DESIGN AND CONSTRUCTION OF MULTI PURPOSE SIEVING MACHINE

A Thesis

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In partial fulfillment of the requirements for the award of the degree of Bachelor of Science in Mechanical Engineering

Submitted to the

DEPARTMENT OF MECHANICAL ENGINEERING

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Declaration

We do hereby solemnly declare that the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for the award of any degree or certificate

We hereby ensure that the works that have been prevented here do not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from a breach of the foregoing obligation.

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Acknowledgment

First, we started in the name of Almighty Allah. This thesis is accomplished under the supervision of **Ibrahim Khalil Apurba**, Lecturer, Department of Mechanical, Sonargaon University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestions, constructive criticism, and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

The authors are also grateful to **Md. Mostofa Hossain**, Head of the Department of Mechanical Engineering and all respect teachers of the Mechanical Engineering Department for their co-operation and significant help in completing the thesis work successfully.

Abstract

This thesis presents the design and development of a Multipurpose Sieving Machine aimed at improving material separation processes in various industries such as construction, agriculture, and food processing. The primary goal of the project is to create a machine that can efficiently sieve different types of materials, ranging from fine powders to coarse aggregates, with high accuracy and minimal human intervention.The Multipurpose Sieving Machine utilizes a vibratory sieving mechanism that facilitates the separation of materials based on particle size. The machine is equipped with a set of sieving screens, an electric motor, and an adjustable gearbox system to ensure adaptability and efficiency for a wide range of materials. The machine's design prioritizes energy efficiency, ease of operation, and cost-effectiveness.The methodology includes a comprehensive study of material selection, machine design, and the construction of a prototype. Key considerations include the durability of materials, operational stability, and the effectiveness of the sieving process. Experimental tests were conducted to evaluate the machine's performance in terms of throughput, separation quality, and operational time.Results demonstrate that the Multipurpose Sieving Machine significantly enhances the sieving process, offering faster separation with minimal error. The machine performs well across different materials, demonstrating versatility and applicability in both small-scale and large-scale operations. The study also highlights potential improvements for future research, focusing on automation, precision sieving, and incorporating advanced technologies.In conclusion, the Multipurpose Sieving Machine provides a viable and efficient solution to material separation challenges across multiple industries. It offers a balance between functionality, cost-effectiveness, and adaptability, ensuring its usefulness in diverse applications.

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Chapter 1

Introduction

1.1 Introduction

A simple definition of a sieve is that wet sieving is a time-consuming and laborious process as a primary operation in food processing. A sieve with mesh or holes is used to separate fine material from coarse material. It is an essential process for separating fine material from coarse material. A sieve with mesh or holes is used to extract biopolymers from grains. Sieves are generally used to break up aggregates and separate grains of similar size, wet sieving is used to separate starch grains and milk from other particles such as hulls. It plays an important role in the processing of grains such as corn, ginseng, millet, wheat and buckwheat, it is used to separate grain grains from soybean hulls. It is used to separate and extract biopolymers from grains. The heat generation is greatly reduced by the high friction through the mesh, and the grains are freed from their protein matrix. Water helps to better suspend the individual grains than air, and facilitates their separation based on density. This weakens the bonds between the grains and the protein matrix, allowing their separation. When done manually, wet screening is laborious and time-consuming, and back-screening is tedious. In addition, an unpleasant odor can be produced by the fermented product and the acidic water content is both unhygienic and discouraging for producers. The move away from wet screening and the resort to low-quality products. This makes storage very difficult, reducing the desirable food quality and suitability of the product for further processing. However, research work has focused on developing a suitable mechanical system for cleaning agricultural products from wet screening. There are many wet screens in the vicinity, such as gari and cassava mash screens. But most of these local screens are batch operated and do not include the mixing compartment required to thoroughly wash the milk from the food sample. Also, there are various designs for screens.

They vary in complexity of construction and efficiency. Mainly, rotating, vibrating screens and pusher-type centrifuges are used,Separation techniques are used to separate mixtures into their constituent elements and/or compounds. Remember that a mixture contains elements and/or compounds that are not chemically combined. By separating the components of a mixture, we are able to find out the properties of known/unknown substances from the mixture and possibly use them to make useful substances such as medicines. Depending on the physical and chemical properties of the substances in the mixture, we can choose the most appropriate separation technique to separate them from the mixture,Used to separate and break down dry materials such as flour, as well as to aerate and combine. A sieve that is used to separate suspended solids from liquids by filtration, The environmental threat to the country has received considerable critical attention due to the associated economic activities, so input screening is required in post-harvest operations.The screening process is the process of separating larger particles from a mixture, a screening is a tool that has holes in it, or is made of crossed wires to separate larger particles from the mixture. The size of the particles depends on the size of the sieve which is the area of a single hole in the sieve screen, while the trapped particles are usually unwanted residues, so they cannot pass through the holes. Sieve is commonly used in many fields such as agriculture, medicine, gardening, cooking, building construction, industry and it is also used to separate fibers. However, not much attention has been paid to the research on sieves. The introduction of machine sieves significantly reduces the workload as well as time consumption of users because the machine adopts the repetition of the sieving process with high accuracy, a sieve machine is designed to separate particles according to their mesh size. It helps to add other materials such as volume, strength and stability.The nutritional value and importance of various food slurry diets obtained from maize (Zia May), millet and sorghum in many African countries cannot be overstated. For children from low and middle income families, who cannot afford ready-made baby food, they make the first solid food and the most popular weaning food. As a result, considering the originality of this highly valuable grain in Africa, the technology of processing this food slurry has been little studied over the years with limited success. Such a design of suction sieving machine for maize slurry was designed in stages, it improves the sieving of maize slurry by using vacuum pressure to reduce the pressure.

