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DESIGN AND FABRICATION OF PADDY CLEANING MACHINE REVIEW PAPER

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Abstract: This project aims to design and develop a motorised paddy cleaning machine that effectively separates paddy dust and other impurities from grains. The traditional methods of grain cleaning are labour-intensive, time-consuming, and inefficient, posing significant challenges for farmers. The proposed paddy cleaning machine incorporates a sturdy wooden frame, a mesh sieve, and wheels for mobility. It utilises a motor to drive the sieve, facilitating the separation of debris such as sticks, leaves, stones, and dust from the harvested and dried grains. Additionally, fans are integrated into the system to blow away lightweight particles like husks and dust, enhancing the overall cleaning process.The key advantage of this machine lies in its versatility, as it is designed to handle grains of different varieties. By adapting to various grain sizes and characteristics, it enables farmers to utilise the machine across multiple crop types, promoting its widespread applicability and usability.By streamlining the grain cleaning process, the motorised paddy cleaning machine not only saves considerable time and effort for farmers but also improves the quality of the harvested grains. By utilising readily available materials such as wood, mesh, and standard components, the project aims to offer a practical and affordable solution that can be easily adopted by agricultural communities. Overall, this project endeavours to empower farmers by providing an efficient, versatile, and cost-effective solution to the challenges associated with grain cleaning. The motorised paddy cleaning machine has the potential to significantly enhance the agricultural sector's productivity, improve grain quality, and contribute to the economic welfare of the country.

Keywords: DC motor , Hooper, Sieves, Reciprocating motion.

I. INTRODUCTION

Agriculture is very important for a country's economic stability and welfare. If a country's agricultural sector is so productive that it can yield enough to feed the country's entire population, it does not have to import food from other countries. If the country's agriculture sector is so productive that it can produce enough to feed the population as well as create a surplus which can be exported, that results in great economic gain for that particular country. If, however, a country's agricultural sector is unproductive and is unable to produce enough to meet the needs of its population, it adversely affects that country's economy since then it has to import food stuff from other countries which costs a lot. As a result the goods are sold in the local markets at higher rates which the most of its population can't afford. Thus, it leads to inflation and economic instability. Therefore, it is very important for any country to have a healthy and productive agricultural sector which can provide for its population and also boost trade with other countries.

Portable Paddy-Dust separating Cleaning Machine is designed to remove foreign materials and impurities such as sand particles, stones, paddy straws and foreign seeds from paddy. This machine provides farmers an alternative replacement of current conventional method should the farmers want to extract the paddy seed in small scale amount. Currently, they only use a traditional winnowing technique as to obtain the seeds to be used next season or before processing paddies to become rice.It helps farmers improvise their traditional method, reduces purchasing cost of paddy seed and utilizes the cleaning process at low cost and less maintenance. Generally, the hand threshing and the traditional handling used in most developing countries case a larger percentage of foreign matter with the paddy. Thus, more cleaning is required. At this point a rice mill cleaner removes any remaining foreign material that could damage the milling machinery and eliminates foreign material from the milled rice.

The quality of paddy grain is a crucial factor that is constantly changing from the field to consumption. Paddy grain quality can be described more exactly as the total of all the characteristics that contribute to consumer product acceptability. Despite the fact that humans frequently judge this quality subjectively using factors like look, smell, texture, and flavour, there are six key physical properties that actually determine the material quality of paddy: moisture level, grain maturity, variety purity, presence of dockage (such as straw, leaves, and rachis branches), and presence of discoloured and cracked grains are all important factors to consider.

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II. LITERATURE REVIEW

Schmidt [1] It is common knowledge that grains are the most crucial component of agricultural production. They also contain significant genetic information, of which the preferred types might manifest themselves with the right production knowledge. However, farmers need access to clean seeds in order to reap the benefits of good crop varieties. In order for a farmer to produce high-quality grains, clean seeds of enhanced variety must be preserved under particular circumstances. Separating process fraction the grain lot into two categories, one category containing the grain and the other containing inert matter like stem, leaves, dust, dirt, chaff, etc. to be discharged. There are methods that may separate the grain lot into several fractions with various purities. Intermediate fractions typically contain both grains and inert matter and must be further cleaned.

