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Pneumatic Sand Filtering Machine

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Abstract: *Sand is used in construction, manufacturing and many industries. Sand needs to be filtered and separated from unneeded particles, stones and other large particles before it is put to use. Our system puts forward a fully automated sand filtering and separator system that automatically filters sand poured on it. Here we use a motorized shaft that is mounted horizontally using mounts. The shaft is connected to a filter frame with mesh below and enclosing frame on the sides. We now have a rod connected from the shaft to the filter frame in a way such as to achieve the best horizontal motion. Also we have a frame to hold the filter frame in place while ensuring proper horizontal motion at the same time. On switching on the motor using our motor controller circuit, the system allows to operate the motor. This allows us to operate the sand filter motion for appropriate sand filtering needs. We are fabricating the machine for filtering sand it is mainly developed for civil department. At present they are filtering sand manually with help of steel net; by this process they have to spend more time for filtering the sand as well as humans gets more tired by this process. So to save the time and with less man power involved we go for the pneumatic sand filter.*

Keywords: *Sand.*

I. INTRODUCTION

Sand is underrated. It provides the structure of plaster, and the quality of your sand can make the difference between success and failure. So what makes sand good or bad? In general, good plaster sand should be sharp, with a diversity of particle sizes, and clean. Sand should be sharp and angular, not worn and rounded. Imagine trying to build any kind of structure out of balls vs blocks, and the reason for this becomes obvious. Unfortunately this means that many natural sands are poor plaster sand. Beach sand in particular should be avoided, because waves have often been rounding the sand grains for thousands of years.

Particle size diversity is important to create good structure, and to reduce the amount of binder needed. Imagine a bucket filled with softballs, how many golf balls could you add to the bucket without changing the total volume? Then how many marbles could you add to that? Ideally you'd have a mix of nearly every grain size so that there are few large voids left – this creates a structure that resists movement, and also requires less binder to fill all those voids. Less binder equates to less cracking, and shrinkage cracks are one of the plasterer's number one enemies.

Sand should not, however, contain silt – which is the particle size below sand, slightly coarser than clay. Silt fills the voids in place of the binder, resulting in weak plasters. Clay can also cause serious problems in lime-based plasters. Salt also can lead to plaster failure, as well as causing rusting of metal lath or any other metal used in plaster preparation. So when we talk about sand being clean, we mean free of fine particles, and unwanted salt, chemicals or organic matter.

As a conservative rule the largest particles in your sand should be no more than half the thickness of your plaster, but preferably would be at least one quarter the thickness of your plaster (larger aggregate can provide better structure, resulting in a stronger plaster with less cracking). So if your plaster coat is a half inch, your largest aggregate would ideally be between 1/8 and 1/4 inch. There are several types of sand that are widely available, so when you call a sand yard, or any construction materials supplier, you need only tell them what you want and it will promptly appear at your jobsite… maybe. Unfortunately the definition of sand types allows huge variability (even assuming it is followed correctly), and what you receive on the jobsite will depend on what that supplier carries, or what is locally available.

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Nevertheless, as a rough guideline the main sand types everyone carries are masonry sand, concrete sand, and (if you're lucky) stucco sand.

II. LITERATURE SURVEY

Over the years, various methods have been employed to filter sand for use in construction and industrial applications. Traditional sand sieving has relied heavily on manual labor, where workers shake a mesh sieve to separate fine sand from coarse particles and debris. This process is time-consuming, inefficient, and inconsistent. To overcome these limitations, motorized sand sieving machines were developed, using electric motors to automate the vibration process. While these machines improved productivity, they were still constrained by power availability and were less effective in rugged or outdoor environments where electricity is not always accessible.

To address these challenges, researchers and engineers have explored the use of pneumatic systems in sand sieving applications. Pneumatics, which use compressed air to create mechanical motion, are widely recognized for their speed, reliability, and low maintenance costs. Pneumatic actuators, commonly used in industries for tasks like conveyor control and robotic movement, have proven particularly useful for generating consistent and controlled vibrations in sand sieving machines. Integrating pneumatics into the sieving process not only reduces human effort but also enhances efficiency and allows operation in dust-prone environments, where electric systems might pose safety risks.

Several studies and prototype developments have demonstrated the potential of pneumatic sand filtering machines. For instance, projects from 2018 to 2021 have focused on combining pneumatic cylinders with vibrating trays to filter sand more effectively. Some innovations have even integrated microcontrollers and sensors for automated operation, improving accuracy and reducing waste. These developments highlight the growing interest in combining mechanical design with automation to create smarter, safer, and more efficient sand filtering systems suitable for a variety of industrial needs

III. METHODOLOGY

In order to have a robust framework, we have employed a socio-technical system approach to the design of the integrated parking application project. These are a class of engineering systems made up of both a physical domain where the technical system resides and an institutional sphere that defines the context within which the physical domain is implemented (1). In addition, we have also emphasized a user centric design, a design process in which user requirements are considered from the get-go and included all through the product development cycle (2). Stakeholders and end-users input are obtained and reflected in the design process through a series of interactive methods. This process creates a platform on which stakeholders could reflect on the key issues, table their concerns and discuss their expectations of the project with the product development team. These are examined for feasibility and if possible, they are reflected in subsequent designs of the socio-technical system.

