POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART CEILING FAN CLEANER

JABATAN KEJURUTERAAN AWAM

MOK XIAO YUAN

08DKA21F1200

SESI 1:2023/2024

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Laporan ini dikemukakan kepada Jabatan Kejuruteraan Awam sebagai memenuhi sebahagian syarat penganugerahan Diploma Kejuruteraan Awam

JABATAN KEJURUTERAAN AWAM

SESI 1:2023/2024

AKUAN KEASLIAN DAN HAK MILIK

TAJUK PROJEK

1. Saya, Mok Xiao Yuan (031228-13-1157) adalah pelajar Diploma Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah, yang beralamat di Persiaran Usahawan, Seksyen U1, 40150 Shah Alam, Selangor
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2. Saya mengakui bahawa 'Projek tersebut diatas' dan harta intelek yang ada didalamnya adalah hasil karya/ rekacipta asli saya tanpa mengambil atau meniru mana-mana harta intelek daripada pihak-pihak lain.

3. Saya bersetuju melepaskan pemilikan harta intelek 'Projek tersebut' kepada 'Politeknik tersebut' bagi memenuhi keperluan untuk menganugerahan Diploma Kejuruteraan Awam kepada kami.

Diperbuat dan dengan sebenar-benarnya diakui)
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SAFEE ( ) sebagai penyelia)
projek pada tarikh: 20/05/2024)

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MOK XIAO YUAN

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APPRECIATION

First of all, I would like to thank PSA for providing a very meaningful project/subject. The significance of this project lies in innovating students' ideas and putting them into practice. Unlike before, this project has increased interaction among team members, communication between the team with the supervisor, and the completion of various elements of the entire project. The success of this project is thanks to the help and support of many people, and I would like to take this opportunity to thank everyone.

Leading our learning and research is Madam Zurina Binti Safee, whom we must first thank. She has provided us with all the help and support, and we thank her for taking the time and effort to help us complete the project, especially during the research and report writing phases. Throughout the project, we are very grateful for her patient guidance and assistance.

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Finally, I would like to thank my team members, relatives, and friends for their appreciation and support. Thank you for their tremendous help throughout the research process. Without their assistance, support, and encouragement, our project would not have been as successful and smooth.

ABSTRAK

A ceiling fan cleaner is a specific instrument or cleaning solution intended to improve the effectiveness and efficiency of cleaning ceiling fans. These days, cleaning professionals and homemakers frequently use antiquated techniques, like disassembling fan blades before cleaning or utilising ladders. Humans also utilise insufficient cleaning supplies like rags, brooms, and even feathers, which is problematic because it raises safety issues and results in inconsistent cleaning. When a person cleans ceiling fan blades using the conventional method, which involves climbing a ladder to reach higher, there is a significant chance that something will go wrong. This study aims to evaluate the efficacy of the Smart Ceiling Fan Cleaner. The goal of this study is to evaluate the time-saving capabilities of the Smart Ceiling Fan Cleaner as well as its efficacy in terms of safety and cleanliness. The purpose of the basin is to gather dust that gets in people's eyes and breathes. People can ensure their safety while effectively and efficiently cleaning ceiling fans with the help of the Smart Ceiling Fan Cleaner. As a result of this study, a Smart Ceiling Fan Cleaner was created to address the issue at hand and streamline the ceiling fan cleaning procedure.

Keywords: Safety concerns, extended cleaning time, high risk of accident, simplify the cleaning process

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LIST OF SYMBOLS

SIMBOL	DESCRIPTION
s	Second
m	Minute

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The introduction's goal is to set the stage for the main content by giving readers or listeners important background information about the topic. It draws the reader in, emphasises the significance of the subject, and usually presents the main point or argument. The goal of academic writing, speeches, and presentations is to draw in the audience, provide background, and draw attention to the material that will be covered before bringing them to the main point of the text or discussion.

1.2 PROJECT BACKGROUND

A ceiling fan is a mechanical device that is suspended from the ceiling of a room and usually has rotating blades to move air around the room. Its purpose is to enhance the flow of air throughout the space and produce a cooling effect. A ceiling fan's motor, blades, and mounting system are its essential parts. The motor, which powers the blades' rotation, is often positioned in the middle of the fan. The motor is connected to the blades, which are normally two to five in number, and they extend outward. When the fan is operating, the angle of these blades is designed to move air efficiently. Often, remote controls or switches are included with ceiling fans so that users can change the speed of the fan to suit their preferences. Ceiling fans not only offer a refreshing breeze but can also be used to create an updraft by flipping the direction of the blades, which helps distribute heat more evenly during the winter months. In order to accommodate a range of tastes and room sizes, ceiling fans are widely installed in both residential

and commercial settings. Due to their lower electricity consumption and ability to help save energy while maintaining a comfortable environment, they are a well-liked and economically friendly substitute for air conditioning (MK Think, 2017).

A ceiling fan cleaner is a particular tool or solution for cleaning intended to improve the effectiveness and efficiency of cleaning ceiling fans. Because of their high position and the development of dust on the fan motor housing and blades, cleaning ceiling fans can be difficult. This process is meant to be made easier with a ceiling fan cleaner, which can be found in a variety of forms. These are a few typical kinds. Nowadays, cleaning contractors, housewives, and other people have issues when it comes to cleaning ceiling fans. The methods that are currently in use include antiquated procedures like climbing stairs before beginning the cleaning process. There may be a risk about safety if people use unstable ladders or climb on furniture to rich to the height needed. Cleaning tools such as cloths, brooms, and chicken feathers are still in use, but they prove inadequate due to safety concerns, prolonged cleaning time, and subpar results. Despite previous studies highlighting these challenges, comprehensive solutions remain elusive. Hence, this study seeks to explore remedies for the complexities associated with cleaning ceiling fans (Arini Saleh, 2018).

