Design and Implementation of an Automated Sieve System

A thesis report submitted to the department of mechanical engineering for the partial fulfillment of the degree of Bachelor of Science in Mechanical Engineering.

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APPROVAL

This is to certify that the project on "**Design and Implementation of an Automated Sieve System"** By Md. Rabbi Miah ID:ME-2101023463, Riyad Songram ID:ME-2101023404,Rezaul Hasan ID:ME-2101023519,Amit Bishwas ID:ME-2101023462, Manik Das ID:ME-2101023453, Bindu Roy ID:BME-1803016232 has been carried out under our supervision. The project has been carried out in partial fulfillment of the requirements of the degree of **Bachelor of Science (B.Sc.) in Mechanical Engineering** of years of 2024 and has been approved as to its style and contents.

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STUDENT'S DECLARATION

This is certified that the work presented in this thesis titled **"Design and Implementation of an Automated Sieve System"** is outcome of the investigation carried out by authors under the supervision of **Md Misbah Uddin**, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thesis has been or is being submitted elsewhere for the award of any degree.

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ABSTRACT

In this article, a mechanical sieving machine with an automatic control and vibrator was developed. It is a device that can be used to sieve granulated materials such as sand for industrial purposes and food for agricultural and domestic purposes to obtain the required grain sizes. Sieving, either for industrial, agricultural, or domestic purposes can be done either manually (manual labor) or mechanically by using an appropriate machine (sieving machine). The manual sieve taking longer hours and tedious while mechanical sieving takes shorter time with just an operator overseeing the smooth running of the machine. In industrial operations where sand is required such as for aggregate mixing in construction or molds for casting in foundry operations, the grain size of the sand for the particular purpose is very important. Using a sieving machine will enhance the work and make the sieving faster either for construction or for foundry. The machine uses an electric motor connected to a reciprocating sieve screen through a connecting rod. There is a switch and motion sensor that controls the speed and on and off the motor which in turn increases or reduces the vibration of the screen. Overall, this article provides an overview of the mechanical sand sieving machine with an automatic and control vibrator, its working principle, design, and operation. It also highlights the challenges faced in the construction of the machine and makes recommendations to improve its efficiency.

Keywords: Agricultural Products, Construction, Foundry, Sand, Sieving Machine.

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Chapter-01
Introduction

1.1 Background:

Sieving is a fundamental process in various industries, including agriculture, pharmaceuticals, mining, and food processing. It is primarily used to separate particles based on size and is crucial for ensuring the quality and consistency of products. Traditional sieving methods, which often rely on manual operation or simple mechanical devices, have been widely used for decades. However, these methods frequently suffer from limitations such as inefficiency, high labor costs, and inconsistent performance.

With advancements in technology, there is a growing trend towards automating industrial processes to enhance efficiency and productivity. Automation in sieving systems promises numerous benefits, including reduced labor, improved accuracy, and consistent operation. The integration of modern electronic components, such as microcontrollers and sensors, into traditional mechanical systems represents a significant leap forward in this direction.

The advent of affordable and versatile microcontrollers, such as the Arduino Uno, has made it feasible to implement complex control systems for automation at a relatively low cost. The Arduino Uno, combined with sensors and relay modules, can manage various tasks that were previously handled manually or with more expensive automation equipment. This thesis explores the application of such technology in creating an automated sieve system driven by a 220V AC motor.

1.2 Problem Statement

Despite the widespread use of sieving systems in industrial applications, traditional methods often encounter several issues that affect their efficiency and effectiveness:

- **Labor Intensity:** Manual sieving requires continuous supervision and operation, which can be labor-intensive and prone to human error.
- **Inconsistent Performance:** Manual systems may lack consistency in operation, leading to variability in the quality of separated particles.
- **Energy Inefficiency:** Conventional systems may run continuously regardless of material presence, leading to unnecessary energy consumption and increased wear on equipment.
- **Maintenance Challenges:** Frequent manual operation can lead to higher wear and tear on mechanical components, increasing maintenance costs.

To address these issues, there is a need for an automated sieving system that can operate with minimal human intervention, ensure consistent performance, and optimize energy use. The proposed system aims to integrate modern electronic control technologies to achieve these objectives, offering a significant improvement over traditional methods.

1.3 Objectives

The primary objectives of this thesis are as follows:

1.3.1 Design and Develop an Automated Sieve System:

- Create a system that integrates a 0.5 HP, 1400 RPM, 220V AC motor with an Arduino Uno microcontroller, PIR sensor, and a 2-channel 5V relay module.
- Ensure that the system is capable of automating the sieving process based on material presence detected by the PIR sensor.

1.3.2 Implement Effective Control Mechanisms:

- Utilize the Arduino Uno to process inputs from the PIR sensor and manage the motor operation via the relay module.
- Develop control algorithms that ensure the motor runs only when material is detected, thereby optimizing energy usage and reducing unnecessary wear on the motor.

1.3.3 Evaluate System Performance:

- Assess the effectiveness of the automated sieve system in terms of operational efficiency, accuracy, and reliability.
- Compare the performance of the automated system with traditional manual methods to quantify improvements in efficiency and labor reduction.

1.3.4 Address Integration and Safety Considerations:

- Ensure safe integration of high-voltage AC components with low-voltage DC control systems.
- Implement necessary safety measures, such as a magnetic contact circuit breaker, to protect the motor and associated electronics.

1.3.5 Propose Recommendations for Future Work:

- Identify potential areas for improvement and suggest enhancements to the system based on testing results and feedback.

1.4. ABOUT OF PROJECT WORK:

The aim of course can achieve by learning in classroom and laboratory. However, threw the project something extra knowledge can achieve.

- To develop planning, designing and manufacturing skill.
- To provide inter disciplinary studies.
- To develop higher level skill.
- To develop the spirit of the work and be mature.
- To develop ability for teamwork.

We have a chance for applying our knowledge obtained during B. Sc. Mechanical program. We have been through many things like flexibility study, designing, drafting, process planning, costing, management and spirit of team work. As we make "Automatic control & sieve machine" to fine particle filter.

1.5 Significance of the thesis

The significance of this research lies in its potential to transform traditional sieving processes through automation. By integrating modern electronic components with mechanical systems, the research addresses several critical issues associated with manual sieving methods:

- **Enhanced Efficiency:** Automation allows for continuous and consistent operation, reducing the need for manual supervision and enabling more efficient processing of materials.
- **Improved Accuracy:** The use of sensors and precise control mechanisms ensures that the system operates with high accuracy, leading to more consistent separation of particles.
- **Energy Conservation:** The automated system optimizes motor operation, running only when necessary based on material presence, which conserves energy and reduces operational costs.
- **Reduced Labor Costs:** By minimizing the need for manual intervention, the system lowers labor costs and allows personnel to focus on other tasks.