The international standards organization (iso) human centered design for interactive systems (3) Specifies six principles of a user centered design approach:

- The design is based upon an explicit understanding of users, tasks and environments.
- Users are involved throughout design and development.
- The design is driven and refined by user-centered evaluation.
- The process is iterative.
- The design addresses the whole user experience.
- The design team includes multidisciplinary skills and perspectives.

Methodology can properly refer to the theoretical analysis of the methods appropriate to a field of study or to the body of methods and principles particular to a branch of knowledge. In this chapter, it talks about the methods use to gather information in order to finish the research. It was involve the process flow of every step in archive the objective of this project. There are many methods use in this project such as internet references, interviewing lecturers and technicians and the most important is group discussion.

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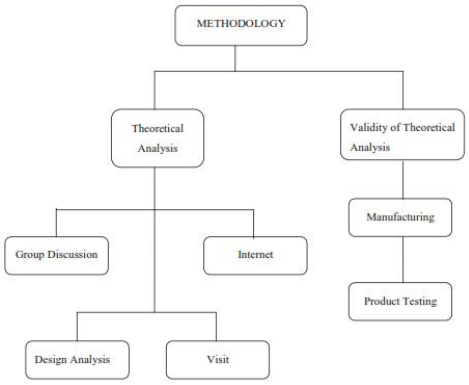

Fig.1 Methodology

METHODOLOGY OF WORKING PROCESS

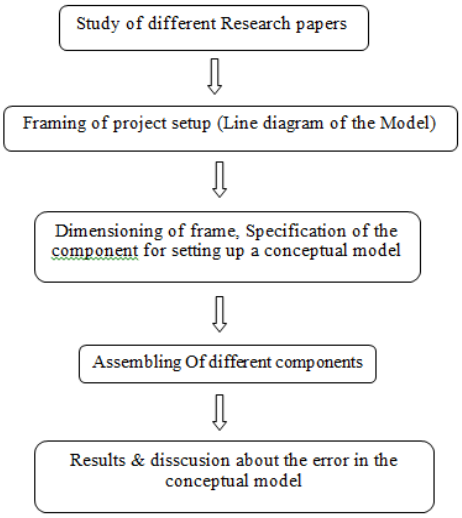

Fig.2 Flow Chart For Working Process

IV. SYSTEM DESIGN

4.1 SYSTEM DESIGN & COMPONENT

In our attempt to design a special purpose machine we have adopted a very a very careful approach, the total design work has been divided into two parts mainly;

- System design
- Mechanical design

System design mainly concerns with the various physical constraints and ergonomics , space requirements, arrangement of various components on the main frame of machine no of controls position of these controls ease of maintenance scope of further improvement ; weight of m/c from ground etc.

In Mechanical design the component in two categories.

- Design parts
- Parts to be purchased.

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For design parts detail design is done and dimensions thus obtained are compared to next highest dimension which are readily available in market this simplifies the assembly as well as post production servicing work.

The various tolerance on work are specified in the manufacturing drawings the process charts are prepared & passed on to the manufacturing stage .The parts are to be purchased directly are specified &selected from standard catalogues.

4.2 WORKING AND PROCESSES

Pneumatic Sand Filtering is used to remove metal chips, stones, nails, and so forth from elaboration sand which is utilized for casting purpose and development works. Filtering is done manually which takes out unwanted parts from construction sand. In order to reduce timing and do the process effectively, we are going to fabricate a pneumatic sand filter which works using pneumatic mechanism. The main objective of the compressor is to produce high pressurized air which is used to activate the cylinder. The air from the compressor is pumped with high pressure. The pneumatic actuator is connected to a filter frame with mesh below and with enclosing frame on the sides. As we start the sand filter system, the actuator pulls the frame forward and backward so that a mesh strainer, isolates the sand for the construction work.

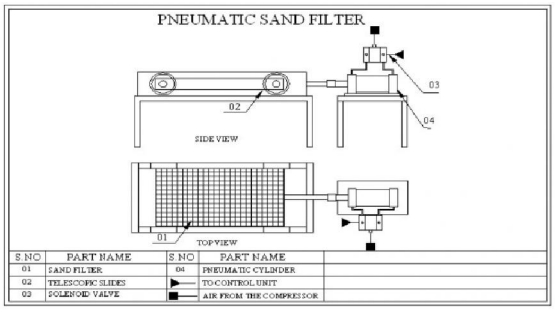
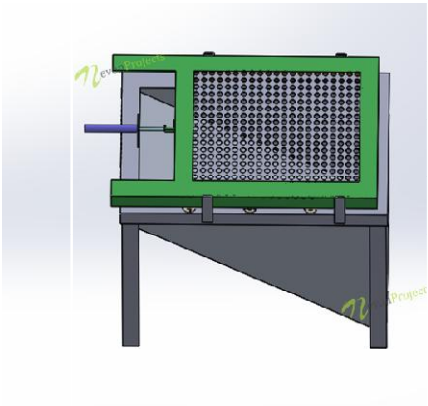


