequent dropping of different sizes of groundnuts nets of three kinds can be provided with different size of capsule slots, size vise small, medium and large. In this way the "GROUNDNUT DECORTCATING" performs the work.

IV. PROGRESS OF RESEARCH

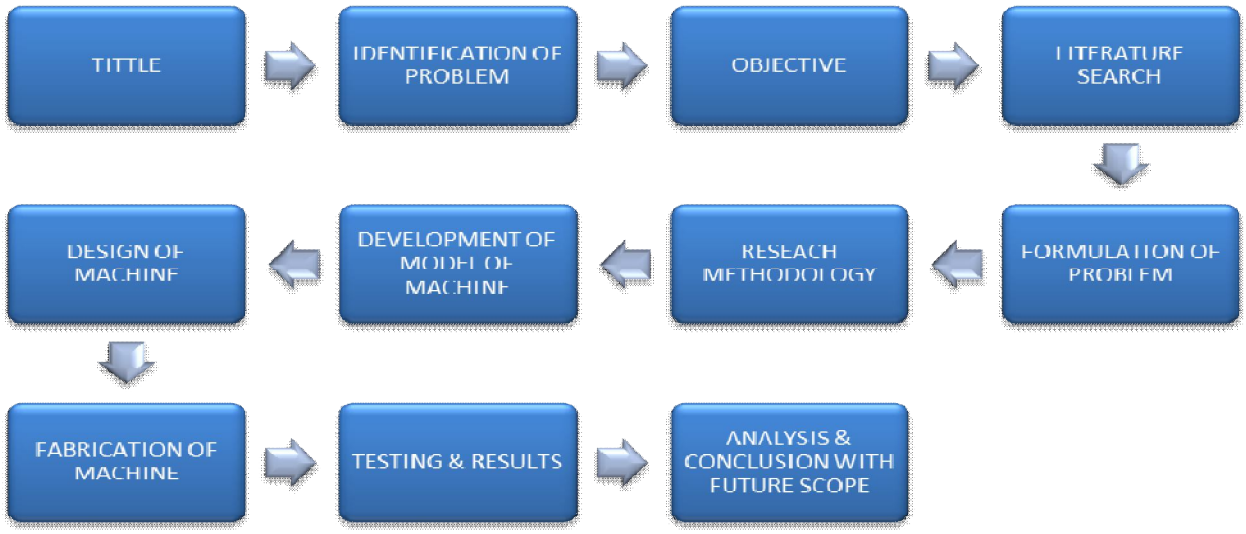


Fig. 1 Plan of Action

V. MODELING & FABRICATION

For calculate forces and different parameters following parts are selected for software modeling.

A. Shaft of the fan
B. Pedestals Bearing
C. Pulleys
D. Foundation Frame
E. Cover of fan
F. Hopper
G. Semicircular Net
H. Roll Shaft