1.3 PROBLEM STATEMENT

The ceiling fan blades are dirty because of the long-term use without cleaning. So, humans need to clean the ceiling fan blades regularly to ensure that the ceiling fan blades are functioning. During the traditional method of the cleaning process, there is a high chance that humans can’t reach the height to clean the ceiling fan blades. (Frazana, 2019). Typically, ceiling fans are installed at least 3 meters above the floor. It's a height beyond human comprehension. Accordingly, there is a significant chance that an accident will occur when someone employs the conventional method of cleaning ceiling fan blades, which involves climbing up a ladder. For instance, the

Indian press stated that a woman in her 40s passed away after falling while cleaning her home's ceiling fan blades. It is risky, particularly for young children and the elderly. We could feel uncomfortable if a cloud of dust falls into our noses and eyes while the ceiling fan blades are being cleaned (Ahmedabad Mirror, 2017). After the research, it is necessary to create a new innovative product that can facilitate the process of cleaning the ceiling fan blades.

1.4 PROJECT OBJECTIVE

The objective of this study is to:

I. To produce the Smart Ceiling Fan Cleaner.
II. To determine the effectiveness of the Smart Ceiling Fan Cleaner in terms of cleanliness and safety.
III. To measure the efficiency of the Smart Ceiling Fan Cleaner in terms of time.

1.5 RESEARCH QUESTIONS

I. How does the Smart Ceiling Fan Cleaner work effectively to clean the ceiling fan blades?
II. Can this Smart Ceiling Fan Cleaner reduce the time of the cleaning process?
III. Does this Smart Ceiling Fan Cleaner can improve the safety of the users?

1.6 SCOPE OF THE WORK

I. Smart Ceiling Fan Cleaner is produced for standard fans at the house.
II. The specification of the Smart Ceiling Fan Cleaner:
    - Material use:
        1. Roll cleaning cloth

2. Aluminium
3. Plastic
4. Locker
5. Handle
6. Adjustable rod

III. Test workability

- Testing the workability of a Smart Ceiling Fan Cleaner involves assessing both the time required for the cleaning process and the manpower needed. Conduct trials with various fan types to determine efficiency and ensure the cleaner is user-friendly, minimizing the required manpower. Evaluate results to optimize the cleaning process for effectiveness and time efficiency.

IV. Test effectiveness

- The questionnaire is given to the respondents about the effectiveness of a Smart Ceiling Fan Cleaner by Google Form. This questionnaire will get reviews from the respondents.

1.7 SIGNIFICANCE OF THE WORK

Even though brooms and chicken feathers have been tried as cleaning tools for ceiling fans, these techniques are not always safe and can be challenging for users. On the other hand, these issues are addressed by the Smart Ceiling Fan Cleaner that is presented here. This invention could be advantageous to the community since it provides a workable solution for cleaning ceiling fans and ultimately reduces the likelihood of accidents during cleaning.

1.8 IMPORTANCE OF THE WORK

i. **Safety guarantee:**
Users do not need to climb the stairs to clean the ceiling fan blade that may face risk of injury.

ii. **Time saving:**
The roller will clean the ceiling fan blades with continuous turning to maintain efficiency of the ceiling fans.

iii. **Cleanliness:**
Users can achieve the same effectiveness of cleanliness with the conventional method throughout this product.

1.9 SUMMARY

A summary of this project title's origins can be found in the introduction. The widespread issue that many people faced when cleaning ceiling fans served as the impetus for this initiative. Researchers were forced to take up the issue after realising how commonplace people's problems were in this area. It became clear that cleaning ceiling fans was dangerous, especially when users had to climb shaky stairs, which raised questions about their safety. Moreover, those with backaches reported discomfort from the task, highlighting the necessity for a solution to improve safety and comfort when cleaning ceiling fans.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Literature review is an overview of the previously published works related to fan cleaner. This section will distribute about, an introduction and background information section; second is the body of the review containing the discussion of sources; recommendations and conclusion section to end the paper. The literature review serves to comprehend the current research and discussions pertinent to a specific topic or field of study, aiming to articulate this understanding through a written report.

2.2 FAN CLEANER

Fan cleaner is the tool or method for removing blade dust. Ceiling fans must be cleaned and maintained regularly to stay functional and effective. An electric fan's fan blades usually accumulate dust over time. This is because the fan blades' rubbing against the air to produce static electricity draws microscopic dust particles into space. Additionally, clean frequently can guarantee ideal ventilation and stop allergens from spreading.

2.2.1 FEATHER SWEEP

The Figure 2.2.1[a] shows the chicken feather sweep, have powerful cleaning functions for removing dust and static electricity while renowed. It is composed of chicken feathers, thin wires, and a rattan handle. The chicken feathers are coated with glue and wrapped around the rattan handle(JSTOR, September 2019).

With the changes of the times, the emergence of Plastic feather sweep (Figure 2.2.1[b]) gradually replaced chicken feather sweeps. The method is the same, except that the chicken feathers are replaced with polypropylene plastic wires (Wikipedia, JSTOR September 2019). Its price is cheaper than a real chicken feather sweeper, but its usability is not as good as that of a chicken feather sweeper.

Figure 2.2.1[a]: Chicken feather sweep

Figure 2.2.1[b]: Plastic feather sweep

2.2.2 VACUUM MACHINE

The vacuum machine(Figure 2.2.2) is very effective at removing dust. Its strong suction can remove all of the dust that has stuck to surfaces, improving cleaning effectiveness (Wikipedia). The vacuum machine cleaner (Figure 2.2.2) has an adjustable head section that lets you choose different suction heads for different positions. It is attached to a movable telescopic wand to accommodate different conditions.

Figure 2.2.2: Vacuum machine

2.3 MATERIAL OVERVIEW

An overview and material selection are crucial steps that must be completed before a product is produced. Understanding material properties, characteristics, and the suitability of various materials for the intended purpose are some of the benefits of this process. A material overview also makes sure that only dependable and high-quality materials are used, which lowers the possibility of mistakes, flaws, or failures in the finished product.