Additionally, the research contributes to the field of industrial automation by demonstrating the practical application of microcontrollers and sensors in improving traditional processes. The successful implementation of the automated sieve system provides a valuable case study for similar applications in various industries, highlighting the benefits of integrating modern technology with conventional equipment.

1.6 PROJECT MEANS

- PLANNING BEFORE CARRYING OUT THE WORK.
- ROW MATERIAL REQUIRED FOR THE WORK.
- ORGANIZATION OF THE WORK.
- JOINT EFFORTS PUT TOGETHER IN THE WORK.
- ESTIMATION OF THE MATERIAL REQUIRED IN THE WORK.
- COSTING OF THE WORK.
- TECHNIQUES.

Chapter-2

LITERATURE REVIEW

2.1 Introduction

In this section topics related to Automatic control and sieve system are included. These provide a sampling of problems appropriate for application of Automatic control and sieve system. The references are summarized below.

2.2Literature Review

Material handling methods are important in every sector of modern technology. Different authors studied different methods for establishing better material handling process in different time spans. Chakraborty & Banik (2006) showed the way to select the necessary material handling equipment by using multi-criteria decision making tools [1]. Decision making problems were broken down to reach in the conclusion by using AHP. Onut et al. (2009) discussed Multiple Criteria Decision Making for choosing the appropriate material handling equipment to explore the dueling factors [2]. In that research, FANP, MHE and TOPSIS were employed to determine the system characteristics and proper system alternatives. Osman Kulak (2005) developed the factors for the selection of material handling equipment's. He used FUMAHES, which is a multi-attribute decision making process [3]. Evaluation for complete and incomplete information has also done in his research in order to the selection process. Product development for specific industry has been researched by Krishnan and Ulrich (2001). Variation in market opportunity is necessary. This is also important for the sale of the products. This work combined the operation management and product designing in a single phase [4]. Brown and Eisenhardt (1995) organized the product development into a three steamed research. Research findings were synthesized into a successful product designing model [5]. Considering cost is an important factor for designing and development of new product. Marion and Meyer (2011) investigated in such a way that new entrepreneurial companies can yield a definitive fund flux [6]. Chen and Liu (1999) researched that 3 objectives can be achieved at a same time. They are identifying factors of product designing stage, cost effective design and design with computer software. They also cleared that, product life cycle is also important for the cost effective design [7]. According to the above research studies, the authors tried to incorporate the idea of material handling and product designing in a single skim. A new design has been proposed for the handling and sieving of sands in the mini construction sites in cost effective way.

CHAPTER 3
HARDWARE AND SOFTWARE ANALYSIS

3.1 Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong. The worst case scenario is that you would have to replace the chip and start again.

Specification

- Microcontroller : ATmega328P
- Operating Voltage : 5V
- Input Voltage (recommended): 7-12V
- Inout Voltage (limit) : 6-20V
- Digital I/O Pins : 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins : 6
- Analog Input Pins : 6
- DC Current per I/O Pin : 20 mA
- DC current for 3.3V Pin : 50 mA
- Flash Memory : 32 KB (ATmega328P) of which 0.5 KB used by bootloader
- SRAM : 2 KB (ATmega328P)
- EEPROM : 1 KB (ATmega328P)
- Clock Speed : 16 MHz
- LED_BUILTIN : 13

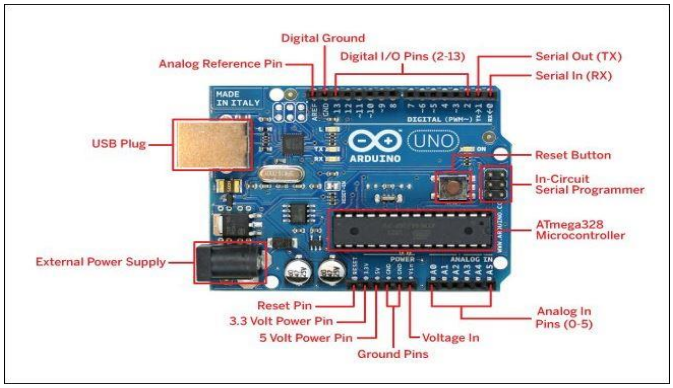


Figure:- Arduino UNO

3.2 Ultra sonic sensor (HC-SR04)

An electronic instrument that uses ultrasonic sound waves (through air) to measure the distance of the target object and the reflected sound is converted into electrical signal.

Specifications

- Power Supply : DC 5V
- Working Current : 15mA
- Working Frequency : 40Hz
- Ranging Distance : 2cm – 400cm/4m
- Resolution : 0.3 cm
- Measuring Angle : 15 degree
- Trigger Input Pulse width : 10uS
- Dimension : 45mm x 20mm x 15mm
- screw-screw :28 mm, M2
- Lens diameter :23 mm

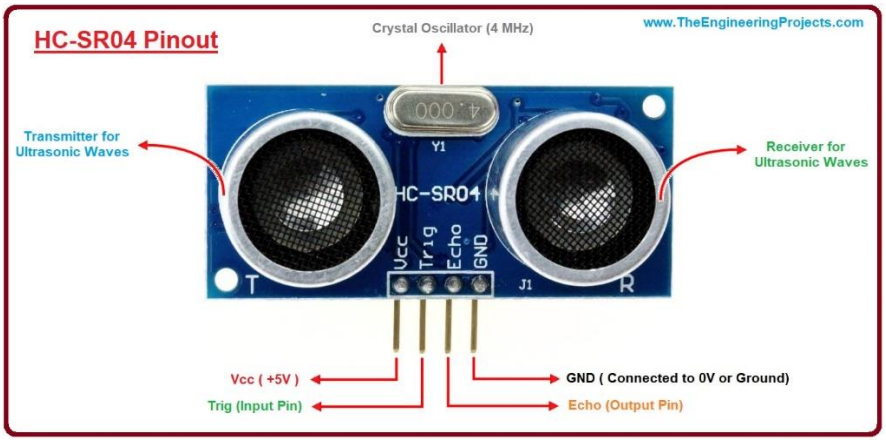


Figure:- 3.2 Ultra Sonic Sensor (HC-SR04)

3.3 Dual-Channel Relay Module

The dual-channel relay module is more or less the same as a single-channel relay module, but with some extra features like optical isolation. The dual-channel relay module can be used to switch mains powered loads from the pins of a microcontroller.