Therefore, the need to develop a completely different sieving machine based on the vibration principle became necessary and this led to the primary goal of this work.The mechanization of grain screening has revolutionized the agricultural and food processing industries, providing significant advances in efficiency, precision, and overall grain quality. The use of machines to screen grains ensures high accuracy in separating particles based on size, which is essential for producing uniform wholesome products.This mechanical process not only improves the removal of impurities such as stones, dust, and debris but also significantly reduces the presence of contaminants such as mold, insects, and broken grains, thereby ensuring higher food safety standards. The use of screening machines increases productivity by handling large quantities of grain quickly and consistently, which is important for meeting the demands of large-scale operations. Additionally, mechanized screening optimizes resource utilization, minimizes waste, and reduces labor costs, contributing to economic efficiency. The precision provided by these machines supports better quality control, resulting in superior end-products that meet stringent industry standards and consumer expectations. Ultimately, adopting sieving machines in grain processing is an important step towards achieving higher efficiency, improved safety, and sustainable practices in the agricultural sector.Thus reducing waste and optimizing resource use. Overall, the practice of grain screening is essential to maintaining high standards in the grain supply chain, promoting improved health outcomes, and supporting sustainable agricultural practices.Hand sieving is a particle size analysis method that has been practiced for almost as long as humans. From ancient farmers using simple screens to separate grains and seeds to real gold miners discovering their nuggets, sieves have always been a simple way to separate particles of different sizes.Thus reducing waste and optimizing resource use. Overall, the practice of grain sieving is essential to maintaining high standards in the grain supply chain, promoting improved health outcomes, and supporting sustainable agricultural practices.Hand sieving is a particle size analysis method that has been practiced for almost as long as humans.

From ancient farmers using simple screens to separate grains and seeds to real gold miners discovering their nuggets, sieves have always been a simple way to separate particles of different sizes.The general-purpose sieve is used to separate the required grains from the unwanted materials and then it is used to identify the grains according to the required size of the sample allocation. A sieve is used to separate and break up the particles of dry materials such as sand, flour, gari, etc. A sieve is a simple practice for sorting particles of different sizes. A sieve is used on a sieve to sift very fine particles. Finer coarse particles are separated or broken by grinding them together.The advantages of vibration sieving machines compared to suction sieving equipment include: high filtration rates due to sufficient agitation in the design; simplified assembly and disassembly of functional units for easy serviceability; maintaining high hygiene standards by using non-corrosive materials at the points of liquid-metal contact. In addition, the food-slurry sieving machine designed herein has versatile and wide applications for processing various slurry products.The total and ultimate introduction and application of the versatile food slurry sieving machine in medium and domestic sieves will bring about many improvements and enhancements in the processing and utilization of various types of food in the following ways: (i) It will reduce the long time and fatigue associated with the various food slurry sieving processes thereby increasing the production of these important staple foods in Nigeria and across Africa;

(ii) In some cases, the quality of the final filtration will be improved compared to the unhygienic manual sieving of these food products;

(iii) The manual sieving processes of various slurry food products from the local level to commercial and large-scale production will be improved;

(iv) The development of this new machine will lead to the design of processing plants for these various food products with the help of this new sieving technology which will form the most important unit of these plants; and (v) more employment will be created for equipment users as well as for sellers of filtrate products which will now be produced on a larger scale.Almost entirely produced and used in developing countries. It is highly productive, tolerant of poor soils, drought, and relatively disease and pest resistant.Not only does it reduce the fine particles (touch) that pass through the sieve, it also separates the coarse unwanted particles (larger size) that are discarded after each batch is sieved.

The quality of gari production and ultimately the composition of the final product - iba depends on two main factors,

(1) the size of the holes in the sieve used and

(2) the garifying process,

which includes the control of heat input and the operator's skill in handling.Considering these factors, if the size of the holes in the sieve is too small, it will not only cause the sieved cassava mash to be too fine but will also have a feedback effect on the operator who will exert more force on the sieve to shear and compress the mash and will take more time.On the other hand, if the aperture is larger than optimal, although the sieve will be faster and the operator will be easier, the sieve may not be able to remove the unwanted particles. Obviously, time, operator comfort and a sieved particle size will require an optimum sieve aperture size that will produce an acceptable gari grain after garification.classified gari into extra fine fine grain, coarse grain and extra coarse grain gari. And, observed that "generally, for making iba, fine grain or coarse grain,gari is usually fine and extra coarse grain is for soaking". Also, the experimental sieves and tests required to determine this grain size were specified.There can be no alternative but to use the sieve size imposed on them by the artisans unless it is reasonably proven that increasing the sieve aperture to the optimum level will benefit them in the cassava processing business and the gari produced will still maintain its acceptable quality for making iba.The general purpose sieve is used to separate the required grain from the unwanted material, and it is then used to determine the grain characteristics according to the required size of the sample allocation. A sieve is used to separate and break particles of dry materials such as sand, flour, gari, etc. A sieve is a simple method for sorting particles of different sizes.The particles are sieved using very fine holes. The fine coarse particles are crushed together and separated or broken. The quality of sand is one of the most important factors in the industrial world.Today, industries require base sand to be treated as a sand product. Base sand is mixed with many other materials such as dirt and metal,Various types of sieves are used to separate industrial waste such as bolts, washers, nuts and nails of different sizes. The way to collect sand is still manual or machine, like sieve conversion Using the method. And the process requires human power.