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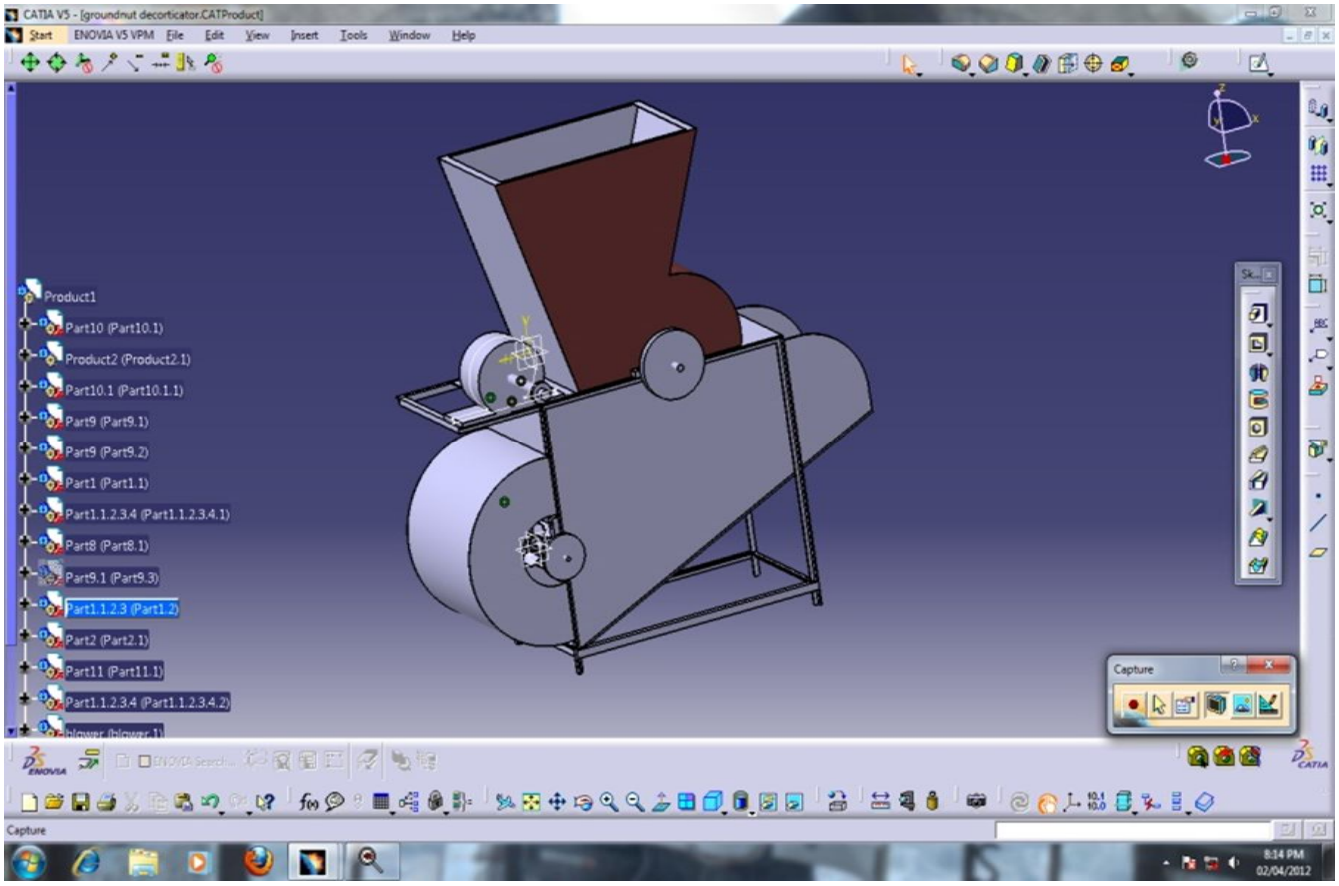
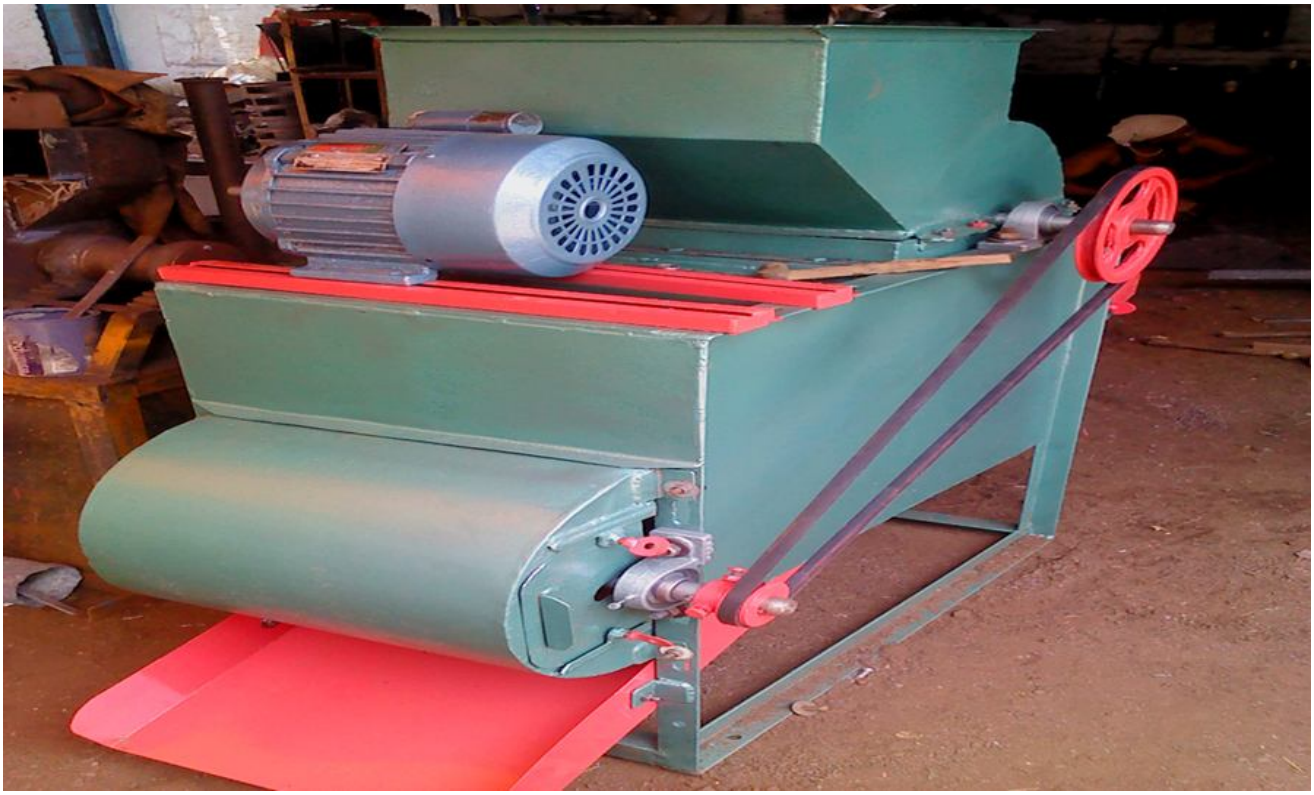