Specifications

- Supply voltage :3.75V to 6V
- Trigger current :5mA
- Current when relay is active : ~70mA (single), ~140mA (both)
- Relay maximum contact voltage :250VAC, 30VDC
- Relay maximum current : 10A

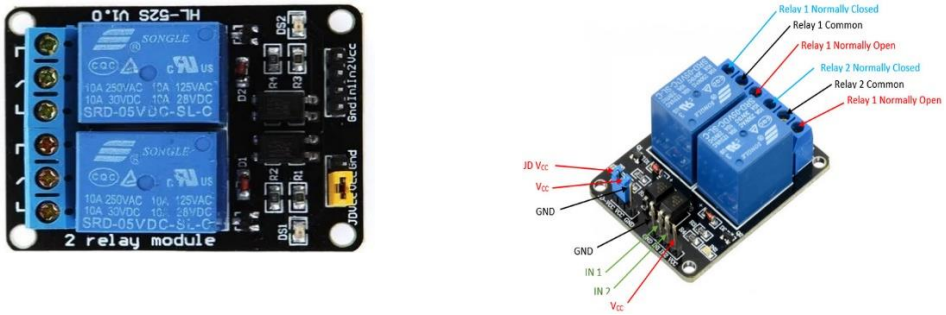


Figure:- 3.3 Dual-Channel Relay Module

3.4 Circuit breaker

2 pole 16 amp MCB miniature circuit breaker meets IEC standard to turn off the electrical circuit during a faulty condition to protect conductors, c curve trip characteristic, used in AC 50Hz, 230/400V with a 6 kA short circuit interrupting capacity.

Specification

- Rated Current : 16 amp
- Rated Voltage : 230V
- Number of pole : 2 poles
- 6 kA short circuit breaking capacity
- Compliance with IEC standard
- C curve trip characteristic gives you the ability to configure the exact protection scheme you required.

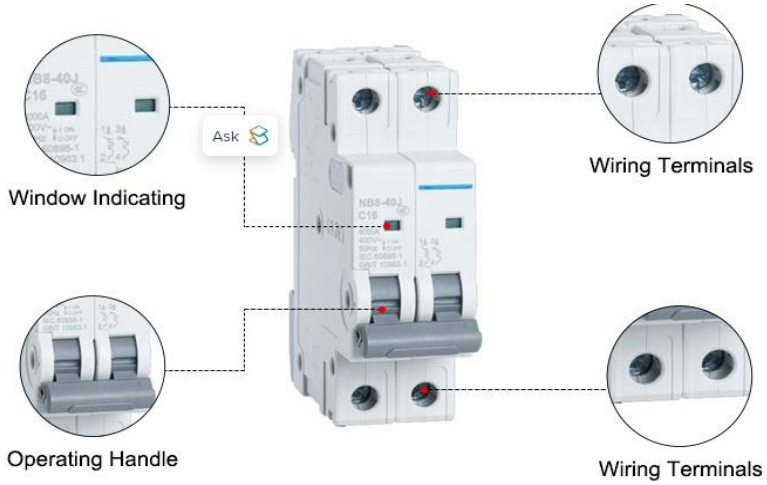


Figure:- 3.4 Circuit breaker

3.5 Magnetic contact

A magnetic contact circuit breaker, commonly referred to simply as a magnetic circuit breaker or just a circuit breaker, is an electrical device designed to protect electrical circuits from overloads and short circuits. It combines both the functions of a switch and an overcurrent protection device into a single unit. These breakers use both thermal and magnetic mechanisms to detect and interrupt faults in the electrical circuit.

Specifications:

- Rated Current : 16 A
- Voltage Rating : 230V AC
- Breaking Capacity: 6 kA
- Trip Curve : C Type
- Number of Poles : Double Pole



Figure:- 3.5 Magnetic contact

3.5 AC to DC Converter Adapter

An AC to DC adapter, also known as a power supply or power adapter, converts alternating current (AC) from a wall outlet into direct current (DC) suitable for powering electronic devices.

Specification

- Input Voltage : 240V AC
- Output Voltage : Commonly 5V-12V, DC
- Output Current : Varies (e.g., 1A)
- Power Rating : Output Voltage × Output Current (e.g., 12V × 1A = 12W)
- Connector Type : Barrel jack



Figure:- 3.5 AC to DC Converter Adapter

3.6 Electric Motor

An electric motor is a device that converts electrical energy into mechanical energy through the interaction of magnetic fields. It is widely used in various applications, from household appliances to industrial machinery.

Specifications

- Type : AC Induction Motor
- Power : 0.5 HP (373 Watts)
- Speed : 1400 RPM
- Voltage : 220V AC
- Current : ~1.5-2.5A
- Efficiency : 70-85%
- Phase : Single-phase



Figure:- 3.6 Electric Motor

3.7 Voltage Regulator

A voltage regulator is a circuit that creates and maintains a fixed output voltage, irrespective of changes to the input voltage or load conditions.

Specification

- Working Voltage: AC 220V
- Maximum Power: 4000W
- Efficiency: 90%
- Voltage Regulation :AC 0-220V, Start from AC 10V



Figure 3.7 Voltage Regulator

3.8 Pulley

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a belt. Transfer of power between the shaft and 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 belt a force, the supporting shell is called a block, and the pulley may be called a sheave. A pulley may have a groove or grooves between flanges around its circumference to locate the belt. The drive element of a pulley system can be a rope, cable, belt, or chain.

Specification:

1st Pulley

- Inner Diameter: 15mm
- Outer Diameter: 50mm
- Thickness: 30 mm



Figure:- 3.7.1 Pulley

2nd Pulley

- Inner Diameter: 15 mm
- Outer Diameter: 150 mm
- Thickness: 30 mm



Figure:- 3.7.2 Pulley

3.9 Motor Drive (BELT)

A belt is a looped strip of flexible material used to mechanically link two or more rotating shafts. A belt drive offers smooth transmission of power between shafts at a considerable distance. Belt drives are used as the source of motion to transfer to efficiently transmit power or to track relative movement.

Specification:

- Length : 220mm (22 cm)
- Thickness : 15 mm (1.5 cm)
- Material : Rubber (V belt)



Figure:- 3.8 MOTOR DRIVE (BELT)

3.10 Light Duty caster Wheel

A caster (also known as castor according to some dictionaries) is a wheeled device typically mounted to a larger object that enables relatively easy rolling movement of the object. Casters are essentially housings that include a wheel and a mounting to install the caster to objects (equipment, apparatus and more).



Figure:- 3.9 Light Duty caster Wheel

3.11 Joints

A mechanical linkage is an assembly of bodies connected to manage forces and movement. The movement of a body, or link, is studied using geometry so the link is considered to be rigid. The connections between links are modeled as providing ideal movement, pure rotation or sliding for example, and are called joints.



Figure:-3.11 Nut and Bolt

3.12 Shaft

A mechanical shaft's primary role is to transmit torque from one part of a machine to another. This transfer of force is crucial for converting the engine's power into motion, making shafts essential components in many mechanical systems.

