

Design and Fabrication of Automated Board Cleaner

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ABSTRACT

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Automation plays a major role in contributing for the societal development and to deliver best engineering solutions. The present project aimed to develop automated board cleaner to reduce the time consumed for board cleaning during teaching process and to increase lecture deliver time. With this motivation, the construction and model of automated board cleaner is done through manual & Auto cad software and validated for the dimensional accuracies for each component. The fabrication process is initiated through the designed Auto cad model. Components such as White board, duster, frames, rods, lead screw, servo motor, bush, switch and copper wires were used for the fabrication process. The "Automated Board Cleaner" is a superb alternative to the "Manual Duster" and can be recommended for practical use to lessen the work required of users of the boards as well as to implement the same in the classroom with an automation system that further enhances the quality of smart classrooms.

Keywords: Automated, Battery, Duster, Whiteboard, Wiper Motor

I. INTRODUCTION

It is a technology that is typically used to automatically clean the whiteboard with the aid of a duster. We can save time and energy by employing this automated technique. This work aims to develop a board cleaning system with motorized wiper to control the total mechanism in reciprocating motion where the control is done by connecting the battery for external power supply. The qualities of the material are then used for other purposes, and the system uses a lead screw mechanism to clean the board with the assistance of DC motors in reciprocating motion where with the

help of the duster the cleaning is takes place. By the help of the lead screw the duster attachment tends to move in reciprocating motion as it connected in DPDT Switch. With the help of the Power obtained from the battery the motor is a combination forboth lead screw rotation and wiper system, When the lead screw tends to rotate the duster attached with the wiper motor makes the movement into reciprocating motion. As a board the duster setup is placed at the centre of the board where the reciprocating motion takes place where cleaning process has been implemented.

II. LIST OF COMPONENTS

- 1) White Board
- 2) Duster
- 3) Two-way Switch
- 4) 12V Battery
- 5) Wiper Motor
- 6) Lead Screw
- 7) Frame

III. DESIGN AND CALCULATION

The following calculations have been made with fabrication in mind. These calculated values may not exactly match the actual performance, but it leads to idea of creating the output in a proper manner.

Given data:

Motor:

Volt = 12v

Speed = 145rpm

Length of base = 380mm

Width of base = 203mm

Height = 175mm

Material = mild steel, Weight = 1.5kg

T = 60 N-m

Power = $W/t = V.I$

Where,

W = electric energy

v = volt

I = Current

T = time

Speed:

i) LOW SPEED:

$P = I1 \times V = 3 \times 12$

$P = 36$ watts

ii) HIGH SPEED:

$P = I2 \times V = 5 \times 12$

$P = 60$ watts

Lead Screw:

Torque at are given pivot point $\times (M/V$ shaft diameter / are gear diameter)

$= 22.5 \times (10/50)$

$= 4.5$ Nm

Angular speed for arc gear:

$= \text{linear gear} / \text{arc gear diameter}$

$= 60/45$

$= 1.33$ rad/sec

Speed required for arc gear:

$= \text{Angular speed for one gear} \times 60/2 \times 3.14$

$= 1.33 \times 60/2 \times 3.14$

$= 13$ rpm

Speed required for m/r:

$= \text{speed required for arc gear} \times \text{gear ratio}$

$= 13 \times 5$

$= 65$ rpm

For Low speed:

$P = 2\pi Nt/60 \quad 36 = 2 \times 3.14/60 \times N \times T$

Gear ratio = 5

IV. FABRICATION



Figure 4.9 Fabricated Model

As per our fabrication work, the Automated Board Cleaner machine will give satisfactory rubbing effect on the work place by the effect done by the DC Wiper Motor with the help of power gained from the battery

which we are used in the component. The main part of the work is Lead Screw mechanism connected with the duster attachment, which is fixed in vertical position, with the help of the power supply the combined motor, i.e for rotating the lead screw and wiper motor part. With the aid of DC geared motors, the system cleans the whiteboard using a lead screw mechanism. The rotary motion will be converted by the motors driving the screw of the lead into reciprocating motion carrying the reciprocating strip with duster attached to it by special attachment. All the setups are placed in the frame which is finely held on the sides with the help of the clamp fitting on all four sides. A higher-quality duster that is fastened to the duster holder has been utilized to thoroughly wipe the whiteboard.

V. BENEFITS

- ✓ Its construction is straightforward and requires little upkeep.
- ✓ Low price.
- ✓ Lightweight and transportable in size.
- ✓ There are no external devices used to control it here.
- ✓ Reduced manual labour.
- ✓ Time-saving initiative.
- ✓ Time can be saved by automating operations.
- ✓ Simple and quick operation with a large wiping area
- ✓ High level of precision.

VI. RESULTS AND DISCUSSION

Using this approach, cleaning the board takes an average of 7 to 10 seconds to finish. On the other hand, the cleaning process takes roughly 25 to 30 seconds when utilizing the manual method. Therefore, the automated board cleaner has an advantage over the earlier models. The attachment of a duster setup at the centre of the whiteboard induces sufficient pressure during operation, which helps to clean the board extremely well and efficiently, and it makes less noise

than other motorized cleaners. Through there is some lag in the switch section, averagely it is optimum. For controlling we used a DPDT switch for forward-reverse motion and the outcome of the work comes well. Our work is incredibly user-friendly and ergonomically sound. The project's goal of designing an automated board cleaning has been partially met.

Every argument must be checked before each method is used to ensure that there are no issues during implementation. The whiteboard is placed on the respected frame setup that is made. At the end of the frames are welded to get proper attachment to hold the total setup without any unbalance. The automated board cleaner has, in our opinion, been successfully designed. The system was fabricated with various features that minimize human effort while maximizing instructional effectiveness.

VII. FUTURE SCOPE

- ✓ By using app control, we can able to improve the technical formation in board cleaning system.
- ✓ Gestures method also assigned for different actions, where we need gesture controller to be placed in the board itself.
- ✓ Performing with double motor we can able to move the duster much faster than the previous work with additional systems.

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