Therefore, to make the process more ‘efficient,’ there is a need for technology that can reduce manpower and also reduce the cost of the process.The particles are sieved using very fine holes. The fine coarse particles are ground together and separated or broken. The quality of the sand is one of the most important aspects in the industrial world.Today, the industry requires base sand to be treated as a sand product. Base sand is mixed with many other materials such as dirt and metal,Different types of sieves are used to separate industrial waste such as bolts, washers, nuts and nails of different sizes. The way to collect sand is still to use manual or machine, conversion methods such as sieves. And the process requires human power to complete. Therefore, to make the process more ‘efficient,’ technology is needed to help increase productivity that can reduce manpower and also reduce the ‘cost of the process.Today, mechanical sand sieving machines are available in a variety of designs, from simple hand-operated models to sophisticated automatic machines. The basic principle of operation is to pass the sand through a series of screens or sieves designed to remove unwanted components.Some modern designs of mechanical sand sieving machines include vibrating screens, rotary screens, and reciprocating screens. Vibrating screens use high-frequency vibrations to separate sand from unwanted materials, while rotary screens use a rotating drum to perform the same task. Reciprocating screens use a back-and-forth motion to separate sand. In addition to their use in the construction industry, mechanical sand sieving machines are also used in other industries such as agriculture and mining. In agriculture, they are used to separate seeds from soil and other materials. In mining, they are used to separate valuable minerals from other materials.Numerous research studies have been conducted on mechanical sand sieving machines over the years. These studies have focused on various aspects of the machines such as their design, performance and efficiency. Nachimuthu, et al (2016) designed and fabricated a sieving machine and pointed out that while designing a sieving machine, it is necessary to consider some other criteria such as the structure of the machine body, mechanical system as well as strength, safety and ergonomic design. A sieving machine for separating screws, nuts and bolts and dust with different mesh sizes depending on their size was developed.

Mechanical sand sifting machines have been used for centuries. The earliest designs were manual and used screens made of woven materials such as silk, plants or wool. These early designs were relatively simple and inefficient, but they paved the way for more advanced machines. In the 19th century, mechanical sand sifting machines began to emerge that were powered by steam engines. These machines were larger and more complex than their manual counterparts, but they were also more efficient. In the early 20th century, electric motors became widely available and sand sifting machines were adapted to use this new power source,using high-frequency vibrations to separate the sand, while rotary sieves used a rotating drum to accomplish the same task. Reciprocating sieves use a back-and-forth motion to separate sand.In addition to their use in the construction industry, mechanical sand screening machines are also used in other industries, such as agriculture and mining. In agriculture, they are used to separate seeds from soil and other materials. In mining, they are used to separate valuable minerals from other materials. Numerous studies have been conducted over the years on mechanical sand screening machines.

These studies have focused on various aspects of the machines, such as their design, performance, and efficiency.Nachimuthu, et al (2016) designed and manufactured a screening machine and noted that while designing a screening machine, it is necessary to consider some other criteria such as the machine's body structure, mechanical system, as well as strength, safety, and ergonomic design.

A screening machine was developed to separate screws, nuts, and bolts and dust with different mesh sizes. A crank was attached to a vibrating table to vibrate the tray to act as a separator.It is powered by DC electric motor. Khan, et al., (2018) developed a fully automatic sand-screening machine that separates the waste particles to overcome the human effort involved in the sand-screening process during construction and to simplify the machine. It works on the principle of slider crank mechanism. The project focused more on safety and its ergonomic design.

Therefore, sand is a simple material used in construction sites. Only stones, mortar, plaster, cement, etc., are the most important materials in construction, so sand has many uses in various ways.Different types of sand have different uses, especially in construction sites. Fine sand (0.07 mm 0.25 mm) is required for plaster and fine sand (0.25-5 mm) for flooring. It is necessary to analyze the sand according to the needs of the field. Depending on the work, specific grades of sand are tested.

Sand screens with sieve plates are used only in construction sites, This product is a household screening machine that can be used to separate or sift unwanted and unwanted soil from crops. The machine is compact and only requires limited space. The machine can also separate stones and other unwanted materials from purchased or stored goods. An effective method is used to create functional objects within the constraints.Sieving is a simple method of separating different particles. Fine and coarse grains hit each other and are sieved and separated or broken. This sieve has very fine holes for sifting flour grains. A similar type of analysis is also used in agricultural products. It helps to generate new ideas and has the potential to be implemented. The main purpose of the sieve machine in education is to consolidate knowledge and information and guide students towards practical application.

1.2 Problem Statements

i. Sieving of sand particles in construction, grain sorting in agriculture is done manually and human effort is required.

ii. After careful review of literature, it was found that no specific solution to separate different sizes of grains are not available.

iii. The Speed of Motor cannot be controlled so that can be set according to preference.

iv. The waste which is not sorted in sieving remains in sieve after an operation it needs to manually cleaned and remove.

v. Now days people always prefer the most suitable way to cut their cost and time. Example in a construction where they have to finish the work before the due date. His might be a problem. Since we have waiting long waiting for the good to arrive

vi. However, sometime in big company there are high tech machine that can do this work sieving any sub stand or mixture. But sometime in construction required a special sieve machine that are comfortable and easy to use.

vii. Traditional method gives low efficiency as it is operated manually but the automated sand sieving machine have higher efficiency

viii. Traditional method requires more labour.

ix. Traditional method is more time consumed during the process of preparing the concrete.

x. The cost of highly sophisticated machine is very high which is not affordable for small scale foundries and low-level contractors.