Lastly, it is feasible to evaluate the materials' affordability, robustness, accessibility, and environmental impact by looking through them beforehand. Making educated decisions to maximise efficiency and savings is made easier with the help of this information.

2.4 ROLL CLEANING CLOTH

Specifically designed to protect and maintain the various types of rolls used in industrial processes, roll cleaning cloths are cleaning agents. A vast array of industrial machinery, including printing presses, manufacturing tools, and other apparatuses, use these rolls.

2.4.1 COTTON FIBERS

Cotton's fine fibre structure and interstitial spaces enable it to efficiently collect and hold dust particles instead of releasing them into the atmosphere. This lessens the possibility of dust settling back on the surfaces you've cleaned by increasing the cleaning efficacy of cotton cleaning cloths or mops. Furthermore, because cotton fibres are soft and breathable, using cotton cleaning tools usually doesn't harm household surfaces. They also don't produce static electricity, which makes dust removal and adsorption easier.

Figure 2.4.1: Cotton Fiber

2.5 ALUMINIUM

Aluminium is highly recyclable, and recycling requires only a fraction of the energy needed for primary production. This recyclability contributes to its sustainability and aligns with global efforts to reduce environmental impact. Aluminium's unique combination of properties, including its lightweight nature, corrosion resistance, and versatility, makes it a fundamental material in numerous industries, playing a pivotal role in modern technological advancements and sustainable practices.

2.5.1 Aluminium handle 25mm(diameter) x 1.5m size, grade alloy 3003

Aluminum exists in different shapes and grades, where the grade depends on the intended use. For example, aluminum alloy 2024 widely used in aircraft, especially wing and fuselage structure under tension.

Aluminum alloy 6063 is popular for visible architectural applications such as window frames, door frames, roofs, and sign frames. Aluminum alloy 3003(Figure 2.5.1) use for general fabrication or chemical application like cooking utensils, food containers, chemical equipment, pressure vessels, general sheet metal fabrication, hardware, tanks, and cabinets.

It has medium strength alloy with very good resistance to atmospheric corrosion and very good weldability as well as good cold formability. It has better mechanical properties, especially at elevated temperatures than the 1000 series alloys.

Aluminium alloy 3003(Figure 2.5.1) shows lightweight and ideal for commercial use, it is a standard universal thread, this material suits most on aluminium broomstick or the stick of mop commonly. The size of aluminium alloy is 25mm(diameter) with 1.5m(long).

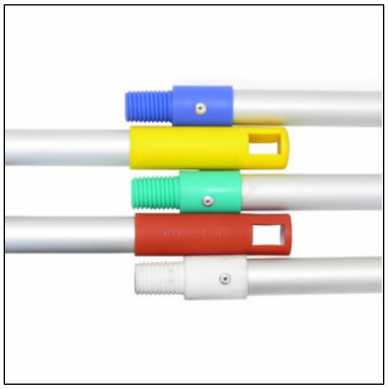


Figure 2.5.1: Aluminium Alloy 3003

2.6 STEEL

Steel is a versatile and indispensable alloy that has played a pivotal role in shaping the modern industrial landscape. Comprising primarily iron and carbon, with other elements in varying proportions, steel exhibits exceptional strength, durability, and a wide range of applications across numerous industries.

2.6.1 STAINLESS STEEL

The characteristics of stainless steel (Figure 2.7.1) is corrosion resistant, high tensile strength, very durable. Because it is composed of stainless steel, the handle is lightweight and convenient to store, greppable, weightless, and the stainless-steel handle is sturdy.

Figure 2.6.1: Stainless Steel

2.7 PREVIOUS RESEARCH

Previous research forms the foundation upon which new investigations are built, providing valuable insights, methodologies, and findings that contribute to the broader understanding of a particular subject.

2.7.1 User and Market Research with Proposed Concepts for Ceiling Fan Dust Cleaner

(Marilyn Supriya Albert, Sudarshan Katti & Arunachalam Muthiah, 07 June 2022)

Ceiling fan cleaning tools/equipment are a must-have household item for some families. Considering the current market, there are a set of standards, cleaning tools (products) available for ceiling fan dust removal. These products were not successful among users due to some ergonomic and usability issues. However, there aren't any research articles about these information/facts.

In order to better understand users' needs and expectations regarding cleaning methods and equipment, a user survey was conducted using a questionnaire, which helped to further understand the design process. This survey was included several questions regarding the above-mentioned issues while cleaning process, resulting in various concepts and hypotheses. The new concept design of this cleaning tool was developed to meet the needs (functionality and aesthetics) and expectations of the users.

From the results, the user felt some pain/discomfort in certain body parts such as the neck, shoulders, and arms, and experienced greater pressure at the waist area. Of course, other major issues were also identified during the observations, such as accessibility, ease of use and ease of implementation when using existing ceiling fan cleaning tools/equipment. Taking these user concerns into consideration, some conceptual designs were proposed that could potentially serve as better designs for the ceiling fan dust removal process.

2.7.2 Exploration of the factors affecting the performance of the ceiling fan

(International conference on advances in mechanical engineering-2022)

"Because the fan's geometry is connected to the flow field of the ceiling fan, it is also crucial. The angle at which the fan is held mostly controls how much air is circulated in the space. The size of the blade and the kind of motor being used generally have an impact on the flow field. The weight and height of the fan have a direct impact on the flow field as well. The performance and efficiency of the ceiling fan are impacted if the blade has any kind of bend or dent in it. Turbulence produced by a non-flat, uneven blade surface during rotation will lower the fan speed." According to the previous research, uneven blade can reduce the effectiveness and workability of fan, and the dust produced by static electricity may also have an effect.

