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DESIGN AND FABRICATION OF BLACKBOARD CLEANER

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ABSTRACT—One of the traditional ways of teaching learning process is carried out by using blackboards in classrooms. Blackboards and chalk are inseparable from classrooms. Thus the dusts from chalk can cause some health hazards when the human inhaled it over a long period of time. Hence an attempt has been made by introducing black board cleaner which is operated by six bar mechanism. Its working is similar to the wipers in automobiles. It reduces the potential work of the person who erase the board and reduces the time consumption in cleaning the blackboard. It also prevents the exposure of chalk dust to atmospheric air and helps to create a dust free classrooms.

KEYWORDS: Blackboard, duster, chalk dust, health hazards, six bar mechanism.

I. INTRODUCTION

Blackboards are one of the essential tools for classrooms and teaching learning process. It is carried out by using boards traditionally. The common way of cleaning the blackboard is by using dusters manually but that method of cleaning has some defects and causes some health hazards. Nowadays, there is a huge growth of technologies developed to minimize the manual work in several fields. So in order to minimize the manual work in cleaning the blackboard by implementing some mechanism. The project blackboard cleaner is used to clean the blackboard and reduces the time consumed in hand erasing and keeps the board clean. Here we implemented the modified application of six bar mechanism to clean the blackboard.

Black board cleaner is a device which is used to clean the blackboard with minimum effort and free from dusts. The mechanism employed here is six bar mechanism. The rods and bars are used for linkages and felt material for cleaning the board. Upon using blackboard cleaner we can reduce the manual effort and prevent the health hazards by inhaling of chalk dusts.

II. PROBLEM IDENTIFICATION

The chalk dusts acquired from chalk pieces while erasing the blackboard causes some irritations to eyes. If humans inhale it over a long period of time can cause some respiratory diseases like asthma and some airborne diseases and

sometimes it causes skin allergies to the person to whom erasing the blackboard. It is not only harmful for humans but also causes some damage to the electronic components which are present inside the classrooms.

III. METHODOLOGY

The following methodology is adopted for the project.

PROBLEM IDENTIFICATION

LITERATURE SURVEY

DESIGN AND CALCULATION

ANALYSIS

MATERIAL PURCHASE

FABRICATION

EXPERIMENT

REPORT SUBMISSION

IV. LITERATURE SURVEY

- **V. Kannadhasan, et al** describes the fabrication of automatic blackboard dust remover. Their main motive is to clean the blackboard using remote control and to overcome the respiratory diseases.



Automated chalk board cleaner is a device which will clean the blackboard frequently and thus reduce manual work. This device is operated using DC motor. The entire setup is controlled using remote and a sensor. The entire setup costs eight thousand rupees.

- **Dr.N.P.Mungle, et al** describes that they develop a mechanism to remove dust from the duster. Inhaling chalk dust for short period not have any effects but inhaling it for over a long period of time causes some severe health hazards and also affects the atmospheric air. Their project is to reduce manual efforts of human by made some changes in mechanical structures and employing vacuum pump along with dust collector which is removable.
- **Suzilawati binti Alias, et al** proposed that whiteboards are the most commonly used tool in mode of the educational institutions which will be cleaned using human effort. The aim of this smart whiteboard cleaner is to make ease the teacher's work. This whiteboard cleaner will use 12v DC motor through which the DPDT switch will be operated that will induce the cleaner to move all over the board. The result of this product is compared with manual board cleaning and found that smart whiteboard cleaner will clean the board three seconds earlier without manual effort. Finally they proved the efficient way of cleaning the whiteboard without involving human effort a is also a time saving product.
- **Dr.N.P.Mungle, et al** describes that they develop a mechanism to remove dust from the duster. Inhaling chalk dust for short period not have any effects but inhaling it for over a long period of time causes some severe health hazards and also affects the atmospheric air. Their project is to reduce manual efforts of human by made some changes in mechanical structures and employing vacuum pump along with dust collector which is removable.
- **Gaurav Gangurde, et al** developed a solution to avoid the difficulties faced by teachers while cleaning the blackboard. This developing word needs many innovations to be made to make our life very comfortable. So he combined his mechanical and electronic knowledge to innovate an automatic blackboard cleaner. Rack and pinion is employed to move the duster and erase the blackboard. A sensor is used to monitor the position of the duster. By using this machine we can reduce the manual work.

DESIGN OF BLACKBOARD CLEANER

Black board cleaner designed by using six bar mechanism.

SIX BAR MECHANISM

Six bar mechanism is a mechanism which consists of six links and seven joints with single degree of freedom. Here, two fixed joints and others are movable. With one crank which converts circular motion to reciprocating motion

V. COMPONENTS REQUIRED

1.Mild steel is a carbon steel which consists of 0.05-0.25% of carbon. It is ductile, easily weldable, easy handling, affordable, less weight. It is used in the form of rods, bars, disc, etc.