1.3 Objective

The objectives of this project are:

- To investating the possibility using sieves to automatically separate small and large granules.
- To easily separate different types of granular materials using small and large sieves.
- To make it easy for the general public to separate different types of granules by size, contributing to a more sustainable lifecycle.

Chapter 2

Literature Review

2.1 Introduction

In the present world, there are plenty of scientific innovations and sophisticated technologies that have simplified human life and raised the standard of living. Scientists are busy with research and development works. Day-by-day scientists come up with better ideas that make the life of the common man more automated. As an attempt to develop an automated set-up in whatever area possible that would further simplify human life and make it easier, we ended up with a very relevant area of concern - sorting. Various other places where sorting comes into play predominantly are airports, seaports, small-scale industries, supermarkets, etc. However, due to the restricted reach of automation in sorting in these sectors, the thought of automated sorting in such fields ought to be considered with much importance. Thus, to extend the advantages of automated sorting in large sectors to the above-mentioned sector, a notion of automation has been thought to be implemented in small-scale sectors [7-8]. A literature survey is a proof essay of sorts. It is a study of relevant literature materials about a topic we have been given.

2.2 Literature Review

A. Design and Fabrication of Domestic Sieving Machine Alan Biju, Alwin Thomas, Akash J Kalarickal, Jeswin Jose, Rittin Abraham Kurien, Conventional practices like winnowing require highly expertise hand movements considering gravity, aerodynamics and centrifugal force. This is the major difficulty observed in the winnowing process. Nowadays people always prefer the most suitable way to save time and energy. This project proposes a domestic sieving machine which can easily remove unwanted particles from the grains, nuts and other pulses automatically.[1]

B. Automatically Driven Sand Sieving Machine P.R. Gajbhiye ,RupeshKhode PratikSukhadeve ,VickyChaple Construction of buildings requires sand as an important ingredient Sand is used at different stages in construction right from the foundation to the finishing work i.e. plaster. This sand is needs to be screened properly for various stages in construction, i.e. size of sand for construction work is slightly coarse whereas that used for plaster work is fine These processes are carried out manually. Sieving of sand is carried out using rectangular mesh which is inclined at certain angle. This causes a relative motion between the particles and the sieve. Depending on their size the individual particles either pass through the sieve mesh or retained on the sieve surface.[2]

C. Development of NCAM Reciprocating Cassava Mash Shifter Abiodun L.O., Oladipo N.O and Bamidele B.L. The NCAM cassava mash sifter was developed to tackle the problems of high labor, expense associated with manual sifting, time wastage, the tedious mature of the operation, injury to the hand or palm as one rubs against the raffia sieve continuously, back ache, caused by prolonged sitting in one position during manual sifting, low productivity, and the hygienically unsafe nature of manual sifting as products are exposed to germs.[3]

D. Stacked Siever for Natural Sand Processing W.D. Handoko, N. Widiastuti, G.S. Budi, K. Karelius, S. Pratapa This stacked sand sieve was intended to replace conventional sieves that had several disadvantages, including unstable speed, inefficient time in processing large amounts of sand, and relatively higher costs incurred. This stacked sieve exhibited the following characters: 1) composed of two sieves, 2) can be assembled easily to change the size of the sieve, 3) had 3 variations of the sieve slope, and 4) used a gasoline motor to pro- duce a sift speed of 25.2 cm/s and 36.4 cm/s. The sieve slopes were manually adjusted by positioning the sieves according to the available slots on the device.[4]

E. Energy-based Indicators of Soil Structure by Automatic Dry Sieving Dmitry Fomin, Maria Timofeeva, Olga Ovchinnikova, Ilya Valdes-Korovkin, Andrey Holub, Anna Yudina Numerous methodological approaches and fractionation procedures contribute to the continuation of discussions about soil aggregate formation. This study aims to justify the dry sieving procedure and suggest an optimal sieving regime for automatic shakers for soil samples. For this approach to calculating total sieving energy, using oscillation frequency, vibration amplitude,

and time was proposed. Retisol, Phaeozem, and Chernozem topsoil samples from agricultural and native ecosystems were analyzed using a sieving test, in which 50-kg soil samples were divided into 500–700 g subsamples and sieved with a constant oscillation frequency (50 Hz), but with varying vibrational amplitudes (0–2.5 mm), for sieving times that ranged from 1 to 5 min. We found that the optimal sieving regime is characterized by total sieving energy of 1850 J kg− 1, reached during 2 min of sieving with a 50 Hz frequency and a 2.5 mm amplitude. Based on results of the dry sieving test, we have proposed the indicators of mechanical stability of soil structure: index of soil structure stability (SS) which characterize the degree of change in the soil aggregates size during sieving with minimal and optimal sieving energy, and modified the soil friability index (F4), that characterizes the rate of change in the soil aggregates size under mechanical load by dry sieving. The proposed formula of total sieving energy calculation allows comparing results between soil studies. Our meta-analysis showed that most (26 of 34) studies used insufficient sieving energy, where the aggregate size distribution did not reach the equilibrium state. A detailed protocol for soil dry sieving analysis is provided. [5]