Fig.3 Block Diagram

4.3 WORKING PRINCIPLE

Here the pneumatic sand filter is operated by means of a pneumatic cylinder. The pneumatic cylinder reciprocates as the filters separate the sand from the stones. Telescopic slides are placed on the base frame and the filter is attached to the telescopic cylinders. The pneumatic cylinders piston rod is attached to the filter. While the pneumatic cylinder operates continuously the filter also reciprocates. The sand filter is made in such a way that it can filter the sand in a very faster manner. The pneumatic cylinder has to be selected in such a way that it should force the sand filter to operate on its own way.

4.4 CONSTRUCTIONAL DETAILS



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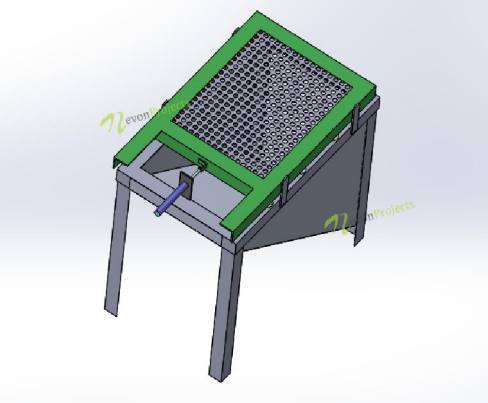

Fig.4 Pneumatic Sand Filtering Unit

4.5 PROCESSES INVOLVED

DRILLING

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips from the hole as it is drilled. In this Project the jig plates require holes for locating indexing plate and screw rod, drill bush assembly. These holes are done by conventional vertical drilling machine.

WELDING

Welding is an operation whereby two or more parts are united by means of heat or pressure or both. It is usually used on metals and thermoplastics but can also be used on wood. The parts that are joined are known as a parent material. The material added to help form the join is called filler or consumable. The form of these materials may see them referred to as parent plate or pipe, filler wire, consumable electrode. In this project it is used to join the jig plate one to another. This is done by arc welding machine.

GAS CUTTING

Apart from using hacksaw, power saw, chisels, etc. for metal cutting operation, gas or oxygen cutting is extensively used now-a-days in industry. The process consists of preheating the metal to be cut to its ignition temperature above 870°C in case of steel. In this project it is used to cut the raw materials such as plates. This done by gas cutting machine.

FINE GRINDING

Fine Grinding is a batch-mode abrasive machining process that combines the speed and aggressiveness of super abrasive wheels with accuracy of lapping kinematics to produce flat and parallel work piece surfaces. This is done as the each plate and base plate for good surface finish. It is done by conventional grinding machine.

V. RESULTS AND APPLICATIONS

Thinking about all the structure parameters, constant computations, wellbeing standards, cost productivity, material life time and work accessibility; it tends to be presumed that the Mechanism that is proposed is the most fitting for conduction and transportation of sugarcane. To test and confirm the working of developed mechanism for Sugar cane lifter, we have taken practical demonstration and also we have collected the feedbacks and improvements points in developed model.

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COMPARISION BETWEEN CONVENTIONAL METHOD AND NEW DEVELOPED MECHANISM

Sr No.	Points observed	Conventional method(Existing manual methods	New developed mechanism(sugarcane lifting mechanism)
01	Labour required per day	06	02
02	Time required	More (for 1 trolley loading about 1.5-2 hrs)	Less (for 1 trolley loading about 45-50 min)
03	Manual efforts	More	Less
04	Space required	NA	Storage space required for machine
05	Maintenance cost	NA	10% of initial cost
06	Labour cost	More (as more labours are required)	Less (as less labours are required)

VI. CONCLUSION

In conclusion, the Pneumatic Sand Filtering Machine is an efficient and innovative solution for separating fine sand from larger particles using pneumatic power and mechanical vibration. It enhances the quality of sand used in various industrial and construction processes by ensuring uniform particle size and removing impurities. The integration of pneumatic systems makes the operation faster, cleaner, and more automated compared to traditional manual filtering methods. This machine not only saves time and labor but also contributes to improved material quality, making it a valuable tool in modern engineering and manufacturing applications. neumatic Sand Filtering Machine represents a significant step toward automation and efficiency in material handling. Its ability to deliver consistent and high-quality sand filtration with minimal manual intervention makes it ideal for large-scale operations. By reducing human effort and increasing precision, the machine promotes productivity and supports sustainable practices by minimizing material waste. Its adaptable design also allows for customization based on specific industrial needs, making it a versatile and cost-effective solution in the long run.

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