Fig. 2 Final Model of Groundnut Decorticating



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Photo 1 Final Assembly of Groundnut Decorticator

VI. TESTING AND RESULTS

Samples of different sizes of raw ground nuts were collected from the market and kept in in the sunlight to remove the moisture present. The procedure was followed as mentioned earlier to shell the groundnuts. Sets of experiments were performed and readings were tabulated for the conclusion. The mean reading of the experiments s given in the following testing table. Table consist of , weight of sample, weight of shelled nuts and time required to shelled groundnut.

Sr. No.	Raw Groundnut weight in Kg (Q_t)	Decorticated nuts weight in Kg (Q_s)	Weight Of Undamaged Groundnut In Kg. (Q_u)	Weight Of Damage Groundnut In Kg. (Q_d)	Time To Shelling Operation In Sec. (T_m)
1	1	0.83	0.645	0.185	23
2	1	0.81	0.655	0.155	21
3	1	0.8	0.64	0.16	20
4	1	0.82	0.65	0.17	25
5	1	0.8	0.655	0.145	23
Total	5	6.06	3.245	0.815	112
Mean	1	0.812	0.649	0.163	22.4

Table 1. Experimental Results

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From testing we can comment that the production rate can be increased and time of operation to remove the nuts also can be decreased as compare to manual shelling. During the experiments we found that if we fed 1 kg of raw ground nuts then we get 0.8 kg of shelled nuts. After experimenting with different volume of ground nuts we found that for 50 kg of raw groundnuts we gets 40 kg of shelled nuts. In this way the designed machine provide better output and efficiency as compare to the available machines.