F. Quality attributes of parboiled rice prepared with a parboiling process using a rotating sieve system Naruebodee Srisang, Thatchapol Chungcharoen The aim of this study is to apply a rotating sieve system to the parboiling process for parboiled rice production. The parboiling time and rotation speed were the main production factors affecting the quality attributes of the parboiled rice, including the degree of starch gelatinization (DG), fissure percentage, head rice yield (HRY), white belly, and color. The results showed that the parboiling process with a rotating sieve can decrease the parboiling time required to provide an even quality of parboiled rice. The parboiling time for an even quality of parboiled rice was 5 min at rotation speeds of 10 and 15 rpm, while the parboiling time at a rotation speed of 5 rpm was 10 min. These times were shorter than that with a fixed sieve (15 min). Moreover, the parboiling process using a rotating sieve system provided better qualities of parboiled rice than that using the fixed sieve system, including higher DG and HRY and lower fissure and whiteness percentages. Additionally, the values of DG and HRY were increased with increasing parboiling time. In contrast, the fissure and whiteness percentages of the parboiled rice decreased. However, the quality of the parboiled rice was not dependent on the rotation speed [6]

G. Shredding and sieving thermoplastic composite scrap: Method development and analyses of the fibre length distributions Guillaume A. Vincent, Thomas A. de Bruijn, Sebastiaan Wijskamp, Mohammed Iqbal Abdul Rasheed, Martin van Drongelen , Remko Akkerman Recycling of thermoplastic composites has attracted considerable attention in the recent years. Several recycling solutions include shredding scrap to centimetre-sized flakes to retain long fibres, followed by a remanufacturing step that prevents fibre breakage. Determining the exact fibre length distribution (FLD) for these routes is crucial, as it is of importance for the processibility of the material as well as the mechanical performance of the recycled parts. In this paper, novel analysis methods are introduced to calculate FLDs based on photographs of flakes. The reliability of the method and of the sampling was found to be high. The relation between flake size and FLD was studied, showing that offcut layup barely influences the FLD in comparison to flake size. The effects of shredding settings and sieving were studied, showing a strong correlation between machine parameters and FLD, whereas the offcut size was found to have no effect on FLD. [7]

H. Intelligent optimal sieving method for FACTS device control in multi-machine systems Qiang Lu, Wencong Wang, Chen Shen, Shengwei Mei, Masuo Goto, Akihiko Yokoyama A multi-target oriented optimal control strategy for FACTS devices installed in multi-machine power systems is presented in this paper, which is named the intelligent optimal sieving control (IOSC) method. This new method divides the FACTS device output region into several parts and selects one typical value from each part, which is called output candidate. Then, an intelligent optimal sieve is constructed, which predicts the impacts of each output candidate on a power system and sieves out an optimal output from all of the candidates. The artificial neural network technologies and fuzzy methods are applied to build the intelligent sieve. Finally, the real control signal of FACTS devices is calculated according to the selected optimal output through inverse system method. Simulation has been done on a three-machine power system and the results show that the proposed IOSC controller can effectively attenuate system oscillations and enhance the power system transient stability. [8]

I. Design and Fabrication of Domestic Sieving Machine,Alan Biju, Alwin Thomas, Akash J Kalarickal, Jeswin Jose, Rittin Abraham Kurien, Conventional practices like winnowing require highly expertise hand movements considering gravity, aerodynamics and centrifugal force. This is the major difficulty observed in the winnowing process. Nowadays people always prefer the most suitable way to save time and energy. This project proposes a domestic sieving machine which can easily remove unwanted particles from the grains, nuts and other pulses automatically.[9]

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L. Stacked Sirver for Natural Sand Processing W.D. Hand N. Walista, S.Pd. K. KS. Pratap.This stacked sand sieve want to raplace contal seves that had several didacting state spordiping large tots of sant, and relatively higher costs. This stacked the flag harat 1) posed of these. 2) can be sedly to chung the size of the sieve, 3) had 3 saatis of the sve slope and 4) da gasoline motor to pro daus a sifl qual of 25.24The wave Hope warmly wit by posting the sieves sending to the the desve.[12]

2.3 Summary

A multipurpose sand sieving machine separates different sizes of sand and other materials. It does this by using a vibrating screen with different mesh sizes to separate particles by size. These machines are designed to be versatile and adaptable to various materials and sieving tasks, often featuring adjustable sieve sizes, variable speeds, and interchangeable screens.

Chapter 3

Theoretical Model

3.1 Introduction

In this chapter, we will discuss our system methodology, system description, block diagram, working principle, and instrument cost analysis.

3.2 Methodology

The methodology is the proposed work will be carried out

with following steps:-

1. Study of sieving machine.

2. Study of different operations which is need for

fabrication.

3. Selecting the project's components.

4. Calculation.

5. Experimentation by assembling all components.

6. Testing.

7. Result

3.3 3D Model of Multi Purpose Sieving Machine

The figure shows the sieve used as separator. In this the whole work is based on the mechanism of crank and slider mechanism. The rotation of the crank transfers the motion to the movement of sieve. It consists of the pulley-wheel and belt arrangement which rotates the crank and through its slider consists of reciprocating mechanism. The power is transmitted to the crank and slider mechanism. This mechanism is used to rotate the crank, the wheel which is having an extended rod is connected to the sieve holder plate directly by means of a linkage. The sieve plate is passed through the guide ways by means of maintaining the reciprocating motion. The sieve moves horizontally on guided path.

The crank is connected to the wheel which is transfer the motion from one to another. The pulley is connected to another wheel which is transferring motion through belt. The rotating motion of the electrical motor converts to the sliding motion using pulley and wheel by belt. The sliding crank mechanism is used in this project. The wheel which is placed at same level of pulley and is powered by motor and speed controlled through vfd. This sieving operation can be performed for multiple purposes like in sand sieving, construction sites and also in agriculture for harvested crops and sand sorting.