Long-term dust buildup may result in the fan producing more power and less efficiency. A regular maintenance can provide more benefit, reduce the stress of the fan machine, increasing the effective of workability and keep the air flow with quality in hermetic space.

2.8 SUMMARY

Fan cleaners are essential tools for removing dust from electric fan blades. Maintaining the functionality of ceiling fans requires routine cleaning and maintenance. Because the fan blades create static electricity when they rotate, which draws in fine dust particles from the surrounding air, dust builds up on the blades over time.

A project's primary material selection is an important decision because it affects the final product's future by requiring in-depth investigation, analysis, and evaluation of a range of materials. A thorough examination of the literature in its field has been made possible by the extensive range of previous consultations, which is a crucial part of the literature review.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The foundation for carrying out research successfully is methodology, which offers an organised way to approach research issues. A number of crucial components are covered in this chapter, such as the introduction, research design, techniques for gathering and analysing data, research tools, sampling plans, and a summary of the subject matter. A thorough discussion is necessary to ensure that the product being developed is compared with others, as this is given special attention.

Methodology, which directs the selection and analysis processes, is essential to product engineering. It is possible to create products with accuracy and quality by carefully applying the methodology. Furthermore, the methodology includes the strategies, plans, and methods for gathering and analyzing data, all of which are essential for supporting a study's conclusions. The methodology section clarifies the issue being investigated and provides support for the strategies and methods selected for the study.

3.2 METHODOLOGY FLOW CHART

Methodology flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task. Example Figure 3.2 shows each step we take when building a smart ceiling fan cleaner.

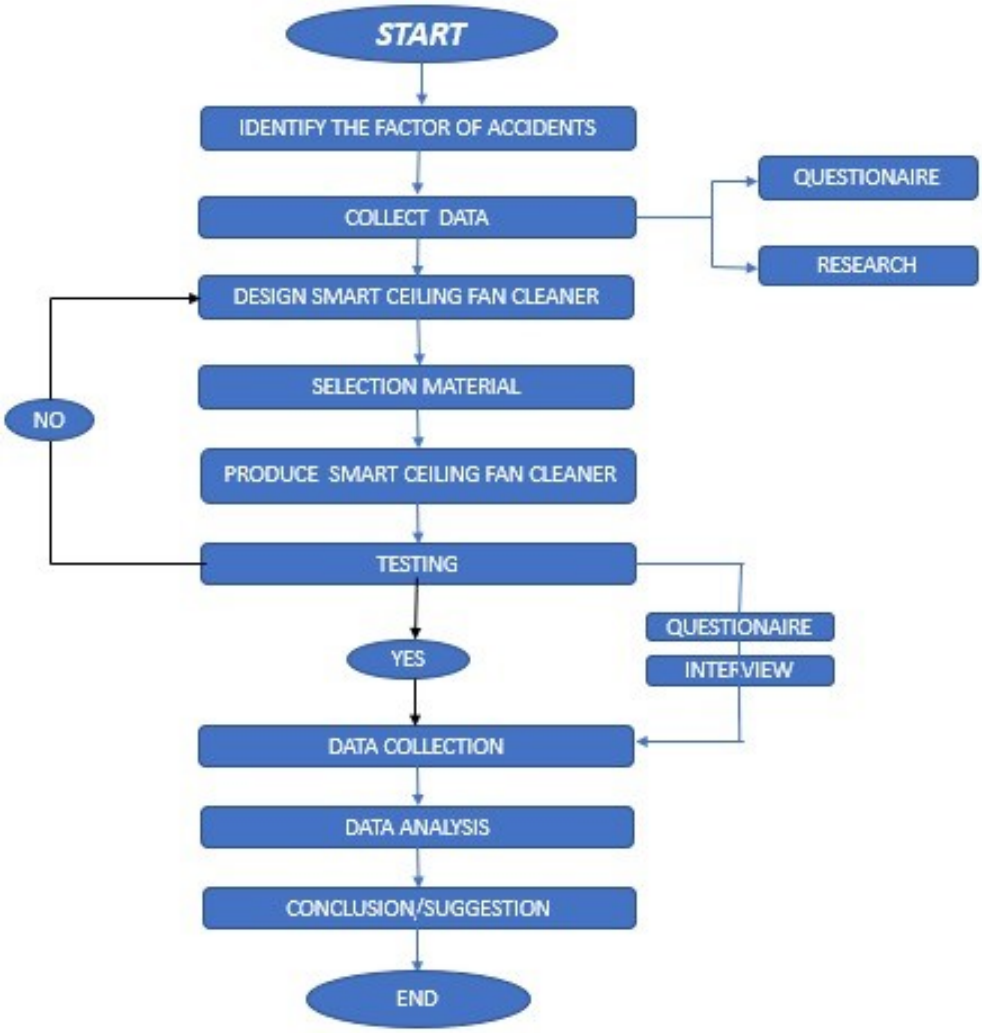


Figure 3.2: Methodology Flow Chart

3.3 IDENTIFYING PROBLEMS

At the early of this study was done to identify the problem of cleaning the ceiling fan with time duration went process cleaning. Therefore, researchers all planning is implemented to overcome the problem by creating a Smart Ceiling Fan Cleaner. With this product will help all time during cleaning prosses with cleaniless, also prevent accident happen to user.

3.4 ANLYSIS ON SURVEY RESPONSE

The questionnaire is implemented to analysed and to show the effectiveness of this product. In other word, this questionnaire is to show that the objective of this project is achieved. There are 4 sections in the form that will be given to the respondent, which is section A, B, C, D.

i. Section A: Background of respondents
ii. Section B: Problems encountered during conventional fan cleaning
iii. Section C: Risk Faced when cleaning ceiling fan conventionally
iv. Section D: Suggestion & Comment

All the data that has been collected from the questionnaire will be analysed using Microsoft Excel. The table shows the score scale and the level.