- **Material:** Steel (AISI 1045)
- **Diameter:** 15 mm
- **Length:** 540 mm

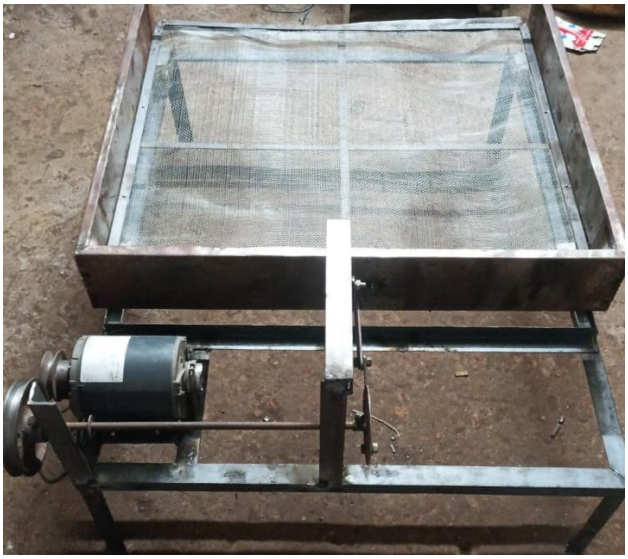


3.13 Supporting Frame

A supporting frame is being used to properly hold the entire component in a sieve machine. The frame is made of steel. The most important element for power hammering machine is the frame.

Specification:

- Length : 1220 mm (122 cm)
- Wide : 920 mm (92cm)
- Height : 300mm (30 cm)
- Material : 38.1 mm (3.81 cm) angle



3.14 Compression Springs

Compression Springs are open-coil helical springs wound or built to counteract compression along the wound axis. The most common metal spring design is helical compression. These coil springs can function independently, although they are often constructed over a guide rod or inserted within a hole. Applying a load to a compression coil spring pulls back against the load and strives to return to its previous length. Compression springs are one of the most efficient energy storage devices, providing resistance to linear compressing pressures.

Specification

- Wire diameter : 05mm
- Coil diameter :28mm
- Free length :200mm
- Number of active coils: 09



Figure:3.13 Compression Springs

3.15 Sieve Net

Sheet a sieve, fine mesh strainer, or sift, is a tool used 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 material.

Specification

- Material : Stainless Steel
- Mesh Size : 2.5 mm
- Mesh Type : square
- Dimensions : 90mm×90× mm×16mm(length, width, height)
- Wire Diameter: 0.46mm
- Frame Material: Metal
- Frame Type : Bolted

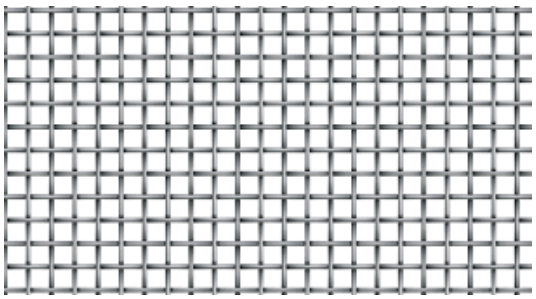


Figure:- 3.14 Sieve Net

3.15 Sheet metal

Sheet metal is metal that is formed into thin, flat pieces. Sheet metal is generally produced in sheets less than 6 mm. It is one of the fundamental forms used in metalworking and can be cut and bent into a variety of different shapes. Thicknesses can vary significantly.

Specification

- Material: Type of metal (e.g., aluminum, steel, stainless steel, copper)
- Thickness: Gauge or thickness of the sheet (e.g., 1 mm, 2 mm, 16 gauge).
- Dimensions: Sheet size (length and width) and any tolerance ranges.
- Finish: Surface finish (e.g., matte, polished, brushed, anodized).



Figure:-3.15 Sheet metal

3.16 Arduino IDE

The Arduino IDE is used for writing, compiling, and uploading code to Arduino boards, enabling the development and execution of custom programs to control electronics and create interactive projects. It simplifies the process of coding and communicating with Arduino hardware, making it accessible for both beginners and experienced developers.



Figure:- 3.16 Arduino IDE software interface

3.17 Cirkit Designer

A cirkit designer app is used to create, visualize, and simulate electronic circuits, helping users design and test their electronic projects efficiently. It provides tools for drawing circuit schematics,

analyzing circuit behavior, and troubleshooting issues. By offering features like real-time simulation and component libraries, it simplifies the design process and aids in predicting circuit performance before physical implementation.

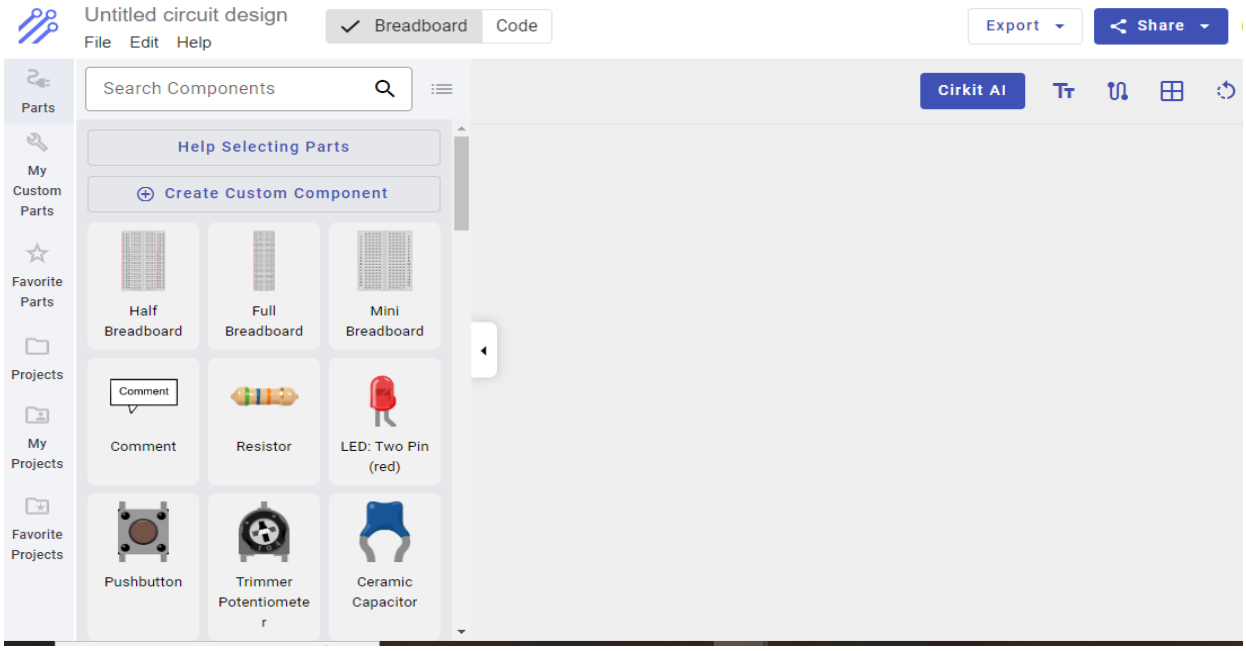


Figure:- 3.17 Cirkit Designer app interface

CHAPTER 04
Methodology

4.1 OUR METHODOLOGIES FOR THE PROJECT

- Creating an idea for Automatic Control and sieving machine.
- And designing a block diagram & circuit diagram to know which components need to construct it.
- Collecting the all components and programming for the micro controller to controlled the system.
- Setting all materials. Then assembling the all block in a sieving machine and finally run the system & checking.