2. Bearing is a device which converts the relative motion to desired motion and also helps to reduce friction and provides smooth operation. Here ball bearing type is used.

3. Crank disc converts circular motion to reciprocating motion with the help of linkages.

4. Connecting rods connects the crank with other links and one link with the another adjacent link.

5. Riverts are used for the connection purposes. it acts as a joints.

6. Duster with felt material is used to clean the board.

VI. CALCULATION

Duster length = 0.5 m

Take radius (r) = 0.5 m

Assume board dimension to be

(0.7m x 0.5m).

Area of the board (A)

(A)=0.7*0.5

(A)=0.35m²

Arc length (s)

(s)= $\pi * r$

(s)= $\pi * 0.5$

(s)=1.57m

Angular displacement (ω)

(ω)= arc length (s) /distance(r).

(ω)=3.14/0.5

(ω)=6.28 rad.

Speed (N)

(N)=(60* ω)/2 π

$$(N)=60*6.28/2\pi$$

$$(N)=591.87\text{rad/sec}$$

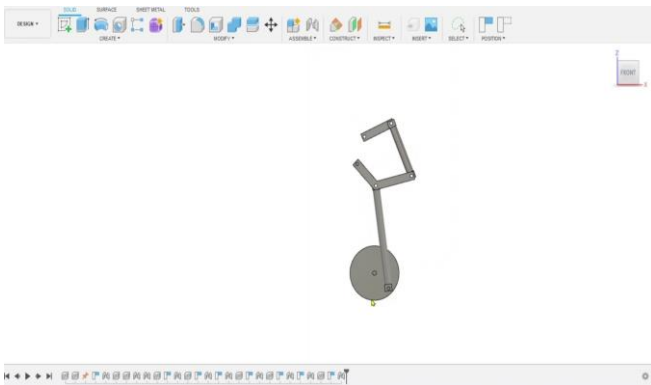
Area covered by duster(a)

$$(a)= (\pi*r^2) / 2.$$

$$(a)=0.39\text{m}^2.$$

VII. DESIGN FOR MECHANISM

Designing is done at Autodesk fusion 360.



FRONT VIEW OF MECHANISM



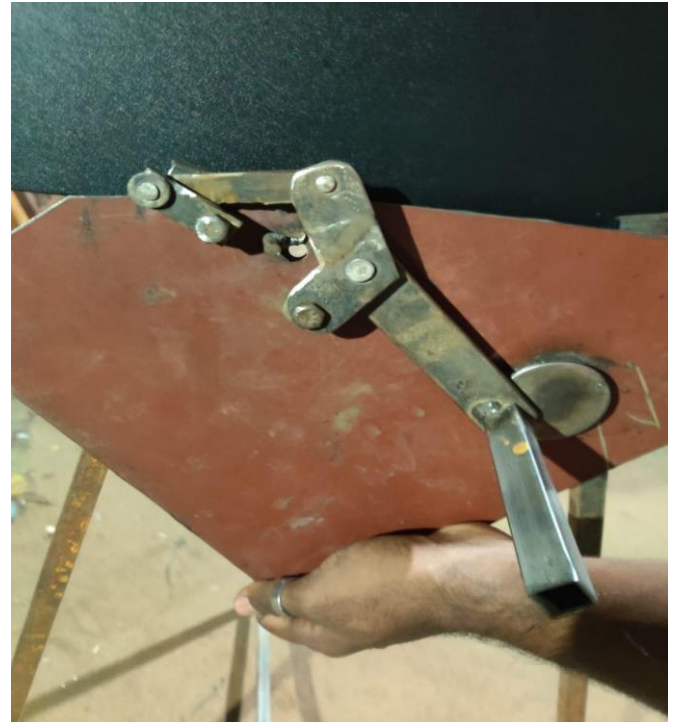
ASSEMBLED MECHANISM

VIII. DESIGN ANALYSIS

At first it has been planned to use four bar crank rocker mechanism. but could not attain the required angle of 180 degrees for cleaning the board. The maximum angle achieved by four bar crank rocker mechanism was 135 degrees by using Fusion 360 software. Hence there was an implementation of six bar mechanism which satisfied the required angle for cleaning the black board. Then It has been decided to make the prototype for the project.

IX. EXPERIMENTATION

Initially the dimensions selected for the mechanism is minimum, so could not able to obtain the required output. Hence dimensions were scaled up to get the required output. Some unwanted unconstrained motions were obtained, later it has been overcome.



MECHANISM WITHOUT SCALING

X. FABRICATION PROCESS

Final fabrication process is made up of (ms) mild steel by performing certain manufacturing process like welding ,cutting ,drilling ,etc.

1. Drilling: at first drilling operation was performed on the plate to make holes at the desired dimensions using M8 and M6 sized drillpits.