Score	Level
1	Strongly Disagree
2	Do not agree
3	Disagree
4	Agree
5	Strongly Agree

Table 3.4[a] score scale and level of standard

Mean score	Interpretation score
1.00 to 2.33	Disagree
2.34 to 3.66	Agree
3.66 to 5.00	Strongly agree

Table 3.4[b] Interpretation of mean

3.4.1 ANALYSIS ON SURVEY RESPONSE

1. ANALYSIS SECTION A: BACKGROUND RESPONDENT

    1. Gender – The percentage of male respondents is 53.8% and the percentage of female respondents is 38.5%.

    2. Age – The most respondent age are between 20-30 years old with 60.2% and 15.4% around 10-20 years old follow with the least 7.7% age between 50-60.

    3. Status - From the data showing we can see total of respondent 75% are single and 25% is marry.

    4. Work Status - From the data showing we can see 84.6% respondent are not working and 7.7% for both respondent working and student.

    5. Fan Cleaning Frequency - From the data we asking respondents how often they clean the fan most of them says once amont with 46.2% the other 23.1% says if there is a celebration.

2. ANALYSIS SECTION B: Problems encountered during fan cleaning by conventional method.

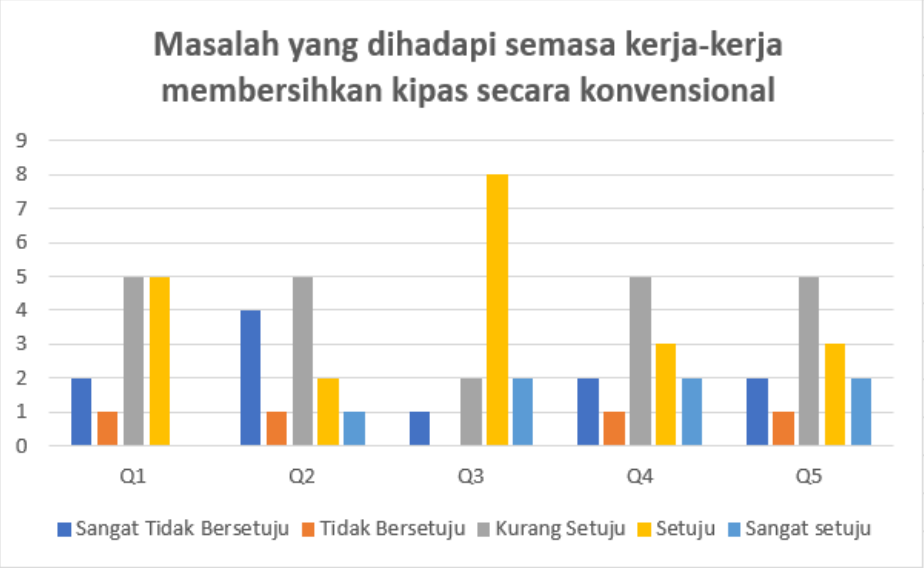


Figure 3.4.1[a]: the voted from the respondent analysis by Bar chart

*The graph shows the problem encountered during fan cleaning by conventional method. Y-axis is the number of votes from responder, and X-ais is about each question.

No	Mean score	Interpretation score
Q1	3	Agree
Q2	2.62	Agree
Q3	3.77	Strongly agree
Q4	3.15	Agree
Q5	3.15	Agree

Table 3.4.1[a] Mean score scale and interpretation of mean for section B

Figure 3.4[a] and Table 3.4[a], show the mean score bar chart for data analysis Section B. In the bar chart, each colour represents a different score and, in Table 3.4.1, the mean score is the average score from the respondent for every question. Based on the table, the highest score of "Strongly agree" which is **question 3**, the dust falling anyway while cleaning the ceiling fan, means most of the respondents from our research, reflected the problems of dust falling.

3. ANALYSIS SECTION C: Risk faced when cleaning ceiling fans conventionally.

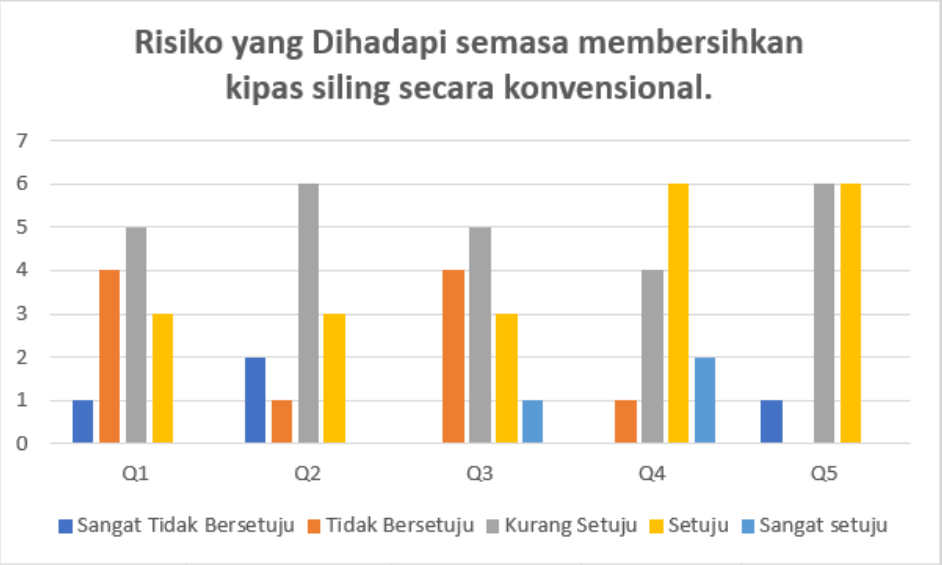


Figure 3.4.1[b]: The voted from the respondent analysis by Bar chart

*The graph shows the problem encountered during fan cleaning by conventional method. Y-axis is the number of votes from responder, and X-ais is about each question.

