

SMART CHALK DUST REMOVER

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Abstract - The prolonged use of chalk is causing respiratory illnesses and skin allergies among teachers and students. Chalk dust also has an adverse effect on human vision. The tiny particulates of chalk in dust tend to accumulate in the respiratory system, causing health issues. In traditional methods, chalk dusters are cleaned by hitting them against a wall, or floor, causing environmental pollution. Therefore, it is necessary to design machines that clean chalkboard dusters and create dust-free environments in classrooms and laboratories.

Key Words: Chalk Dust, Respiratory, Skin Allergies Chalkboard Dusters & Hazardous

1. INTRODUCTION

A teaching and learning process refers to the teacher and student, who deliver and receive information. How do they deliver their knowledge to students? Nowadays, there are many methods by which teachers can present their knowledge to students, such as using computers, giving notes, or using a whiteboard or blackboard to deliver information. For effective learning, a classroom must have a chalkboard. The traditional way of cleaning the chalkboard using a duster causes stress to the board cleaner. Chalk pieces are primarily made up of calcium carbonate (CaCO₃). It causes eye irritation and skin infections. It can also cause breathing problems for some individuals who are allergic to chalk dust. In this case, the only option for teachers is to change the teaching method or switch to dustless chalk. The traditional ways of teaching may be hard for teachers to adapt to new ones. Additionally, dustless, and low powder chalk can cause asthma attacks and allergies in students who are allergic to dust.

Based on the above work, a new idea has emerged to accomplish the problem that occurs in schools and universities by developing a smart duster for cleaning chalk dust. With this idea, time, energy, and health risks associated with chalk dust powder can be reduced.

1.1 Blackboard

A blackboard, also known as a chalkboard, is a reusable writing surface on which text or drawings are made using sticks of calcium sulphate or calcium carbonate, which are known as chalk. Originally, blackboards were made of smooth, thin sheets of black or dark grey slate stone. Modern

versions are frequently green because the colour is thought to be easier on the eyes.

1.2 Blackboard Duster

A duster is a soft resin material that is used to rub or erase the blackboard. The Witten material on the board should be removed so that we can write something new to express our point of view. It is typically made of felt strips attached to a handle.

1.3 Blackboard Chalk

Students and teachers have been writing on blackboards with blackboard chalk since the early 1800s. Blackboard chalk is not real chalk. It is gypsum (calcium sulphate), but people call it "chalk". Because it is soft, people use it to draw on hard surfaces. If you rub this chalk on something hard or rough, it will leave a mark. To remove the chalk marks from the board, use a chalk eraser. Blackboard chalk is typically sold in shops in 5 cm long sticks.

1.4 Conventional method of erasing Blackboard

The most popular method of erasing the blackboard is to use a hand-held eraser and manually erase the chalkboard as needed. Cleaning blackboards with a moist cloth is, of course, an old trick, but it is only employed when the chalkboard is not needed right away. Efforts have been made to improve the materials used in erasers

2 WORKING PRINCIPLE

The system works on a vacuum process for cleaning the blackboard duster with the help of the motor and vacuum produced inside the model. The motor drives shaft and brush connected to it. A sensor plays a role in the system for starting and stopping the motor and vacuum pump. Dust on the duster is collected and trapped by a dust collecting system to prevent it from circulating in the surrounding air and creating a dangerous atmosphere. When the duster is placed in the space provided, the sensor activates, causing the brush to rotate and creating a vacuum process for 10 seconds, thus drawn out the chalk dust through the suction produced by the vacuum pump. This prevents chalk dust from entering the atmosphere. After 10 seconds the process stops automatically

3. Components Description

3.1 IR Sensor

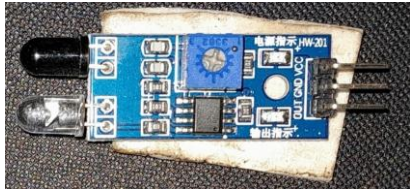


Fig -1: IR Sensor

An infrared sensor is an electronic device that emits light to detect some object in its surroundings. An infrared sensor can detect motion as well as measure the heat of an object. Generally, all objects in the infrared spectrum emit some form of thermal radiation. These types of radiations are invisible to our eyes, but an infrared sensor can detect them. The emitter is simply an infrared LED (Light Emitting Diode), and the detector is simply an infrared photodiode. The photodiode is sensitive to IR light of the same wavelength as the IR LED. When IR light strikes the photodiode, the resistances and output voltages change in proportion to the magnitude of the IR light received.