4.2 BLOCK DIAGRAM

Block diagram is a diagram where all equipment's are organized by block. This is a primary diagram of our system. Here we use Circuit Breaker, AC to DC converter, PIR Sensor, Arduino Uno, Relay Module , Magnetic Contactor , 0.5 HP 220V Motor , Large Pulley, Rotational motion to Reciprocating Motion Mechanism, Sieving System, Hopper etc. Here we also use various instrument which is visible in this block diagram.

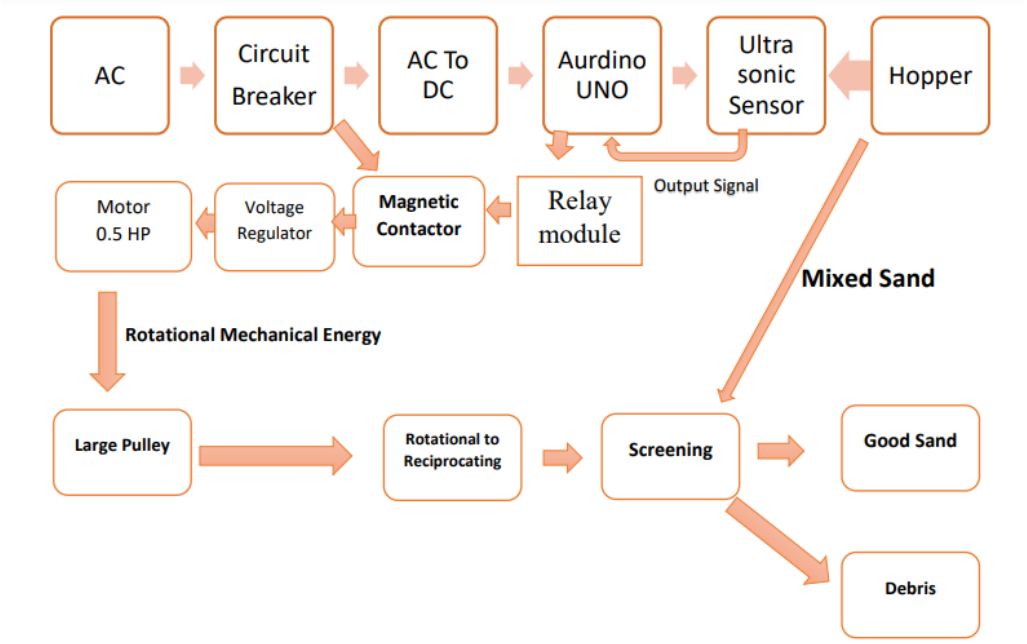


Figure:- 4.2 Block Diagram of our project

4.3 SCHEMATIC ELECTRIC DIAGRAM

The schematic diagram here is representing the electrical circuit a. Here we have used standardized picture and lines.

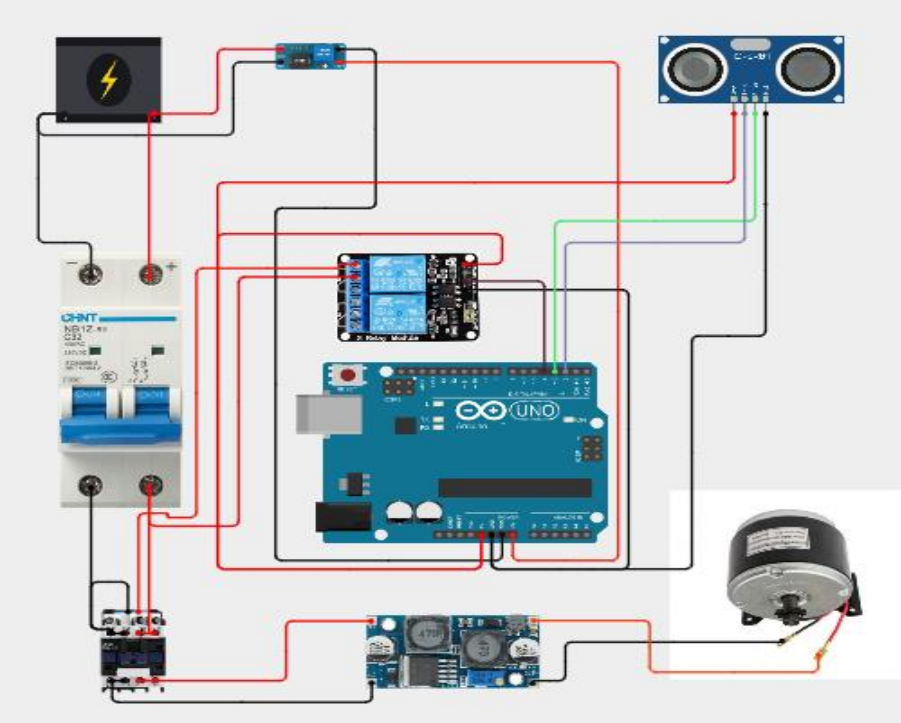


Figure:- 4.3 Schematic Electric Diagram

4.4 WORKING PROCESS

Let's a look at the sand sieving system! It has a cool automatic control feature that helps it work really well. This system a 220V motor with 05 horsepower. It to a pulley, which changes rotational movement into back-and-forth movement for the sieving unit.

How it works: the motor only turns on when there's sand in the hopper and over sand in hopper after 8 second the motor automatically off. A ultrasonic sensor sense the sand or any sieve materials down hopper to sand sieve and starts the motor when needed. If there's no sand down , the motor stays off. This saves energy and avoids unnecessary work!

As sand moves into the sieving unit, it shakes back and forth. This allows fine sand to go through the mesh screen and drop into a collection area. At the same time, bigger debris gets pushed to the back.

This automatic on/off setup means less hassle and helps separate clean sand from any junk easily! Just remember, regular maintenance for the motor, pulleys, and sieving unit is key for everything to run smoothly.

