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Vol. 1, No. 1, 2020, pp. 7-11

Contents lists available at Journal IICET

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Design and development of smart whiteboard cleaner in classroom application

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Article Info

Article history:

Received Apr 6th, 2020
Revised May 11th, 2020
Accepted Jun 15th, 2020

Keyword:

whiteboard cleaner
board cleaning
board cleaning system
automatic whiteboard cleaner

ABSTRACT

Nowadays, whiteboards are used widely in higher educational centre over the world. The whiteboards usually are cleaned manually using manpower. This study offers a solution to clean the whiteboard automatically called Smart Whiteboard Cleaner. The idea gained after viewing the manual process of whiteboard cleaning in polytechnics in ways to provide some comfort for teachers while cleaning the whiteboard. Smart Whiteboard Cleaner is a tool which can move up and down to clean the whiteboards by pressing the button called Double Pole Double Throw (DPDT) button and powered with the help of DC Motor 12V. Smart Whiteboard Cleaner will be implement to facilitate the process of the classroom housekeeping. The result is compared between manual duster cleaning and Smart Whiteboard Cleaner. Finding shows that manual duster cleaning completed after 6.53 seconds while Smart Whiteboard Cleaner only takes 4.01 seconds. This makes Smart Whiteboard Cleaner worth to use as it can save time. In conclusion, Smart Whiteboard Cleaner is a good option used to facilitate the process of the whiteboard cleaning as it can be cleaned in an easy and can provide convenient ways of use.

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Introduction

Whiteboards are the basic things in classroom and used widely in schools and higher educational centres for teaching and learning purpose. Whiteboards also support face to face meetings by facilitating the sharing of ideas, focusing attention, and summarizing (Gormish, Erol, Van Olst, Li, & Mariotti, 2011)

Development of Smart Whiteboard Cleaner in Classroom Application is a system that is generally used to facilitate the process of whiteboard cleaning. The idea grows after viewing the manual process of whiteboard cleaning by teachers in ways to provide some comfort for teachers while cleaning the whiteboard.

We can save time and energy by using this automatic system as no manpower need to clean the whiteboard manually. The previous technic of cleaning whiteboard has no automatic cleaning function, so teachers wasting their time in erasing whiteboard in classroom. The structure of Smart Whiteboard Cleaner is simple, offer a solution of cleaning within time saving and it can provide convenient ways of use.

The Main objective of Automatic Duster Machine is to provide a concept of cleaning whiteboard or blackboard with a single key pressed as it can prepare low cost and user friendly ways. The machine can be operate in three selectable operation modes. In the first mode, it cleans the left side of the board while in the

second mode it cleans the right side of the board. It cleans the whole area of the board in the third mode. The machine can move the duster in horizontal (x-axis) and vertical (y-axis) direction using stepper motor. Linear motor help the duster to move up and down in direction. Infrared transceiver is used to detect horizontal direction of motor. This machine apply four limit switches to detect the boundary of the board. The main purpose of dsPIC30F401 microcontroller which was programmed in C language is as the main controller in application of the machine (Joshibaamali & Priya, 2015) .

In ways to eliminate the problems related to chalk dust, inconvenient ways for the teachers and wasting time of erasing the boards, Gaurav Gangurde has design and develop a board cleaning system which is using application of DC geared motors to drive the rack and pinion mechanism to clean the blackboard and whiteboard. The motors will drive the pinions into linear motion on the rack carrying the connecting strip with duster attached to it by bearing rotation. The design also using small water sprinkler to spray the water on the blackboard. Sprinkling the water on blackboard will created pressure which is saving time and energy as it also can get rid the motor load by the use of wiper motor. In way to adjust the clearance between pinion and rack, Toggle mechanism is used. Gaurav Gangurde also suggest some new ideas and improvement for the design and development of board cleaning system in future. First it can be *Operate in schedule* which is this machine can operate in time we set for. Secondly the idea *Eye of machine* which is we can create machine that can operate by detection of dirty on whiteboards and erase it automatically (Gangurde).

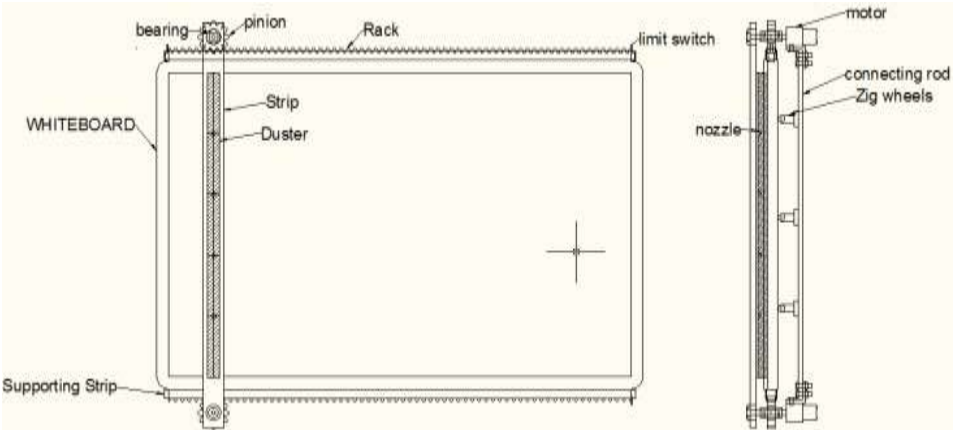

Figure 3. Front View and Side View of Automatic Whiteboard Cleaning system (Gangurde).

