

# Improvement of Rolling Method in Dust Removal of Ceiling Fan

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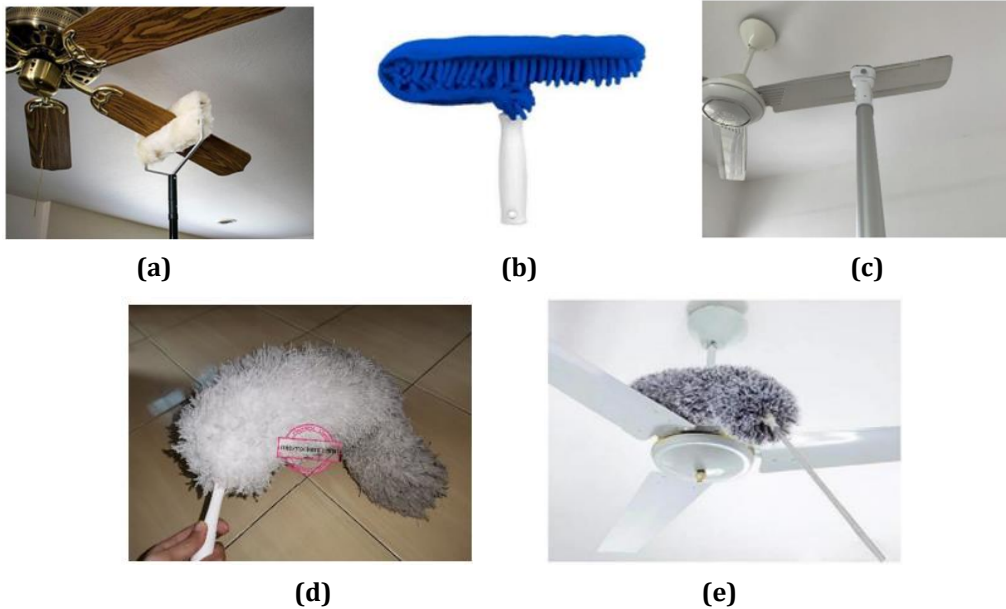
Ceiling Fan Cleaning Tool, Ceiling Fan

## Abstract

Small particle such as dust, dirt and pollen accumulate on oscillating fan. There is a need of creating a fan ceiling cleaning tool that not only to simplify the fan cleaning process and to reduce the cleaning time. Most of the market uses full human power for Ceiling Fan Cleaning Tool. In addition, the materials and designs in the market are of poor quality and easy to damage. A power motored rotating microfiber material is introduced. Dust statically attached to the microfiber while rotating the microfiber causes dust to fall into a dust container. It is found that the rotating speed of ceiling fan increases by 1.2% to 5% after the ceiling fan blade is cleaned by the cleaning tool.

## 1. Introduction

Dust, dirt, pollen and small particles accumulate on the oscillating fan blades due to the static electricity created when fan blades move through the air [1]. Various methodologies were proposed to clean the rotating blades. The obvious methodology is to manually clean it by wiping the blade using cloth or brush. Many innovations in electronic and non-electronic based fan cleaning methods have been introduced. In non-electronic cleaning-based fan cleaning that is a cheaper option, the cleaning tools available in the market are ceiling fan duster [2] and microfiber ceiling fan duster [3] as shown in Fig. 1(a) and Fig. 1(b). As the number of ceiling fans grows significantly, an electronic based ceiling fan cleaner becomes a necessity. The ceiling fan cleaner can be equipped with a soft brush, pressurized air, or a small vacuum to make it easier for dust not to fly everywhere from around the ceiling fan area as shown in Fig. 1(c). Other examples of cleaning tools are feather duster as in Fig. 1(d) and spiderweb cleaner as in Fig. 1(e).