4.5 OUR FINAL SYSTEM VIEW

4.5.1 Front side View

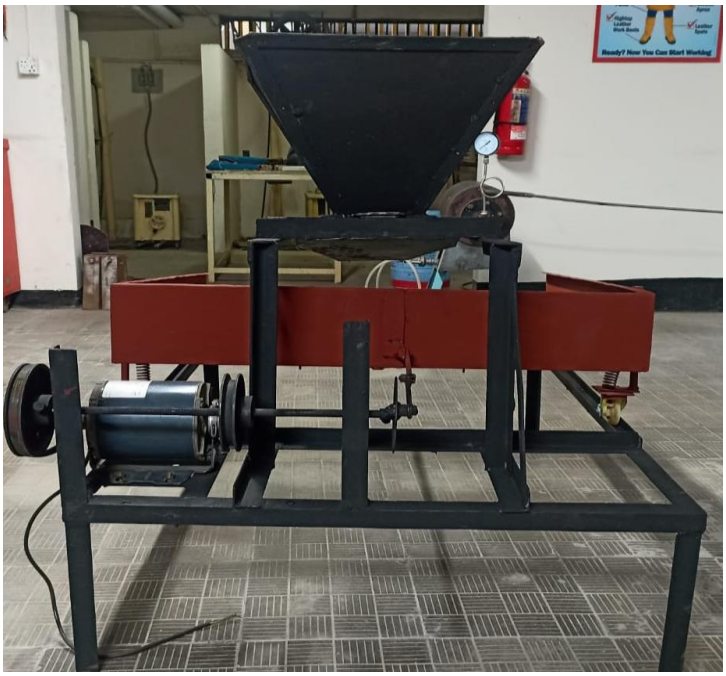


Figure: 4.5.1 Automatic control and sieving system front view.

4.5.2 Back Side View



Figure: 4.5.2 Automatic control and sieving system backside view

4.5.3 Left Side View



Figure: 4.5.3 Automatic control and sieving system left side view

4.5.4 Right Side View



Figure: 4.5.4 Automatic control and sieving system Right side view.

4.5.5 Top Side View

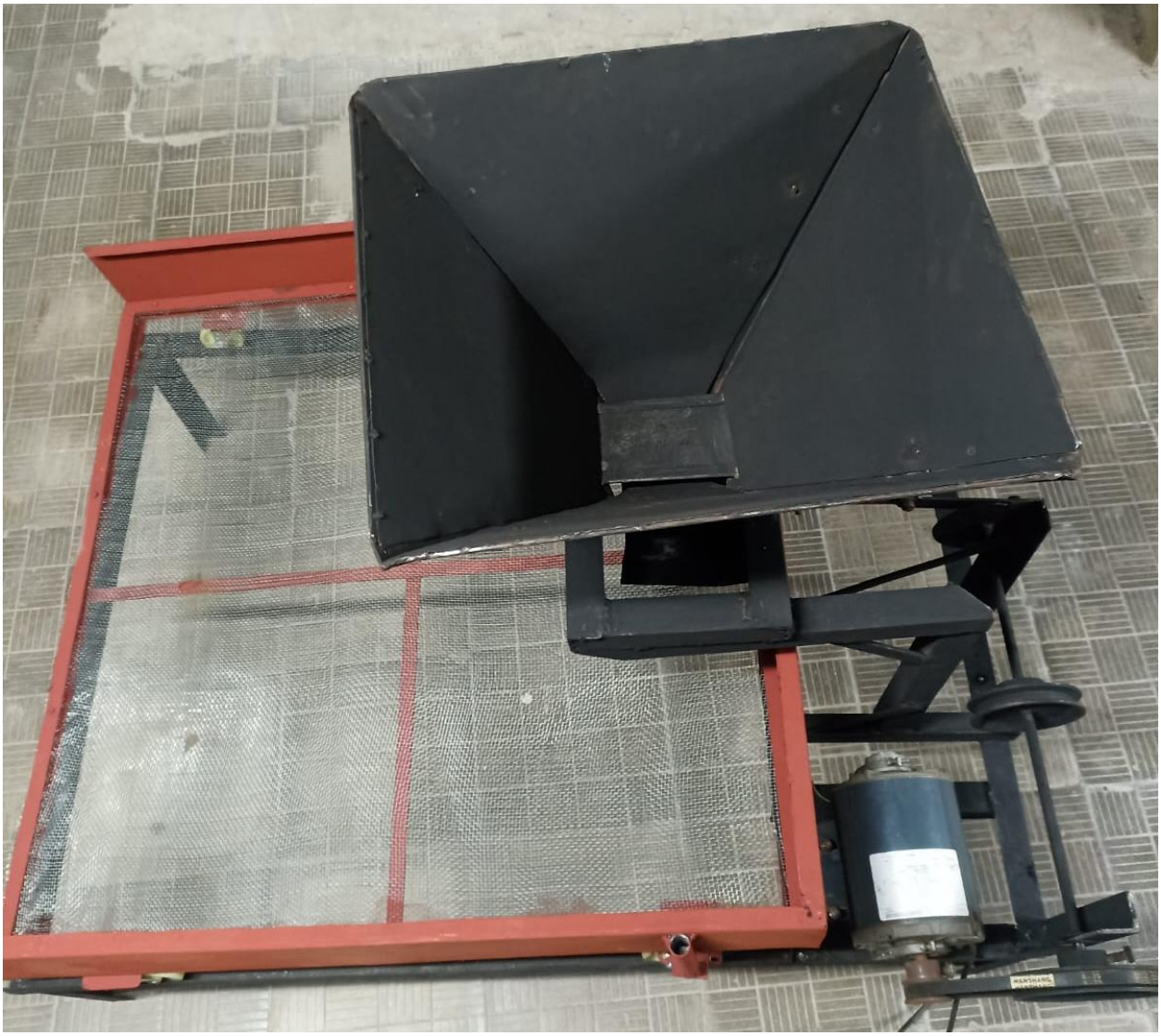


Figure: 4.5.5 Automatic control and sieving system top view.

CHAPTER 5
CALCULATION AND DATA TABLE

5.1 DESIGN CALCULATIONS

The design calculations in this section

5.1.1 Power calculation:

Power = Force × velocity

Force = Weight = mg

Where,

m = mass of sand = 3 kg (for this purpose only)

g = 9.81 m/s^2 (Acceleration due to gravity)

Power = Force x Velocity

= mgv

If 25 % margin of safety is proposed then

Power required = $\frac{m \times g \times v}{0.75}$ **= 1.33 x mgv**

Velocity, **v = rω**

Where,

r = radius of the pulley

ω = angular velocity of the pulley

v = 0.025 m x 300 m

= 7.5 m/s

Power,

P = 1.33 x 3 x 9.81 x 7.5 W

= 293.56 W

So, it is safe to use ½ HP electric motor because it is more than 1/3 HP (248.4 W)

5.1.2 Torque Calculation:

Torque is calculated from the Power generated by the motor to operate the machine,

Diameter of pulley = 05 cm

Number of revolution (N) = 1400 rpm

Power of the electric motor = ½ HP = 375 W

Force (F) = m × r × ω^2

Where m is the total mass of the Sieve chamber = 15 kg,

$$\omega = \frac{2\times\pi\times1400}{60}$$

= 146.60 rad/s

Torque (given by motor) = power/ω

= 375/146.60

= 2.557 Nm

5.1.3 Machine Energy Consumption:

Power of motor =375W.