Sliding type wipe mechanism implement of motion analysis to detect the stain of blackboard chalk automatically and clean up the blackboard. This system apply three guide rails and three sliders. Motor A drives the left and right motion of cross rail beam C and motor B drives the vertical motion of slider 3 (wipe system) to clean the blackboard surface by moving the wipe system along the rail C together. This system using application of sensor which is located at right most of the blackboard to sense the right end position and signal passed to return the wipe system. Smart wipe has a good effect and runs smooth with good reaction speed compared with manually wipe. The rate of motion of the motor can be set in accordance with the need of the wiping speed to suit the need of different occasions. The smart eraser offers a simple structure as the operation is easy. The product is suitable for use in large, medium and small education centers (Kewate, Mujawar, Kewate, & Pant).

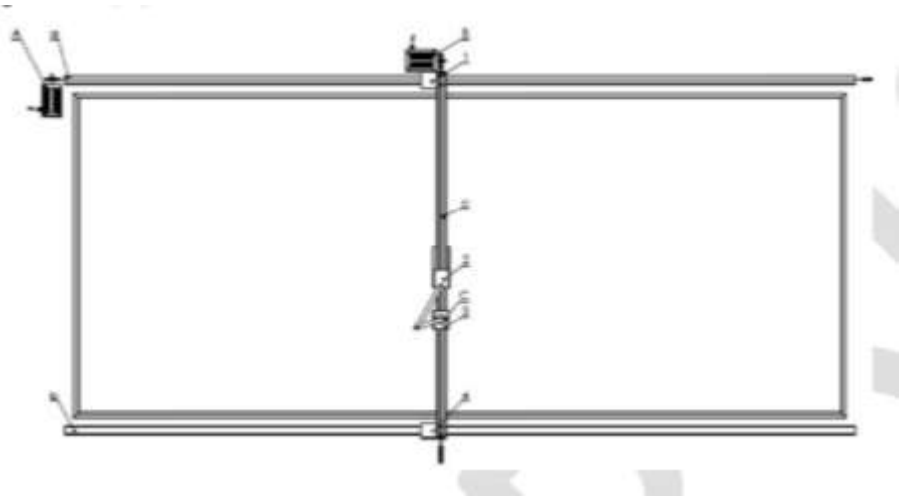

Figure 4. Blackboard Erasing Mechanism (Kewate et al.).

Wall shape recognition using limit switch can be implement by Gondola typed robot system. In this system there are two limit switches. Limit switch is widely used mechanical sensor at robotics and factory automation. We applied this sensor to the gondola-typed building maintenance robot system to recognize the wall shape. With this sensor data, we will control the painting tool nozzles to protect windows and react to obstacles on the wall. Two limit switches sense the wall and the obstacle respectively. By adjusting stroke of limit switch, the sensor module can be applied to various environments. The ARS sensor and the height sensor are used to map 3D localization of the robot. If ARS sensor and height sensor are connected to other place of the gondola, the sensor data send to the limit switch module process algorithm. Two limit are used as the switches have different purpose and setting (Kim et al., 2014).

Method

This tool operate on principles of mechanical and electronics combination. The main objective of Smart Whiteboard Cleaner is to prepare an attachment for whiteboard which can operate automatically by pressing the button thus get rid of the drudgery of manually cleaning whiteboards. The duster can move up and down to clean the whiteboards by pressing Double Pole Double Throw (DPDT) button and powered with the help of DC Motor 12V. Double Pole Double Throw (DPDT) button is refer to electrical configuration of switch. Smart Whiteboard Cleaner uses the mechanism of DC Motor for cleaning the whiteboard. The motor will support the rail which will convert into linear motion carrying the connecting duster attached to the whiteboard. The flow process of Smart Whiteboard Cleaner can be refer to figure 1. Figure 2 and figure 3 show the design of Smart Whiteboard Cleaner