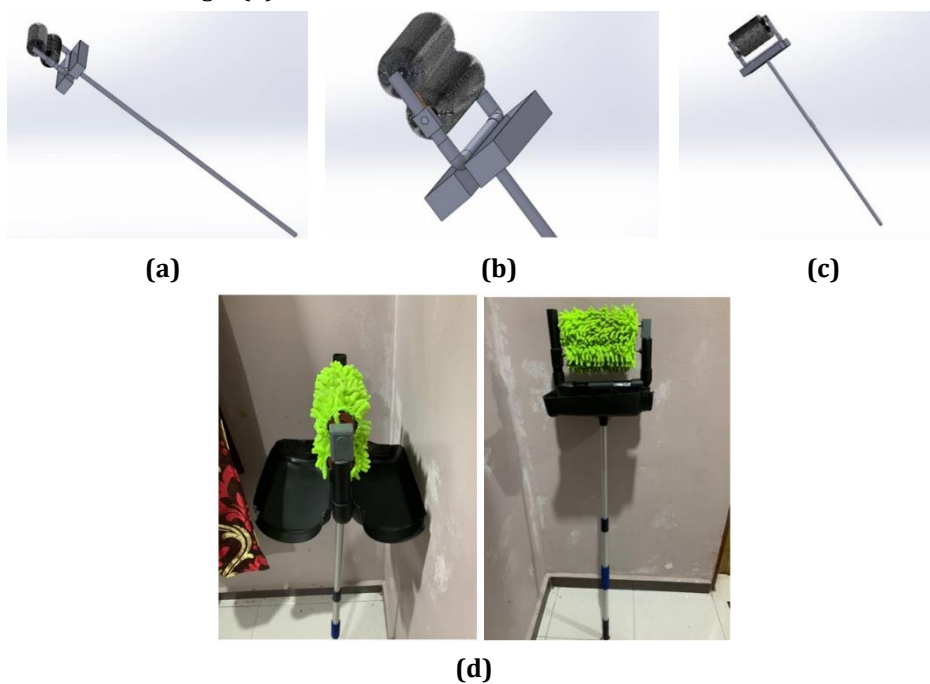
**Fig. 1** Types of ceiling fan cleaning tool (a) Ceiling fan duster; (b) microfiber ceiling fan duster [3]; (c) Electronic fan cleaning tool [4]; (d) Feather duster [5]; (e) Spiderweb cleaning tool [6]

The electronic ceiling fan cleaning tool is a project where the objective of the study is to ensure that the effectiveness of the product can increase the percentage of ceiling fan speed after using the product from this study. The findings of the research conducted conclude that (1) most houses in Malaysia are installed with ceiling fan, (2) user that is housewife are less sensitive to cleanliness due to the effort and abuse to clean.

## 2. Metodology

### 2.1. Product design

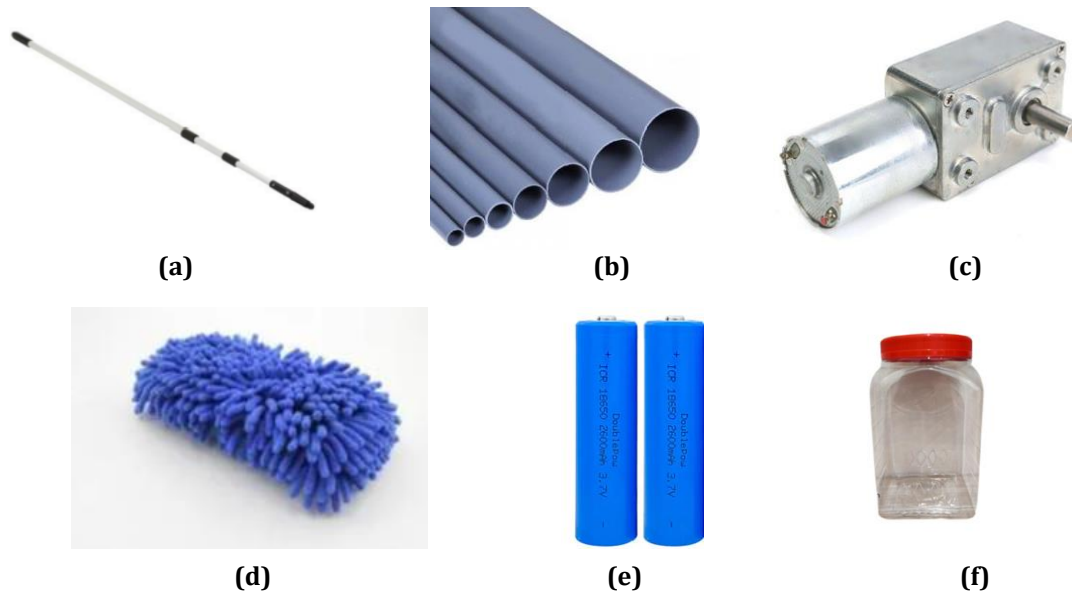
The diagram of the ceiling fan cleaning tool was drawn using SolidWorks software as shown in Fig. 2. Fig. 2(a), Fig. 2(b) and Fig. 2(c) depict the isometric view, side view and front view of the cleaning tool respectively. The produced product is shown in Fig. 2(d).