Power for one hour = 375W x 1hr.

= 0.375 KWhr

If an average of 8 hours daily usage is assumed, then energy consumption per month

= 0.375 × 8

= 3.0 kWh

If electricity cost 1kWh =8.25 taka,

The monthly bill to run the machine = 3.0× 8.25

= 24.75 taka/day

An average worker charges 700 taka per day.

This machine leads to a great financial savings

5.1.4 RPM:

Motor pulley diameter (outer) D_1= 05 cm

Machine pulley diameter (outer)D_2 = 15 cm

Speed ratio = $\frac{D1}{D2}$

=05/15

= 0.333

For a machine with 1400 RPM,

The speed of the rotating arm= 1400 × 0.333

=466 RPM

5.1.5 Torsional Force In Shaft:

Maximum tensile stress of a mild steel = 525 MPa

Maximum shear stress of mild steel = 525/1.73

= 300 MPa

Diameter of shaft (D) = 15 mm = 0.015 m

Force (F) = m × r × ω^2

= 25*0.007*146.70^2

=2251.32 N

Torque transmitted by circular shaft = 1589.625 Nm

5.1.6 Belt length:

Diameter of small pulley, d1 = 50 mm = 0.05 m

Diameter of large pulley, d2 = 150 mm = 0.15 m

Distance between center of two pulleys (x) = 400 mm = 0.4 m

Length of belt = $\frac{\pi}{2} \times (D_1+D_2) + 2x+(\frac{D1-D2}{4x})$

$= \frac{\pi}{2} \times (50+150)+2\times90+(\frac{50-150}{4\times90})$

=493.881 mm

= 49.3 cm

5.2 RESULT AND DISCUSSIONS

The development of an automatic mechanical sand sieving machine was carried out successfully, and the machine was tested for its ability to separate sand particles of different sizes. The automatic mechanical sand sieving machine was able to separate sand particles into different size ranges, based on the hole sizes in the mesh screen, but different sieve screen mesh was used. The machine was tested by pouring 30 kilogram (30 kg) of sand of different sand materials (Sandy and Clay soils) and allowing the machine to work (separate) and the time for complete separation were noted. The reciprocating motion of the sieve screen caused the smaller sand particles to pass through the mesh screen, while the larger particles remained on top of the screen mesh. The machine was able to separate the sand particles effectively, with the smaller particles passing through the mesh screen and the larger particles remaining on top.

5.2.1 Type of Different Sieve test

Table 1: Sandy soil

Type A Sieve 2.5mm*2.55mm				
S/N	**Time (s)**	**Weight of total sand (gm)**	**Weight of sand sieved (gm)**	**Weight of Dirt (gm)**
01	**24**	**30000**	**28750**	**1250**
02	**26**	**30000**	**27120**	**2880**
03	**23**	**30000**	**26250**	**3750**
Type B Sieve 1.5mm*1.5mm				
01	**44**	**30000**	**25407**	**4593**
02	**41**	**30000**	**26115**	**3885**
03	**45**	**30000**	**25505**	**4495**
Type C Sieve 1mm*1mm				
01	**56**	**30000**	**22150**	**7850**
02	**58**	**30000**	**21450**	**8550**
03	**54**	**30000**	**24540**	**5460**

Table 2: Clay soil

Type A Sieve 2.5mm*2.5mm				
S/N	**Time (s)**	**Weight of total sand (gm)**	**Weight of sand sieved (g)**	**Weight of Dirt (g)**
01	**55**	**30000**	**28900**	**1100**
02	**51**	**30000**	**29850**	**150**
03	**61**	**30000**	**27256**	**2744**
Type B Sieve1.5mm*1.5mm				
01	**81**	**30000**	**25256**	**4744**
02	**94**	**30000**	**24212**	**5788**
03	**86**	**30000**	**26216**	**3784**
Type C Sieve1mm*1mm				
01	**141**	**30000**	**21274**	**8726**
02	**153**	**30000**	**20051**	**9949**
03	**136**	**30000**	**22890**	**7110**

Type A sieves are faster than type B and type B sieves are better than Type C sieve. This is due to difference in Rectangular of their holes. The sandy soil is less clumsy than clay soil. So, the sieving of sandy soil is faster than the clay soil.

5.2.3 Time taken for Manual Sand screening and using Automatic sand Screening Reading Time

We are use A type sieve net (2.5mm*2.55) and sandy soil

5.2.3.1 Table

SL No	Weight Of sand (gm)	Manual Screening (second)	Automatic Screening (second)
01	**30000**	**150**	**24**
02	**30000**	**146**	**26**
03	**30000**	**156**	**23**
	Average	**150.66**	**24.33**

Figure : Time comparison between manual sand screening and using Automatic sand Screening.

5.2.3.2 Graph

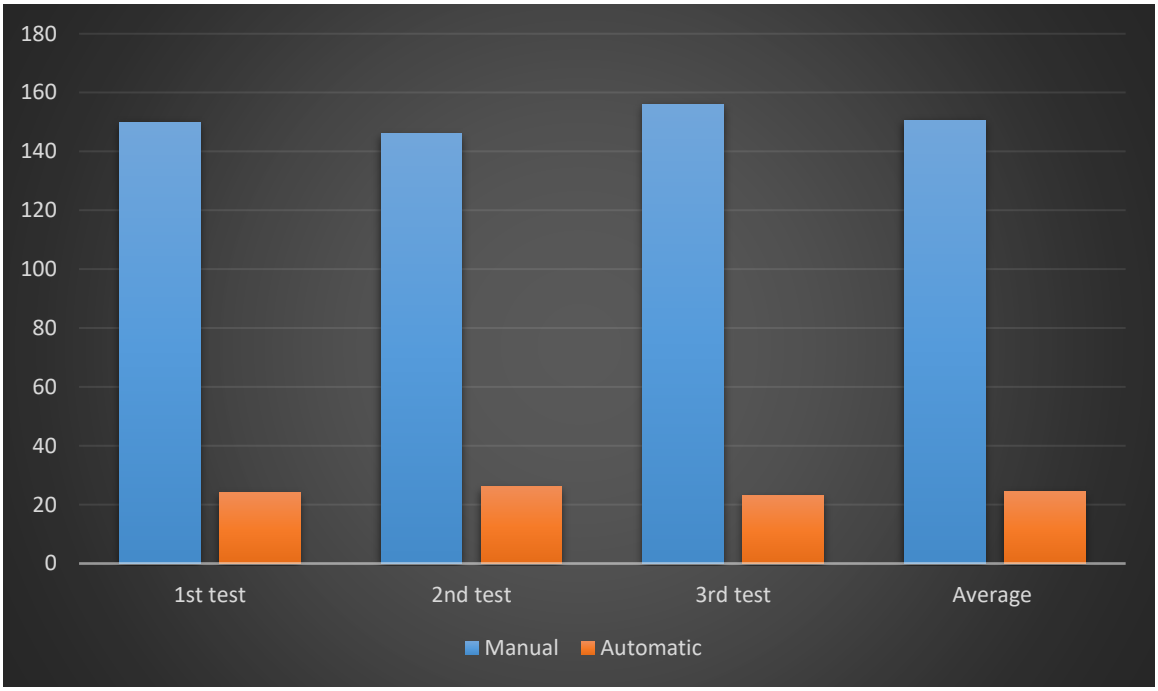


Figure:5.2.3.2 Graph time comparison between manual sand screening and using Automatic sand Screening