2.Cutting: cutting operation was performed for required dimensions on a hollow circular mild steel rod to make a connecting rods and bars to make linkages using metal cutter.

3.Punching: using punching operation the bearing was fixed in the plate to make the operation smoother.

4. Welding: Manual metal arc welding (MMAW) is carried out to make fixed joints and angular linkages by the arc welding machine of (50v-240v).

5.Riverting: The connections between the linkages were made using mild steel riverts by riverting operation. To reduce friction.

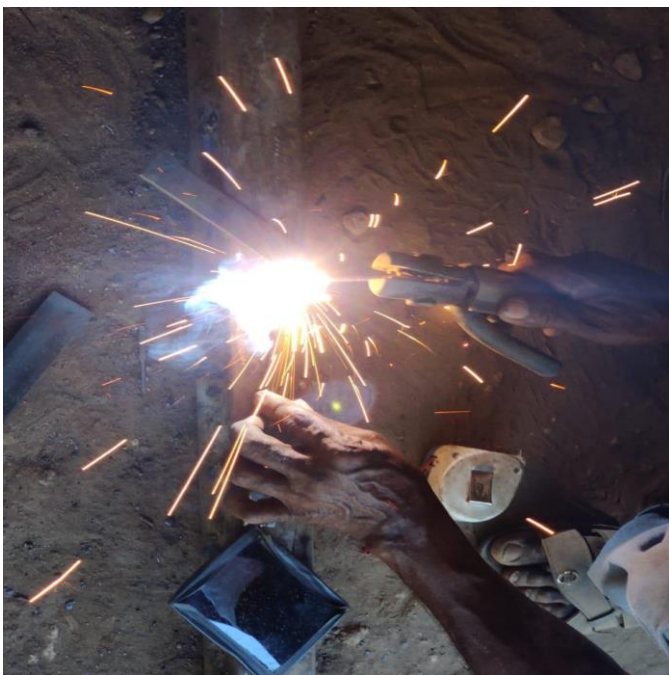
XI. FABRICATION PHOTOGRAPHS



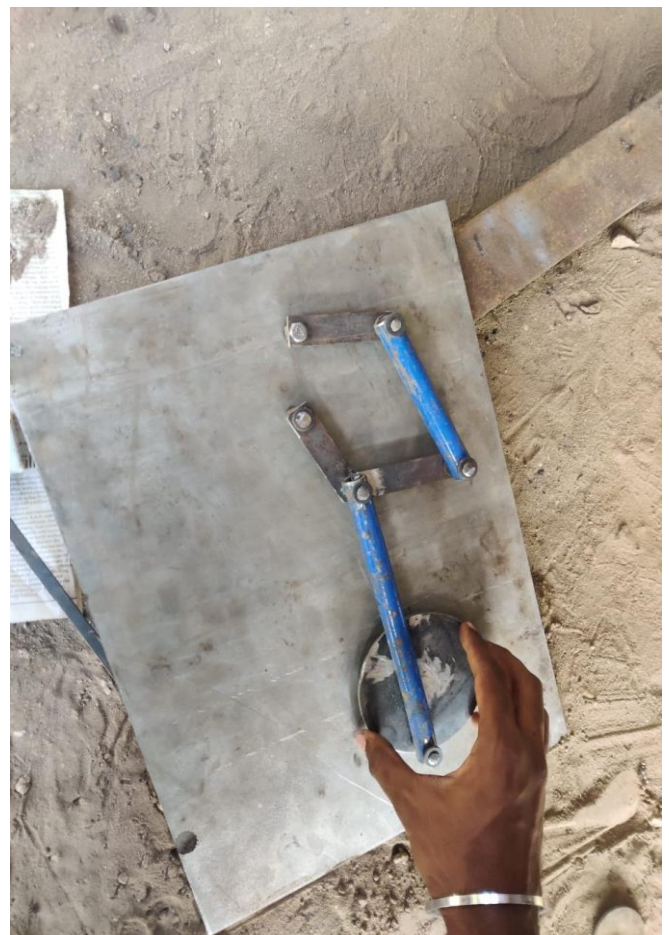
CUTTING OF PLATE



DRILLING OPERATION



WELDING OPERATION



MECHANISM



BLACK BOARD CLEANER

FUTURE UPDATES

- A 12v DC motor can be used to automate the mechanism.
- Remote operated circuits can be implemented to automate the operation.
- In order to clean a large board multiple duster linkages can be used.

XII. CONCLUSION

Compared with manual dusters, blackboard cleaner has a good effect and runs smooth with good reaction speed. The blackboard cleaner has a simple structure, easy to operate, easy to obtain raw materials, manufacturing equipment simple process. It can be controlled easily and have smooth operations, simple in construction and easily manufacturable with high performance and low cost. The product is suitable for large, medium and small institutions with the promotion of certain significance.

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