3.2 Brush



Fig -2: Brush

Brushes are perfect for cleaning the duster because of their shape and design, which resemble long tubes of bristles. constructed from nylon material.

3.3 DC Gear Motor



Fig -3: DC Gear Motor

A standard 12V DC gear motor is used for driving the Shaft. This DC Motor with a metal gear head is ideal for low RPM, and high torque. The motor is rigidly attached to the frame,

according to the motor RPM the motor operation work. More the speed of the motor fast the cleaning work will have done.

3.4 Ne555 Delay Timer Switch



Fig -4: Ne555 Delay Timer Switch

The timer switch relay module has an adjustable timer delay (default setting: 0-10s) and a counterclockwise potentiometer adjustment to increase the delay period. High dependability, high vibration resistance, and excellent electromechanical performance. Timing from microseconds to lengthy hours, easy circuit design, high pulse generation/timing precision, flexible duty cycle, wide application range, and a big amount of information are all features of the Ne555 chip.

3.5 Shaft



Fig -5: Shaft

A drive shaft is a mechanical component used to transmit torque and rotation. It is typically used to connect other components of a drive train that cannot be connected directly due to distance or the need to allow for relative movement. Made up of mild steel.

3.6 Bearing



Fig -6: Bearing

Bearings are one of the most used machine parts because their rolling motion makes almost all movements easier, and they help reduce friction. The design of the bearing may allow for free linear movement of the moving part or free rotation around a fixed axis, or it may prevent a motion by

controlling the vectors of normal forces bearing on the moving parts. Most bearings make the desired motion easier by reducing friction.

3.7 12V 2A Adapter



Fig -7: 12V 2A Adapter

12V 2A adapter is a power source for the product. A physical device that allows one hardware or electronic interface to be adapted to another hardware or electronic interface is known as an adapter. Output: 12V 2A equipment can handle (consume or generate) 24Watts of power

3.8 Vacuum Cleaner

A normal vacuum cleaner is used to remove the chalk dust from the eraser via the vacuum chamber of the casing.

4. Study and Suggested Health Analysis

Chalk consumption in school/college is 4-5 periods per day. Duster erasers are made of two materials fabric (85%) and sponge (15%). During class, almost all the teachers, approximately 80%, agreed that the chalk dust released during the cleaning of the duster in the class resulted in a loss of concentration and a variety of other reactions from the students sitting in the front row. Almost 88 percent of teachers reported problems with chalk dust, and the majority agreed that the problem was caused by improper cleaning of the duster eraser. It has been discovered that 40 to 50 percent of teachers were unaware of the chalk dust problems.

4.1 Problem Statement

The chalk dust acquired from chalk pieces while erasing the blackboard causes some irritations to the eyes. If humans inhale it over a long period can cause some respiratory diseases like asthma and in some cases, the person who is erasing the blackboard may suffer from skin allergies. It is not only harmful to humans. But also causes some damage to the electronic components which are present inside the classrooms.

4.2 Objectives

1. To design a smart and intelligent chalk dust remover.

2. To design a cost-effective and wall-mounted duster cleaner.
3. To design environmental and eco-friendly products.

5. DESIGN

5.1 2D Design of the Product

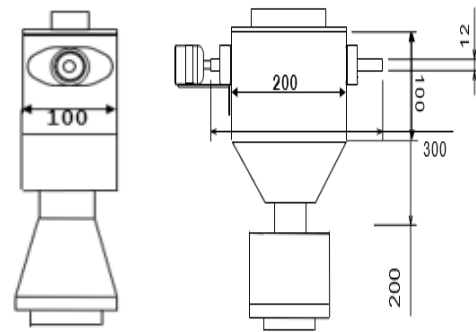


Fig -8: Side and Front View

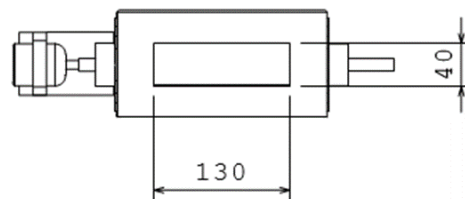


Fig -9: Top View

The above figure 8 and 9 represents the 2D design of the project

5.2 CAD 3D Model of the Project

The below figure 10 to 11 represents the 3D CAD Model of the product. Which are made using CATIA Software.