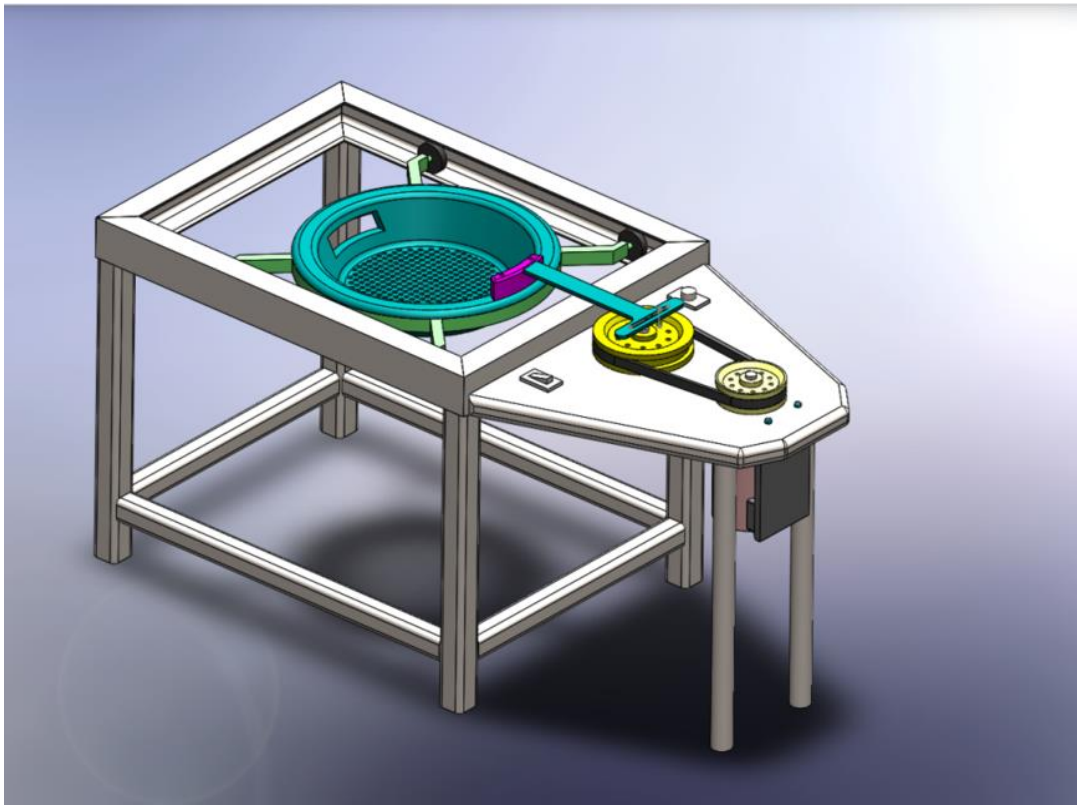


Figure 3.1: CAD Model of Multi Purpose Sieving Machine. [13]

3.4 Block Diagram

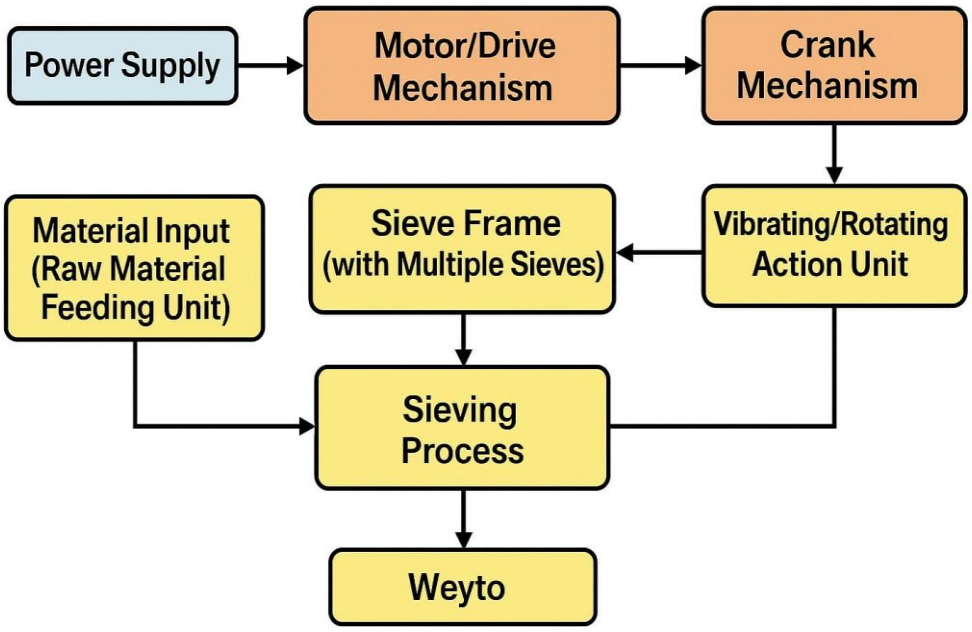


Figure 3.2: Block Diagram

The block diagram of the Multipurpose Sieving Machine consists of several key components that work in coordination to perform the sieving operation efficiently. The system starts with a Power Supply, which provides electrical energy to the Motor/Drive Mechanism. This motor is connected to a Crank Mechanism that converts rotary motion into reciprocating or vibrating motion. This motion is transferred to the Sieve Frame, which holds multiple layers of sieves of different mesh sizes. Raw materials are fed into the system through the Material Input Unit, and as the vibrating mechanism operates, the sieving process begins. Particles are sorted based on size and collected in separate Output Sections. Oversized waste materials are guided to a Waste Outlet. This design allows for efficient separation of materials like sand, grains, or powders, and can be adapted for various industrial or agricultural uses.