A. Results

1) Shelling efficiency (%) = [Qs / Qt] x 100
= 81.2 %

2) Material efficiency (%) = [Qu / (Qu +Qd)] x 100
= 79.93 %

3) Mechanical damage (%) = [Qd / (Qu +Qd)] x 100
= 20.07 %

4) Throughput capacity (kg/h) = [Qs / Tm]
= 130.5 kg/hrs.

The above summarized results show that the decorticating machine is able to give 81.2 % of shelling efficiency AND only 20.7% of damaged nuts. The designed capacity of decorticating machine is 130.5 kg/hour.

VII. COMPARATIVE STUDY

In the following para we have tried to explain the different comparisons between our machine and present shelling machines.

A. The shelling efficiency ranged from 95.44 to 95.27 and 98.92-98.86% at feed rate ranges of 80-120 and 140-180kg/h at box speed of 1.4m/s and moisture content about 17.12%d.b. The cleaning efficiency ranged from 99.01 to 98.79 and 99.17 to 98.93% at feed rate ranged from 80 to 120 and 140 to 180kg/h at box speed of 1.4m/s, air velocity of 8.37m/s and moisture content about 17.12%d.b. for the Decorticating[1].

B. The shelling efficiency when operated electrically with 10 kg of groundnut sample performed at 78% and 85% for shelling and cleaning efficiency respectively, with a mechanical damage of 1.1%. The throughput capacity of machine is 345.4kg/hrs. The manually operated Decorticating has 5kg of groundnut sample and performed at 65% shelling efficiency with mechanical damage of 2.8%. The throughput capacity of machine is 118.9kg/hrs[2].

C. The shelling efficiency when operated electrically of roasted groundnut sample performed at 66% and the manually operated Decorticating has roasted groundnut sample and performed at 55% shelling efficiency.[8]

D. Average efficiency for JH grade and WB grade was found to be 75.75% and 72.97%, respectively. Overall, average efficiency was found to be 74.36%[3].

E. Maximum shelling and winnowing efficiencies of 80% and 79.5% respectively[4].

F. The forward facing impeller with eight slots gave the best shelling efficiency of 96, 77.8 and 62% Moisture content of 5.3% (d.b.) gave shelling and winnowing efficiencies of 96 and 87.3%, respectively, for the forward facing impeller with eight slots, 86.6 and 85.3%, respectively, for the radial impeller with eight slots, and 85 and 83.7%, respectively, for the backward facing impeller with eight slots[5].

G. The shelling efficiency was found to be 90.2, 91.9 and 85.7 % on the average for ICGV-SM-93523, Samnut 10-Rmp 12 and Samnut 10-Rmp 9 varieties of groundnuts, respectively. The shelling efficiency of the machine was found to be highest (91.9 %) in the shelling of Samnut 10-Rmp 12 variety of groundnuts. Also, the average shelling efficiency of 89.0% for the three varieties of groundnuts is quite commendable[6].

VIII. CONCLUSION

Finally from numbers of experiments we can comment that semi atomizes machine is more economical and convenient option for farmers instead of hand driven machines. During designing the machine for more capacity, the demand of the farmers and different users can also be considered. Numbers of experiments were performed with peanuts to check the effectiveness of the machine. Volume of work carried out by the machine is less as it mainly focuses on small and medium farmers. As compare to the available machines cost of our decorticating machine is very low. the “groundnut decorticating machine” is the ideal equipment for decocting process. for betterment of the farmers and his products like groundnuts, this machine can play very vital role in agriculture sector. the “groundnut decorticating machine” can be used in agri-based industry or even a farmer can also get benefitted from the economically suited machine. the shelling of groundnut by this machine is more economical and faster than manual process or any

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other processes. Hence the conclusion of the research work is that by using the designed Decorticating machine, we can save the production time and efficiency gets improved by fair amount benefiting the farmers.