No	Mean score	Interpretation score
Q1	2.77	Agree
Q2	2.85	Agree
Q3	3.08	Agree
Q4	3.69	Strongly agree
Q5	3.31	Agree

Table 3.4.1[b]: Mean score scale and interpretation of mean for section C

Figure 3.4[b] and Table 3.4[b], show the mean score bar chart for data analysis Section B. In the bar chart, each colour represents a different score and, in Table 3.4.2, the mean score is the average score from the respondent for every question. Based on the table, the highest score of "Strongly agree" which is **question 4**, The dust flies while cleaning the ceiling fan interferes with eye and breathing, means most of the respondents from our research, reflected the problems of dust falling.

3.4.2 RESPONDENT COMMENT

The responder comments and suggestions play a vital role in the research process by ensuring the quality, validity, and advancement of scholarly work. Here is the summarize comment from the responder based on the question "**How to clean the ceiling fan effectively and simple?**"

I. Use the stick to connect the brush, no need to climb the ladder
II. Use a fan cleaner with long handle
III. Dust the fan blades with a duster or cloth and use a pillowcase or cloth to trap dust on the blade.
IV. Wipe the blade with a damp cloth.

Second, here is the respond from the other question "**Recommendations to reduce the risk of accidents when cleaning ceiling fans**"

I. Build tools that are easier to clean ceiling fans
II. Wear goggles to avoid dust entering the eyes
III. Use a sturdy and balanced ladder or stool. Wear safety glasses and a dust mask. Place something underneath to catch the falling dust.
IV. Be careful with cleaning agents to avoid damaging the motor. Inspect the fan for any damage before cleaning.

3.5 DESIGN PRODUCT

This design is intended so that before the implementation is done, it can reflect before the project is implemented even this design will provide more detailed information to build a “SMART CEILING FAN CLEANER”.

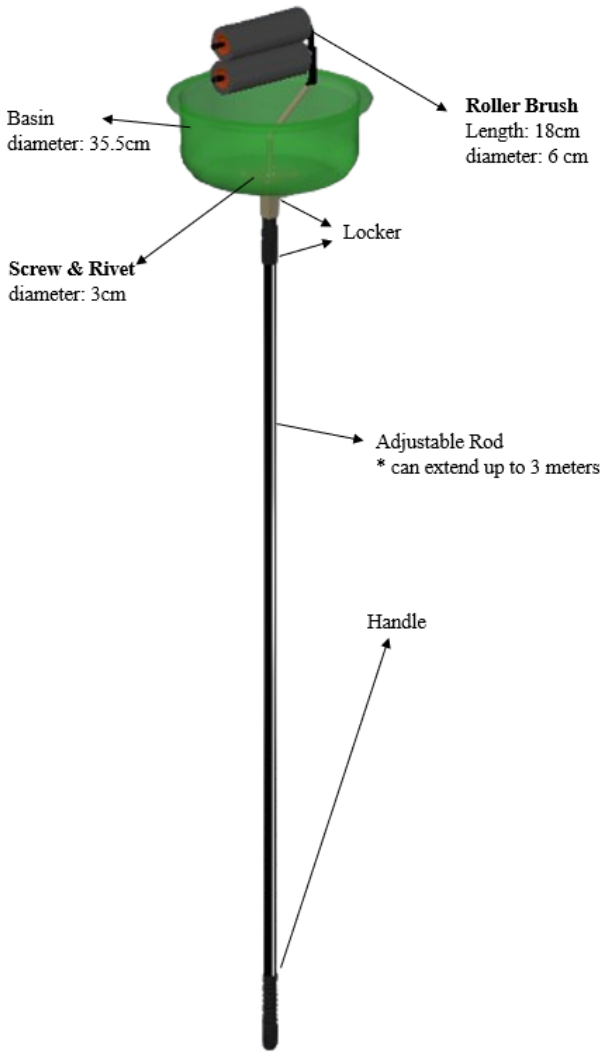


Figure 3.5: The Smart Ceiling Fan Cleaner

3.5.1 PRODUCT MANUFACTURING

Researchers design Smart Ceiling Fan Cleaner by dividing the construction of the product according to the defined parts like **Figure 3.5**.

Firstly, prepare the complete materials before implementing the production of the product. Secondly, build the upper frame using aluminum that connects the roller brush. Then, install the adjustable road with upper frame. After that, attach the basin in between two ends of the aluminum frame.Furthermore, install separately first roller brush with aluminum. Finally, attach all the part by using screw and rivet.

3.6 PRODUCT DEVELOPMENT

This project involves three main steps to implement the project starting from planning, implementation, and testing. All methods used are to find and analyze data on related projects. Product develop to 3 process that are:

Phase 1: Design Stage

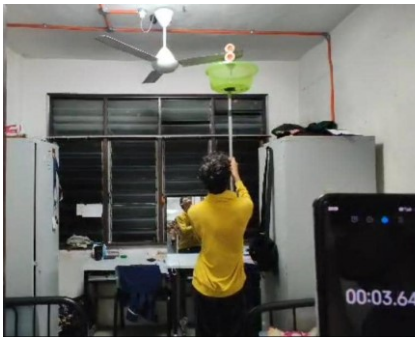
At the beginning, based on the final of user needs during emphety process, the research process moves on to design project. In this section, the first phase of the design has been completed. After that, we started looking for small factories to coordinate with us for the work. We went to a metal workshop and met a technician, Mr. Razak. When he asked about the purpose of our visit, we showed him the drawings. After reviewing them, he used his professional knowledge to make adjustments and suggestions to our design. Subsequently, we took Mr. Razak's concepts back to present to our supervisor and made the second round of design adjustments.