3.5 Complete Project Image



Figure 3.3: Our Final Project Prototype [Top view}



Figure 3.4: Right side view



Figure 3.5: Back Side

3.6 Working Principle

The Multipurpose Sieving Machine is very easy to construct and can be operated easily. It is very economic among this kind of machines. This project is fabricated with the help of parts like a motor, crank and slider link mechanism, bearing, C.I. wheels, sieving box. The horizontal sieving machine is worked on the basis of crank and slider mechanism. Here crank is attached to the sieve box the power is given by motor through pulley belt arrangement. The rail bracket is made in which the sieving box moves in it. The sieving box fixed with the connecting rod in order to move when the wheel is rotated by means of pulley attached to the motor. The sieving box is placed inside the rail bracket and the machine is started. When the sieving box moves in the reciprocating motion the sieving process is performed for various operations by changing the inner sieve for different applications.

3.7 Components List

Hardware Part:

- Motors
- Bearing
- Pully
- Connecting Rod
- Sieve

Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by
alternating current (AC) sources, such as a power grid, inverters or electrical generators.

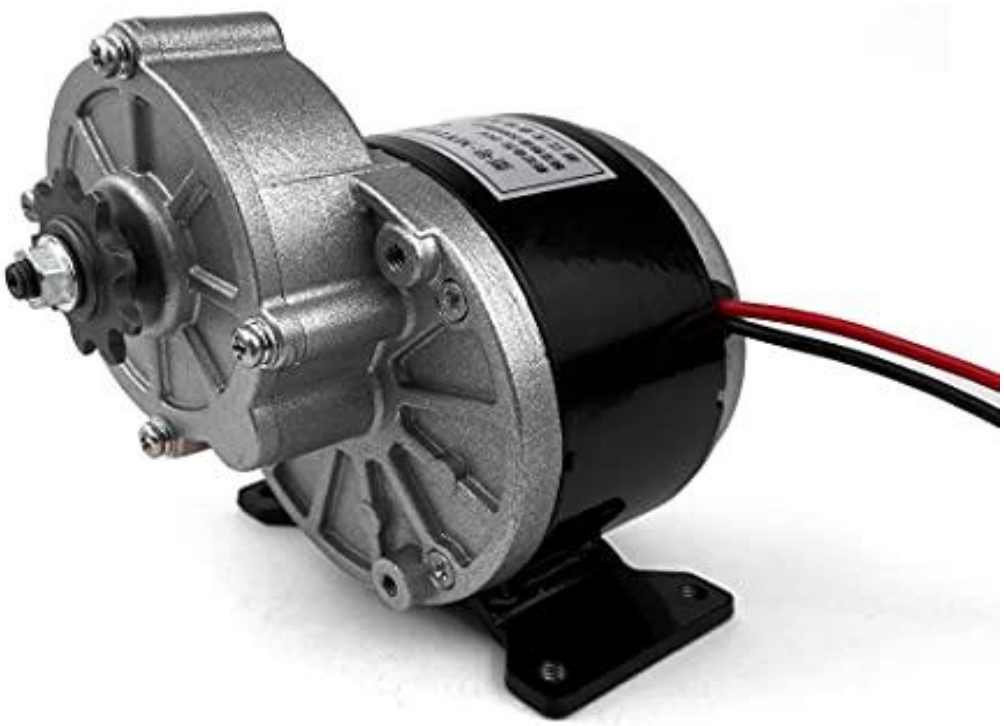


Figure 3.6: Motor [14]

Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.



Figure 3.7: Bearing [15]

Pully

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave or pulley wheel. A pulley may have a groove or grooves between flanges around its circumference to locate the cable or belt. The drive element of a pulley system can be a rope, cable, belt, or chain. also be used to change the speed of rotation, either up or down, by using different sized pulleys.



Figure 3.8: Pully

Connecting Rod

A connecting rod is a crucial engine component that bridges the gap between the piston and the crankshaft, transmitting the linear motion of the piston into the crankshaft's rotational motion. This transmission of power and motion allows the engine to convert the burning fuel into mechanical work.



Figure 3.9: Connecting Rod

Sieve

A sieve, fine mesh strainer, or sift, is a device for separating wanted elements from unwanted material or for controlling the particle size distribution of a sample, using a screen such as a woven mesh or net or perforated sheet material. Sieving is a simple technique for separating particles of different sizes. A sieve such as used for sifting flour has very small holes. Coarse particles are separated or broken up by grinding against one another and the screen openings. Depending upon the types of particles to be separated, sieves with different types of holes are used. Sieves are also used to separate stones from sand. Sieving plays an important role in food industries where sieves (often vibrating) are used to prevent the contamination of the product by foreign bodies. The design of the industrial sieve is of primary importance here.



Figure 3.10: Sieve

3.8 Instrument Cost Analysis

Serial No	Components	Cost
1	DC Motor	4800
2	Sieve	600
3	Connecting Rod	200
4	Pully	1000
5	Bearing	400
6	MS shaft	400
7	MS Angel	3980
8	Nut & Bolt	300
9	Machine macing cost	2000
10	Wiring charge	300
11	Coloring	1200
12	Up-Down cost	1500
Total cost =16680		

Table 1.1: Cost analysis of instruments

Chapter 4

Results & Discussion

4.1 Introduction

In this chapter here we discuss our project result analysis and outcome, advantages, limitations, application, and discussion of our system.