Kajuna [2] Basically, if unwanted material differs from the grain in terms of size, shape, weight/mass, density, or specific weight, it can be removed from the grain. And the harder they are to remove or separate, the more similar the contaminants are to the grains. Another obstacle to cleaning grain is variation in grain shape and size.Cleaning becomes more challenging the more variance there is in the grain lot. For many species, it is challenging to remove inert materials without removing grains of various sizes. The ideal cleaned grain is free from any other materials. The degree to which this is achieved is called the purity (cleaning efficiency), usually measured in percentage.

Arfia [3] The objective of using a separating and cleaning device is to separate grain from materials other than grain (MOG). Such devices may make use of differences in surface characteristics of the grains. There are many types of separating and cleaning device namely: aerodynamic, mechanical, combination of aerodynamic and mechanical, specific gravity table method etc. Many commercial cleaners incorporate more than one of these cleaning methods.

Aguirre and Garray [4] The particles in a mixture must be accelerated as free dispersed bodies and not as a mat for aerodynamic separation to take place. Aerodynamic separation requires a difference in the terminal velocities (suspension velocities) of the components to be separated. Heavy items move downward while light elements are blasted away in an aerodynamic separator or cleaner, which uses air as a medium to lift light materials like chaff and dust out of a mixture of grain and unwanted materials. The generation of air current to blow or hang lighter materials is done by a mechanical or natural fan. The unpredictability of the air current's (wind's) direction, speed, and continuity as well as the labor-intensive nature of the process limit natural air current as a means of separation.

Nagesh and Lakshminarasimhan [5] Emphasised that threshed grains need extensiveBefore it may be used as food, whether whole or ground or even as grain, it requires additional cleaning.In pneumatic (aerodynamic) cleaning, light, flaky, and dusty materials are lifted with the help of air.heavier materials flow downhill while lighter materials travel out of the grains.

Gorial and Callagham [6] Aerodynamic separators and cleaner are basically of two types, namely the vertical air stream and horizontal air stream separators. In the vertical air stream separator, air stream is flowing vertically against the injected mixed product such that heavy particles drop through the air (counter current flow) while the light materials move upward and are carried along by the air (concurrent flow). In the horizontal air stream separator, air is blow horizontally or at an inclined angle to the horizontal against mixed product injected along the vertical plane. The mixed products are displaced along the horizontal plane at various distances based on their aerodynamic properties.

Wang et al [7] In mechanical separation mixed materials are moved over a perforated and oscillating surface with openings of specified shape and size. Mechanical or sieve separation is a process separating the desired material/grain from undesired materials on the basis of differences in sizes and shapes. Multi sieve separators are used for classifying grains to size grades. Nonetheless, presence of short straws creates problems by blocking sieve openings and thereby reduces the quality of final product. Segregation and separation take place along the sieve length as grain and MOG are being transported over the sieve. The thickness and looseness of the grain and MOG layer on the sieve influences separation. The process of separation is ensured by the relative movement of layers of grain and undesired materials caused by the oscillation of plain sieves.

Ebaid [8] Revealed that the key variables influencing separating, cleaning, and overall losses were sieve slope, sieve oscillation, and air velocity. With increasing air speed, sieve tilt angle, and oscillation, the efficiency of separating and leaning as well as the overall loss increased.The air speed and sieve tilt angle had a significant impact on cleaning effectiveness and overall losses.The slope of the sieve was the primary variable with a significant impact on separation effectiveness. At short stroke lengths, the separation efficiency significantly increased with an increase in sieve slope,

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while it decreased at long stroke lengths. In general, cleaning effectiveness decreased as sieve oscillation frequency increased along the length of the sieve. The decreased effectiveness of cleaning.

Harrison and Blecha [9] the transport of particles along oscillating sieves, which is a function of sieve oscillation frequency, affects the efficiency of the process and affects metering of particulate substances along the sieve. The frequency affects the passage of particles through the sieves. There was an increase in cleaning loss with increasing sieve oscillation frequency. Increasing the sieve oscillation from 26 Hz to 34 Hz considerably decreased the cleaning efficiency of fennel grain. In the cleaning system of cereal harvester having oscillatory sieves and also in vacuum separators frequency of oscillations were found to be the main factor that can appreciate the optimal efficiency of separation.

Mohsenin [10] shows that separating a product from its undesired linked Materials in the air stream, such straw and chaff, necessitate an understanding of the aerodynamic properties of every particle. It was also found that a variety of air. For the separation of the grain from MOG to be effective,velocities must be estimated. As a result, in pneumatic conveying and separation, the terminal velocity (Vt) can be used as a crucial aerodynamic feature of materials.