**Fig. 2** SolidWorks views of the product (a) Isometric view; (b) Side view; (c) Front view; (d) Product of ceiling fan cleaning tool

## 2.2. Materials

Fig. 3 shows the material used to construct the ceiling fan cleaning tool. Firstly, it comprises of (a) an adjustable handle. The usage of the adjustable handle is to adjust the height between the ceiling fan and the user's height. Next (b) PVC pipes are cut at different lengths and assembled to form the frame parts of the cleaning tool. (c) A worm gear motor of rotating speed of 160 revolution per minute (rpm) is used to rotate two brushes made of (d) Microfibers material. The worm gear motor is powered up by (e) two 3.75-volt batteries. The dust that has been removed is collected by a dust collector made from (f) plastic container.



**Fig. 3** Material to construct ceiling fan cleaning tool (a) adjustable handle; (b) PVC pipes; (c) worm gear motor; (d) microfibers; (e) 3.75-volt batteries; (f) dust collector

## 2.3. Working Principles

The ceiling fan cleaning tool is equipped with height adjusted. This is to accommodate the needs of height difference of the ceiling fans relative to the ceiling fan cleaning tool user's height. Initially, the two microfiber brushes are placed in between the ceiling fan blade. The ceiling fan cleaning tool is switched on to start the rotation on the microfiber brushes. The two microfiber brushes will rotate in opposite directions to each other. While slowly moving the brushes to the center of the fan, dust on the ceiling fan will be swiped away and collected by receptable. The receptable is then can be separated from the ceiling fan to dispose the dust.

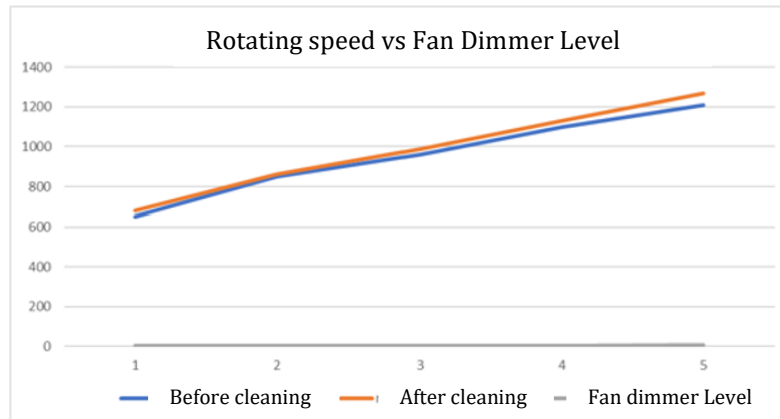
## 3. Result and discusson

Ceiling fan with a fan dimmer level was tested to determine the effectiveness of the cleaning tool. Prior to the testing, the rotating speed of ceiling fan was recorded using video tachometer application [7]. After that each of the fan blades were cleaned using the cleaning tool in movement of one direction. The rotating speed of the ceiling fan after the application of the cleaning tool was recorded.