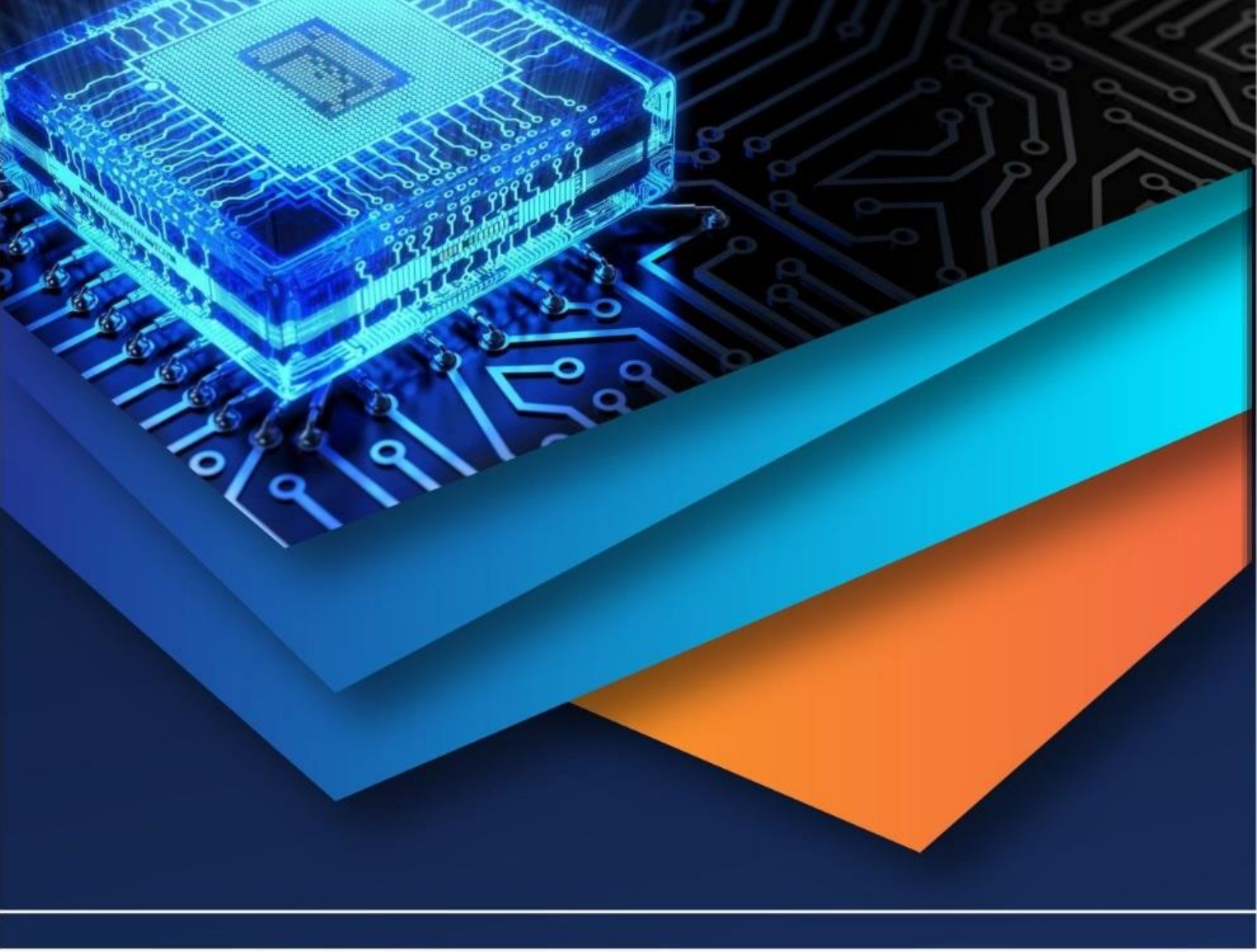
IX. FUTURE SCOPE

A. To remove the soil from raw groundnuts arrangements can be provided.
B. By providing some arrangement dust can control in better way.
C. Machine can be operated with help of bulls available with the farmers.
D. Arrangements for decorticating most of the sizes raw groundnuts can be installed.
E. Process can be made fully automatic.

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