III. METHODOLOGY

A paddy dust removal machine's process consists of a number of processes that are intended to remove dust, debris, and other contaminants from paddy grains in an efficient manner.

The steps in the procedure are as follows:

● Feeding: The first step is to start the machine and add the paddy grains. You have two options for doing this: manually or with a conveyor belt.
● Pre-cleaning: After the grains are put into the machinery, a procedure of pre-cleaning is carried out to get rid of bigger contaminants such stones and sticks. Typically, a vibrating screen or a sieve is used for this.
● Aspiration: After the grains have been through the aspiration chamber, lighter pollutants like dust, chaff, and straw are removed by blowing air through the grains
● Sieving: To get rid of any impurities left behind after the aspiration process, the grains are sent through a series of sieves or screens with varying mesh sizes.
● Fine Cleaning: Some machines may also feature a fine cleaning procedure that uses a brush or scouring pad to remove any leftover dust or dirt for a deeper clean.

The cleaned grains are then released from the machine and prepared for additional processing or storage. Overall, a paddy dust removal machine's technology is made to be effective and efficient at removing pollutants from paddy grains, producing a cleaner, higher-quality final product.

PROCESS INVOLVED

1. Meeting the farmers and discussing the exact requirement in order to have a precise conclusion on the size of the equipment and needs to satisfy.
2. Frame a problem statement such to address the need of stake holder
3. Conceptual design considering the load, work completion time.
4. Do the market survey to find availability of materials as per design and finalise the actual machine parameters.
5. Modelling of the designed machine.
6. Fabrication.
7. Testing and evaluation.

REMOVAL PROCESS

A paddy dust removal machine's goals are to efficiently remove dust, debris, and other impurities from paddy grains to produce a product that is cleaner and of higher quality. The following are some specific goals of a paddy dust removal device:

● Improve Grain Quality: One of the main goals of a paddy dust removal machine is to enhance grain quality by eliminating dust, dirt, and other contaminants that may have an impact on the final product's flavour, texture, and nutritional value.
● Efficiency Gain: By decreasing the time and labour necessary for manual cleaning, the adoption of a paddy dust removal machine can boost the efficiency of the paddy
processing operation.

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● Reduce Waste: A paddy dust removal machine can assist in reducing waste and increasing the yield of viable grains by efficiently eliminating dust and other contaminants.
● Reduce Health Risks: Dust and other contaminants in paddy grains can be harmful to both consumers and employees' health. By ensuring that the grains are clean and suitable for consumption, a paddy dust removal machine can assist to reduce these dangers.

A cleaner and better-quality product can assist paddy grains be more marketable, which could result in higher prices and more demand.

IV. CONCLUSIONS

In the long run, machine picking is typically less expensive than hand cleaning, freeing up money for other cellar quality enhancements. We created a paddy-dust seperating machine that is compact, portable, and multifunctional while also taking into account the drawbacks of the current paddy cleaner. Affordable enough for small farmers to buy it and effective at cleaning of paddy.

- Compared to manual cleaners, a mechanical cleaner is much faster. Some claim that one machine can perform the tasks of 20 harvest workers.
- A mechanical cleaner can be sent out to harvest in the middle of the night and often completes the job in a lot less time than a manual cleaner. This has a lot of benefits in hotter regions.
- The amount of paddy gathered varies on the moisture level, quality, and kind of the crop.
- The design of this machine makes it easy for a single operator to complete the cleaning process.
- This machine significantly lessens the main problem of the grain being harmed in the current cleaning machines. So, grain loss is kept to a minimum.
- Because there are few moving components on this machine, maintenance is minimal.
- The machine is inexpensive and accessible to farmers.

SCOPE FOR FUTURE WORK

To eliminate chaff and foreign matter and to increase the quality of paddy grains manual grading with a sieve has been popular. Other methods include separation under natural air stream, washing with a cleaning basket, sieving with a manual sieve, and hand grading. However, commercially produced and used seed cleaners and graders achieve very high levels of efficiencies (over 98%). Compared to manual cleaning, Paddy may be cleaned on a larger scale.

The paddy cleaning equipment now on the market and in use are large. The current ones are more expensive because they are built for a bigger capacity. These devices are large, bulky, and heavy. The paddy cleaning devices that are now in use are not portable, but there are various ways that we may change that. Conveyor belts and one motor can be utilised in place of two. This won't work not just shrink in size and weight but also in price.

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