4.2 Result Analysis

S/N	Time (s)	Weight Of Sand Sieved (g)	Weight of Dirt (g)
1	16.8	928.36	71.64
2	16.34	934	66
3	17.07	939	61

Table 1.2: Type A Sieve

1	5.67	976	24
2	4.80	988.6	11.4
3	4.50	992.3	7.7

Table 1.3: Type B Sieve

1	1.98	972	28
2	2.75	983.4	16.6
3	2.96	992	8

Table 1.4: Type C Sieve

The fabrication of a mechanical sand sieving machine with automatic vibrator was developed in this article. The machine is designed to vibrate at a specific frequency to ensure that the sand particles are separated based on the size of holes of the screen used at a particular time. Different sieve screen with different holes sizes can be used on the machine at different time to allow for the separation of sand particles into different size ranges. The mechanical sand sieve is an important tool in construction and foundry projects for filtering and separating sand particles. The efficiency of the machine, ease of use, and low cost makes it an attractive option for sand separation across many different industries. The machine can scale up for bigger projects.

4.3 Advantages

Our project certainly has many benefits and some of the main benefits are as follows:

- **High efficiency and throughput:** Able to sort large quantities of grain quickly and accurately, reducing manual labor and sorting costs.
- **Improved recycling value:** Seperates different materials accurately, resulting in a cleaner recycling stream and higher value for recycled products.
- **Landfill grain reduction:** By effectively separating recyclable materials, less grain ends up in landfill.
- **Cost savings:** Can potentially reduce labor costs associated with manual sorting.
- **Reduced environmental impact:** Contributes to sustainable grain management by maximizing recycling potential.
- **Flexibility:** Can be designed to sort a variety of materials including sand, wheat, seeds, grains and more.
- **Improved worker safety:** Eliminates the need for workers to manually handle potentially hazardous grains.

4.4 Limitation

Sand sieving machines, while beneficial for separating sand from other materials, have limitations including the inability to separate particles of the same size, potential for particle breakage during the process, and limitations in handling wet or very fine sand. Additionally, they can be inefficient for very fine particles, require consistent agitation for accurate results, and may not be easily portable.

Here's a more detailed look at the limitations:

1. Limited Size Range and Precision:

- **Cannot separate identical sizes:** Sieving is not effective for separating mixtures where particles have the exact same size.
- **Inaccurate for very fine particles:** Dry sieving may not be accurate for particles smaller than 100 mesh (150 µm), according to Wikipedia.
- **Potential for particle breakage:** The force applied during sieving can break down some particles, especially brittle ones.
- **2. Agitation and Handling:**
- **Inconsistent Agitation:** Mechanical sieve shakers can have uneven agitation patterns, leading to inaccurate particle size distribution.
- **Wet Sand Challenges:** Sieving is primarily for dry materials, and wet sand can clog the sieves, making it difficult to separate effectively.
- **Difficulty with Fine Particles:** Very fine sand can be challenging to separate efficiently, requiring more time and potentially less accurate results.

3. Practical Considerations:

- **Limited capacity:** Some sieving machines, especially those with a single sieve plate, may not be suitable for high-throughput applications or for processing large volumes of sand, according .
- **Portability and Transport:** Some rotary sieving machines are not easily transported.

- **Maintenance and Wear:** Sieves can wear down over time, impacting the accuracy of the separation.

4.5 Application

This project has applications in many fields due its necessity. We have selected a few of them and they are given below:

- **Construction:** Sieving sand for different construction tasks, like plastering (fine sand) or flooring (less fine sand).
- **Agriculture:** Separating grains or other materials from unwanted particles after harvesting.
- **Foundry:** Cleaning sand for casting purposes, removing dirt and pebbles General Material Sorting: Sieving other materials like nuts, washers, and nails based on size.

4.6 Discussion

The waste when exposed to our automatic waste segregator and monitoring system. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process. It would provide in-time solid waste collection. The technologies which are used in the proposed system are good enough to ensure the practical and perfect for solid waste collection process monitoring and management for green environment. The waste segregator as the name suggests, segregates the waste into three major classes: plastic, organic, and metallic. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process. The inlet section is provided with an open and close mechanism to regulate the flow of waste onto the conveyor. The inductive proximity sensor is used to detect metallic waste. A blower mechanism is used to segregate dry and wet waste. The timing and movement of the conveyor belt is controlled by Arduino Uno. Continuous and unnecessary operation of any particular section is thus avoided.

Chapter 5

Conclusion

5.1 Conclusion

In this research study, the mild steel failure problems encountered by loads were successfully. Thus, a cost effective and simple design motor operated multipurpose sieving machine is fabricated. This machine reduces the human effort and hence we don't need multiple persons to filter/sieve at a time. Also, machine is portable as it can be de-assembled and assembled easily. Concluding the project up to now after research four different types of sieving machine was conceptualized to select the best considering every factor to make it more efficient, portable and easily operable. Then the required materials were selected by market study although the fabrication process was undoable due to condition occurred we continued the design process in Solid works and some preliminary calculations. This report also includes doing method of construction and research design flowchart and the Gantt chart. According to calculations and assumptions, this type of sieving machine will be efficient and easily operable, which can help society to learn new way of sieving sand.

5.2 Future Work

i. Automatic Multi Purpose Sieving Machine Management System can be deployed to solve our existing problem as well as bring about a change in our daily life by meeting our demands.

ii. The project can be made for higher capacities by increasing the dimension and improving the design aspects.

iii. The machine can be operated using solar energy also which is economically useful.

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