Table 1 and Fig. 4 show the comparison of the speed of the ceiling fan before and after the application of the cleaning tool. It shows the increase of the rotating speed at all levels of the dimmer level. From Table 1, the increase speed of the ceiling fan ranged from 1.2% to 5.0%.

**Table 1** Rotating speed of ceiling fan

Fan dimmer	Before cleaning (rpm)	After cleaning (rpm)	Speed difference (%)
One	650	680	4.6
Two	850	860	1.2
Three	960	990	3.1
Four	1100	1130	2.7
Five	1210	1270	5.0



**Fig. 4** Comparison of rotating speed before and after application of cleaning tool

In addition to the speed comparison test, the dust condition is compared between two ceiling fans. The first ceiling fan is wiped out without applying the cleaning tool. The other ceiling fan is wiped out after applying the cleaning tool. The methodology of the cleaning tool shown in Fig. 5 while the comparison with and without using cleaning tool shown in Fig. 6. In Fig. 6, it is clearly shown that the dust is removed from the ceiling fan.



**Fig. 5** Cleaning method



**Fig. 6** Comparison of dust with and without using cleaning tool

During initial product testing, several aspects were tested to ensure good performance of the fan cleaning tool. Among them, data collection is done on the ones that have not been cleaned and after being cleaned. This fan cleaning tool is used to distinguish them. First, tests are conducted on the adjustable handle to ensure the durability and stability of the handle can be handled by the user. The handle prototype is difficult to adjust because the wire inside can clump, so the handle is difficult to adjust. However, the adjustable function can still be used.

Secondly, a test on the effectiveness of using a microfiber brush that can reject the dust moved by the worm gear motor. This happens because the speed of the worm gear motor used is 160 rpm and 12 volts. Therefore, this

second test was performed to ensure that the use of the product can reduce dust and dust from the tested ceiling fan blades.

Finally, testing is done on the effectiveness of the container that can be released from this Ceiling Fan Cleaning Tool. This test is done to facilitate the removal process of dust that accumulates after being pulled by the fan blades. This indirectly tests the level of ease of use of this Ceiling Fan Cleaning Tool. Finally, tests are performed on the cable installation from the battery to the motor, to ensure that the installation is done correctly and that each component used in the manufacture of the Fan Cleaner works properly. The results of this test will be used to improve and optimize the design of this Ceiling Fan Cleaning Tool.

#### 4. Conclusion

In conclusion, this Ceiling Fan Cleaner provides various benefits to users if used. The adjustable handle mechanism has several advantages. Firstly, it helps reduce product storage space due to its adjustable height. Secondly, it allows for a more suitable position when cleaning the ceiling and reduces ergonomic problems. In addition, one of the main objectives of the study is to increase the speed of the fan. The condition before and after cleaning using the Fan Cleaning Tool shows the difference in speed that is studied and recorded in the table. This product is designed to accommodate the user's strength and stability without causing fatigue or fatigue. Overall, this Fan Cleaning Tool provides practical and ergonomic advantages to users, making it easier for them to deal with their respective ceiling fans.

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#### Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

#### Author Contribution

*The contributions of all authors must be described in the following manner: **conception and design of the study:** Muhammad Khairul Aiman Norhisham, Muhammad Iqbal Aizad Maznuri, Ekmal Alif Kamal Abd Harith and Hairul Mubarak Bin Hassim; **data collection:** Muhammad Khairul Aiman Norhisham, Muhammad Iqbal Aizad Maznuri, Ekmal Alif Kamal Abd Harith; **analysis and interpretation of results:** Muhammad Khairul Aiman Norhisham, Muhammad Iqbal Aizad Maznuri, Ekmal Alif Kamal Abd Harith and Hairul Mubarak Bin Hassim; **manuscript draft preparation:** Muhammad Khairul Aiman Norhisham, Muhammad Iqbal Aizad Maznuri, Ekmal Alif Kamal Abd Harith and Hairul Mubarak Bin Hassim. All the authors reviewed the results and approved the final version of the manuscript.*

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