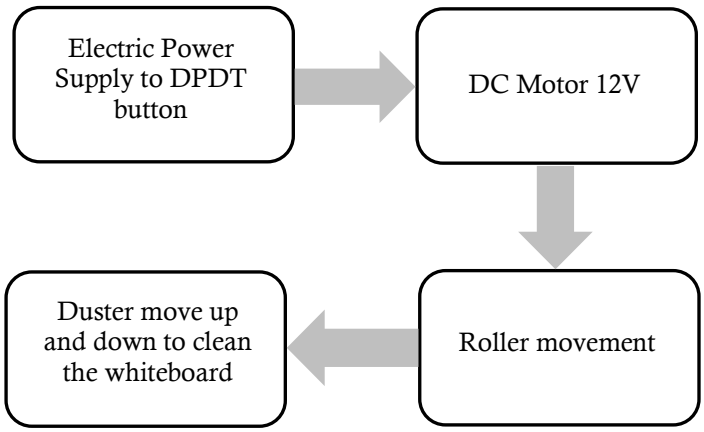

Figure 1. Flow Process of Smart Whiteboard Cleaner

Table 1. Components of Smart Whiteboard Cleaner

Bil	Components	Advantages
1	DC Motor 12 V (Power Window)	Widely used Easy installation
2	Ball Bearing	Wear resistance Widely used
3	Fibre (Duster)	Efficient clean
4	Mild Steel (Frame)	Easy fabrication Light

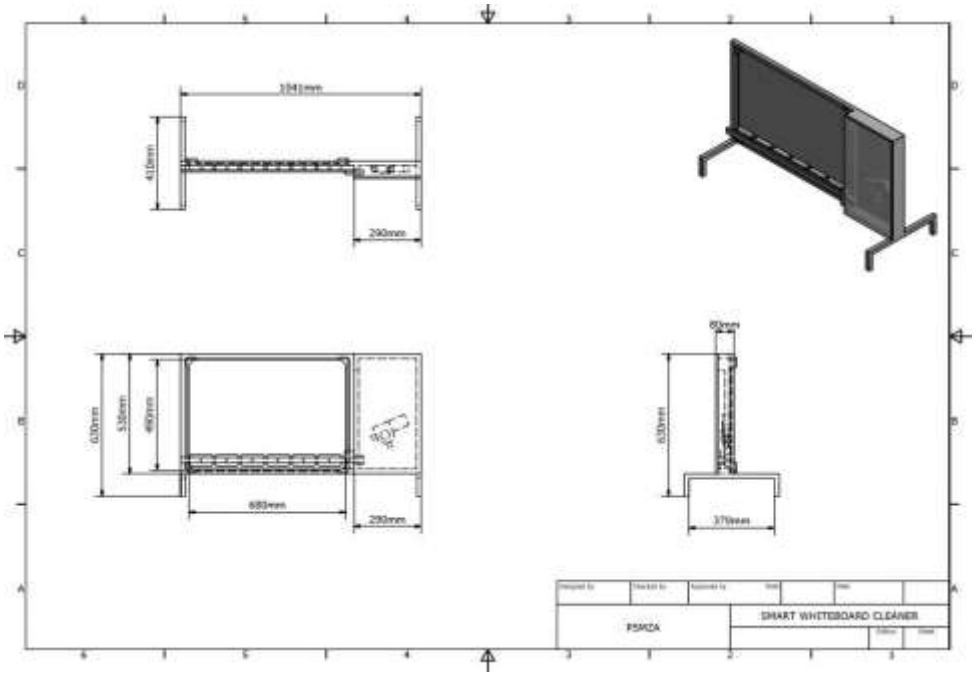

Figure 2. Isometric Drawing of Smart Whiteboard Cleaner

Results and Discussions

By the use of Smart Cleaner Duster, we can save time and energy as no manpower need to clean the whiteboard manually. The teachers waste time in erasing the whiteboard in classroom as the previous board has no automatic cleaning function.

Table 2. Time taken for Manual Whiteboard Cleaning and using Smart Cleaner Duster

Reading	Time (second)	
	Manual Whiteboard Cleaning	**Smart Cleaner Duster**
1	6.23	3.98
2	6.59	4.02
3	6.77	3.99
Average	**6.53**	**4.01**

Figure 5. Graph time comparison between manual whiteboard cleaning and using Smart Cleaner Duster

Refer to figure 5, the graph shows time comparison between manual whiteboard cleaning and using Smart Cleaner Duster. Finding shows that manual duster cleaning completed after 6.53 seconds while Smart Whiteboard Cleaner only takes 4.01 seconds. This makes Smart Whiteboard Cleaner worth to use as it can save time. Furthermore, the structure of Smart Whiteboard Cleaner is simple, offer a solution of cleaning within time saving and it can provide convenient ways of use.

Conclusions

People want every single thing in life look sophisticated, easy and fast in this new era of technology. They wish for something new in ways to upgrade their lifestyle and facilitate their routine by using the application of machines or robots. That's why development of machine and robot becomes high demand and faster in marketing. Development of Smart Whiteboard Cleaner is an alternative option to help lecturers, teachers and students to facilitate the cleaning process of whiteboards. This project has a big potential to be developed as one of the advanced technology in future. It should be installed in school and higher education center over the world. Smart Whiteboard Cleaner was designed and fabricated which can potentially be used in classrooms to facilitate the process of the classroom housekeeping. Smart Whiteboard Cleaner is worth to use as it can save time. In conclusion, Smart Whiteboard Cleaner is a good option used to facilitate the process of the whiteboard cleaning as it can provide an easy and convenient ways of use.

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