Phase 2: Project executing and Testing

After descussion, the final design of Smart ceiling Fan Cleaner are finalized. The materials has been set up with the design illustration for production. The workshop is in good condition, has a sufficient supply of tools, and is manned by professionals to oversee our work. In addition, the production of project with the professional guidance, the entire process went smoothly, and our project was completed on time.

Phase 3: Analysis performance also Identify Conclusion

To achieve the objective and actual performance of the product, we will provide the product to users for practice in order to determine the product's actual performance, also gather customer feedback through the questionnaires and interviews. We gather them for examination in order to ascertain the product's completeness and flaws. Finally, drawing conclusions throughout the construction of this product.



3.6.1 MATERIAL SELECTION

When choosing components to construct a ceiling fan cleaner, we make sure that each component is suitable in every way. Care must be taken during the selection process to ensure that no materials are wasted and that they are long-lasting and safe.

1) ADJUSTABLE RODS

Figure 3.6.1[a]: Adjustable rods

Adjustable rod as one of the parts in this product. it is made by aluminium and perform high strength, light weight with low price compare to others materials, like: metal, plastic, pvc and else. Adjustable rods can help people achieve the estimated height people can't reach.

2) ROLLER BRUSH

Figure 3.6.1[b]: Roller brush

The function of roller brush is, can scrub all the dust on the fan blades. It made of fabric; the characteristics is it have strong cleaning function.

3) BASIN

Figure 3.6.1[c]: basin

To collect the dust particles that are released while cleaning fans. Shaking the basin will keep dust from getting on the floor and from getting in the way of the cleaning procedure.

4) SCREW & RIVET

Figure 3.6.1[d]: Screws & Rivet

Screws & Rivet are used for the connection parts to make the product stronger and safer to use.

5) ALUMINUM

Figure 3.6.1[e]: Aluminium

Aluminium as a connecting tool to several parts because of its, light weight and easy handling.

3.7 COST ITEM

The price of materials is just an initial rough estimate to build our product which is the ceiling fan cleaner.

Material	Unit	Price
Adjustable Rods	1	RM 13.50
Roller Brush	2	RM 11.80
Plastic basin	1	RM 7.90
Screws & Rivet	1 box	RM 5.00
Aluminium Plate	2	RM 20.00
Steel	3	RM 15.00
Extra Cost		RM 15.00
	Total	RM 88.20

Table 3.7: Estimate Cost

3.8 METHODS OF DATA COLLECTION

Data collection is defined as the procedure of collecting, measuring, and analyzing accurate data for research using proper techniques. In order to get the real feedback from users, we implemented two different types of data collection. They are q/uestionnaire and interview.

3.8.1 QUESTIONNAIRE PROCEDURE

We can quickly obtain the average customer feedback for the product by using a questionnaire. Charts are a useful tool for determining whether a product is meeting user needs. Additionally, by using a questionnaire, we can determine which aspects of the issue have not actually been resolved, allowing us to strengthen and advance our efforts.

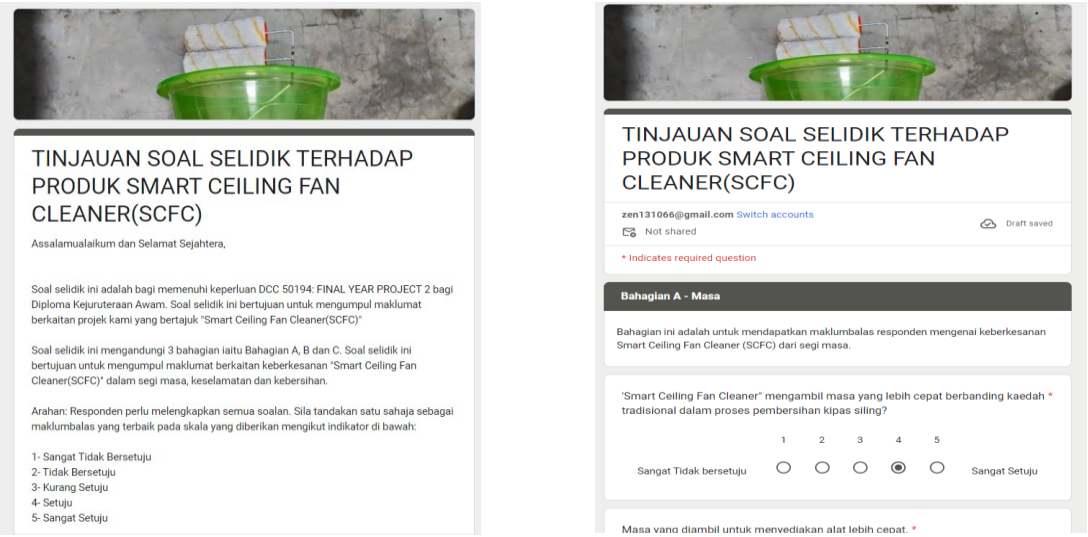


Figure 3.8.1[a]: Questionnaire

3.8.2 ANALYSIS SECTION OF SERVEY RESPONDENT AFTER USING SCFC THROUGHOUT QUESTIONNAIRE

I. Section A: TIME

a) Smart Ceiling Fan Cleaner take more time than traditional methods in the process of cleaning ceiling fans?
b) The time taken to set up the tool is faster.
c) The cleaning process of the Smart Ceiling Fan Cleaner tool after use is faster.
d) Users are faster to clean each fan blade by using 'SCFC'

	Q1	Q2	Q3	Q4
Person 1				
Person 2				
Person 3				
Average				

Table 3.8.2(a): Results on respondent in terms of time (prepared stage)

II. Section B: SAFETY

a) 'SCFC' can prevent dust from entering the eyesight and breathing.
b) The use of 'SCFC' allows hard-to-reach areas on the fan blades to be cleaned safely.
c) 'SCFC' dapat menggelakkan masalah ketinggian semasa pembersihan.
d) Can 'SCFC' prevent consumers from health and safety problems?
e) Can 'SCFC' overcome height problems effectively?