CHAPTER-06
CONCLUSION

6.1. ADVANTAGES:

- Available in wide variety of sizes.
- Maintain good control and required torque .
- Low cost.
- Save man power.
- Saves time.
- Save Electricity.
- Easy to transport.
- Save construction cost.
- Time delay can be achieved easily.
- Mass production.

6.2. DISADVANTAGES:

- This mechanism is only suitable for few operations.
- As torque force required is more there is difficult to find the motor to achieve the required torque.
- Having little wear.
- Must be need 220V AC connection.
- Load shedding time cannot work our project.
- Noise and over vibration

6.3 FUTURE SCOPE

The future prospects of automated sieve system are quite bright, a lot of R & D in this are expected in the concerned fields. Io and Industry 4.0 compatibility will allow control and monitoring from a distance as well as predicting equipment failure thus improving operations. Advancements in adaptive sieving system and multilevel separation will enhance the material handling and purity systems. Concern for energy conservation, renewal, and products and materials with least impact on the environment will be in line with the global environment standards. Also, there will be robotics and automated control systems updated via artificial intelligence to enhance automation, while built-in designs in modularity will provide flexibility. Industries will be protected from numerous safety and Standards have to confined with safety and ensured operational safety and

regulation compliance when implementing automated sieve systems making Automated sieve system at par with the current advancements in the industry.

6.3 APPLICATION OF AUTOMATIC SEIVE SYSTEM

The automated system of the sieves can be used in any type of industries and in many cases where sieves are used. Here's a breakdown of where such a machine can be effectively utilized. Here's a breakdown of where such a machine can be effectively utilized:

6.3.1 Manufacturing

- **Material Processing:** Applied on products such as metals, plastic and mineral products upon which they are classified depending on the size of the particle during the manufacturing process.
- **Powder Coating:** In manufacturing powder coatings consistency is maintained in particle size by use of automated sieves for uniform application.

6.3.2 Pharmaceuticals

- **Drug Manufacturing:** Affirms that all the pharmaceutical powders and granules are well sized in a way that would uphold the quality and size of the tablets that are produced.
- **Quality Control:** These assist in evaluation of the quality and purity of the raw materials and the final products during quality control test.

6.3.3 Food and Beverage

- **Ingredient Processing:** For example in the food industry for washing and arranging food products such as flour and spices in order to remove the chaff and obtain a uniform quality of the product.
- **Quality Assurance:** Tends machines that control the particle size and texture of foods such as sugar, salts, and powdered drinks.

6.3.4 Recycling and Waste Management

- **Material Separation:** Sorts waste according to size and type in order to isolated recyclable material such as paper, plastic and metal.
- **Sorting:** Assists in sorting out of various types in order to enhance the recycling process.

6.3.5 Mining and Minerals

- **Ore Processing:** Employed for making separations between various graduations of ore or mineral particles in the course of mining.
- **Grading:** Holds the processed minerals to a uniform size for ease in further processing or selling the minerals.

6.3.6 Construction

- **Aggregate Processing:** Promotes the right size of aggregates for concrete and asphalt production hence improving on the quality of construction materials.
- **Sand and Gravel:** Distinctions sand and gravel into distinct groups depending on a specific construction use.

6.3.7 Chemical Industry

- **Chemical Powder Processing:** Assist in mechanophysical segregation and processing system of chemical powders to enhance quality and standard of chemicals.
- **Catalyst Recovery:** used for separation of catalysts involved in chemical reactions, as well as for its recovery.

6.3.8. Environmental Testing

- **Soil Analysis:** Species that are used to separate soil samples according to particle size for environmental analysis as well as for classification of the soil.
- **Water Treatment:** Employed in water treatment plants as aspects of water and to remove the particulate substances in water.

6.3.9 Cosmetics

- **Ingredient Sifting:** Ensures that cosmetic powders and ingredients have a consistent particle size for product quality and texture.
- **Quality Control:** Helps in testing the quality of raw materials and finished cosmetic products.

6.3.10 Agriculture

- **Seed Processing:** Used for sorting and grading seeds based on size and quality before planting.
- **Feed Production:** Ensures uniformity in animal feed by separating and grading ingredients.

6.4 CONCLUTION:

The fabrication of a mechanical sand sieving machine with automatic control and 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.

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APPENDIX

Programming Code:

```
// Define pins
const int trigPin = 2;
const int echoPin = 3;
const int relayPin = 4;

// Define variables
long duration;
int distance;
unsigned long lastTriggeredTime = 0; // Time when the sensor was last triggered
bool isBulbOn = false; // Track if the bulb is currently on

void setup() {
  // Initialize serial communication
  Serial.begin(9600);

  // Set pin modes
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(relayPin, OUTPUT);

  // Start with relay off
  digitalWrite(relayPin, LOW);
}

void loop() {
```

```
// Clear the TRIG pin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Set the TRIG pin high for 10 microseconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Read the ECHO pin
duration = pulseIn(echoPin, HIGH);

// Calculate the distance in cm
distance = (duration / 2) / 29.1;

// Print distance to serial monitor
Serial.print("Distance: ");
Serial.print(distance);
Serial.println(" cm");

// Check if the sensor detects something
if (distance < 10) { // Set your desired threshold distance
  lastTriggeredTime = millis(); // Update the time when sensor detected something
  isBulbOn = false; // Ensure the bulb stays off
  digitalWrite(relayPin, LOW); // Turn off the relay (and thus the bulb)
} else {
  // If the sensor did not detect anything, check if 8 seconds have passed
```

```
    if (millis() - lastTriggeredTime >= 8000) {
      if (!isBulbOn) {
        isBulbOn = true; // Update the bulb state to on
        digitalWrite(relayPin, HIGH); // Turn on the relay (and thus the bulb)
      }
    }
  }

  delay(100); // Short delay between readings to avoid rapid switching
}
```