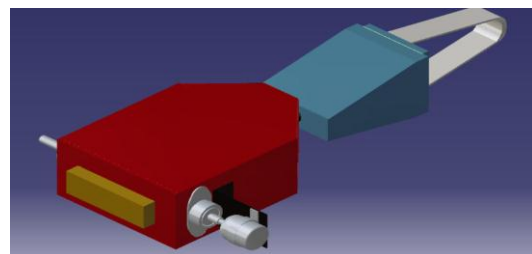


Fig -10: ISO View

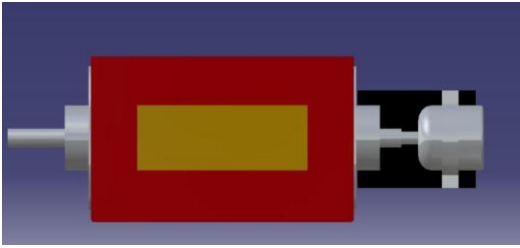


Fig -11: Top View

5.3 Actual Model of Product



Fig -12: ISO View

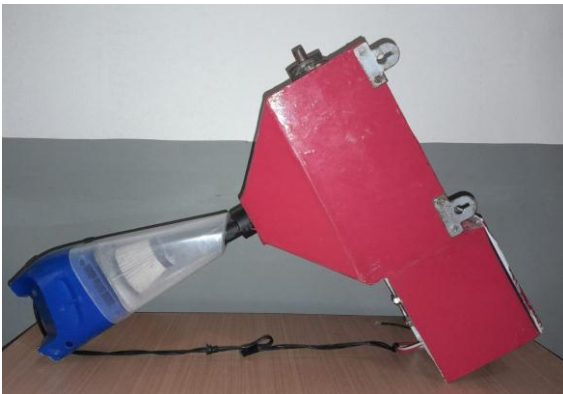


Fig -13: Side View



Fig -14: Top View

6. Advantages

- Reduce health problems
- Reduce air pollution caused by dust particles
- Less manual work
- Non-pollutant
- Lightweight and compact
- Less power consumption
- Easy to use
- Saves time and Energy
- Portable in size and easily transportable
- Construction is simple and requires less maintenance

7. CONCLUSIONS

The machine cleans the duster more effectively and efficiently. As users were unaware of serious health problems such as eye irritation, skin infections and respiratory diseases like asthma, the development of such a machine allows users to avoid serious health problems. The machine is simple to use and can be used by anyone.

The machine has been designed to collect chalk dust from the dusters and prevent dust from entering the classroom environment.

REFERENCES

- [1] K. Pavan Prabhakar, H. N. Vignesh. Design and Fabrication of Vacuum Operated Chalk Dust Collector, International Journal of Scientific Engineering Research Volume 9, Issue 5, May 2018 ISSN 2229—5518.
- [2] Dr. N. P. Mungle, Siddhant Shambharkar. Eco-friendly Duster Cleaning Machine, International Research Journal of Engineering and Technology (IR-JET). Volume 04 Issue 03 Mar-2017.
- [3] Mr. Sunil R. Kewate, Mr. Incamam T. Mujawar. Mr. Akash D. Kewate Development of new smart design to erase the classroom blackboard of schools/colleges. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) 2009.

BIOGRAPHIES



Dr. Basava T, Associate Professor, Department of Mechanical engineering SDMIT, Ujire, received a B.E. degree in Mechanical Engineering from SJM Institute of Technology, Chitradurga in the year 2000, and M.E. in Machine Design from UVCE, Bangalore in 2006, and a PhD from SJCE, Mysore in the year 2014.

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