	Q1	Q2	Q3	Q4	Q5
Person 1					
Person 2					
Person 3					
Average					

Table 3.8.2(b): Results on respondent in terms of safety (prepared stage)

III. Section C: CLEANILESS

a) Is ‘SCFC’ capable of cleaning ceiling fans?
b) Does the ceiling fan spin faster after cleaning using ‘SCFC’?
c) Are you satisfied with the level of cleanliness of the ceiling fan after the cleaning process using ‘SCFC’?
d) Can the dust on the ceiling fan blades be completely cleaned by using ‘SCFC’?

	Q1	Q2	Q3	Q4
Person 1				
Person 2				
Person 3				
Average				

Table 3.8.2(c): Results on respondent in terms of safety

3.9 INTERVIEW PROCEDURE

In-person observations of users' actual product usage are possible through interviewing. The goal of this project is to gather as much realistic feedback as possible from people in actual life circumstances.

The objective of the interview is to determine the level of deviation and the actual circumstances of users when using the Smart Ceiling Fan Cleaner for cleaning. The actual actions and expectations frequently differ from one another.

3.10 SUMMARY

To ensure the smart ceiling fan cleaner are user-friendly and acceptable to be used, A structured user perception has been established for the smart ceiling fan cleaner. For ensuring the smart ceiling fan cleaners work properly, this procedure is crucial.

After data analysis, it is critical to summarise the results and make judgments about how effective the cleaning tool is. Making defensible decisions about the subsequent stages of product development is made possible by this. This talk seeks to emphasise the importance of our products and the advancements made to rectify the shortcomings of the current cleaning tools, proving their superiority.

3.11 GANTT CHART

PROJECT 1

TABLE 3.10: Timeline Project 1

A chart throughout the project's process is one that shows planning in blue and is followed by smooth progress in red.

PROJECT 2

ACTIVITIES/WEEK		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SURVEY	P															
	A															
DISCUSSION	P															
	A															
FINDING	P															
	A															
PURCHASE MATERIAL	P															
	A															
PROJECT MAKING	P															
	A															
PROPOSAL	P															
	A															
E-POSTER	P															
	A															
TESTING	P															
	A															
ABSTRACT	P															
	A															
PRESENTATION	P															
	A															

TABLE 3.10: Timeline Project 2

A chart throughout the project's process is one that shows planning in blue and is followed by smooth progress in red.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

These chapter will discuss the result of our project which have been implement during methodology. There are two types of testing, which are to determine the effectiveness and measure the efficiency of cleanliness. This chapter will analysis the feedback by using questionnaire respond.

4.2 DATA ANALYSIS OF PRODUCT “SCFC”

In other word, this questionnaire is to show that the objective of this project is achieved. There are 3 sections in the form that will be given to the respondent, which is section A, B, C. The aims of this questionnaire are, to collect information related the effectiveness of "Smart Ceiling Fan Cleaner (SCFC)" in terms of time, safety and cleanliness.

i. Section A: Times
ii. Section B: Safety
iii. Section C: Cleanliness

All the data that has been collected from the questionnaire will be analysed using Microsoft Excel. The table shows the weightage and interpretation of mean. This standard is use to identify the feedback from respondent. The all data will be analysis throughout these table.

Scale	Weightage
1	Strongly Disagree
2	Do not agree
3	Disagree
4	Agree
5	Strongly Agree

Table 4.2[a]: Likert scale

Mean score	Interpretation of mean
Disagree	1.00 ~ 2.33
Agree	2.34 ~ 3.66
Strongly agree	3.67 ~ 5.00

Table 4.2[b]: Interpretation of mean

I. Analysis of section A: Time

	Q1	Q2	Q3	Q4
P1	4	4	5	4
P2	4	4	3	4
P3	5	5	5	5
P4	5	5	4	5
P5	3	4	3	3
P6	4	3	3	4
P7	5	5	5	4
P8	5	5	5	5
P9	3	4	4	4
P10	4	4	4	4
P11	3	5	4	4
P12	4	5	3	5
P13	5	5	4	5
P14	3	4	3	4
P15	5	5	5	5
P16	4	3	3	4
Average	4.13	4.38	3.94	4.31

Table 4.2[c]: Result analysis in terms of time

At this section is about the feedback of the problem of safety are solved by Smart Ceiling Fan Cleaner. This data is a result of statistics collected through questionnaire. The questions and scoring standards are as follows:

The question from the questionnaire:

1. Smart Ceiling Fan Cleaner" takes faster than traditional methods in the process of cleaning ceiling fans?
2. The time taken to set up the tool is faster.
3. The cleaning process of the 'Smart Ceiling Fan Cleaner' tool is faster after use.
4. Users can clean the fan blades more quickly by using the “SCFC"

No	Mean score	Interpretation of mean
Q1	4.13	Strongly agree
Q2	4.38	Strongly agree
Q3	3.94	Strongly agree
Q4	4.31	Strongly agree
Total Average	4.19	

Table 4.2[d]: The interpretation of mean

Mean score	Interpretation of mean
Disagree	1.00 ~ 2.33
Agree	2.34 ~ 3.66
Strongly agree	3.67 ~ 5.00

Table 4.2(e): the standard of interpretation mean score

The questionnaires were designed with a rating score (table 4.2[c]), to manage the data collection and evaluation in analysis stages. From the data above, it can be seen that ratings of 3,4, and 5 are more frequent, while ratings of 1 and 2 are almost non-existent. At least so far, the user’s feedback on the product is quite positive.

Of course, to obtain the average rating for “cleaning efficiency” of product (SCFC), another standard is set (table 4.2(d)). Ratings of 1.00~2.33 are “Disagree”, 2.34~3.66 are “Agree”, and 3.66~5.00 are “Strongly agree”. From the performance of the results, the value of the mean score is 4.19[Q1-Q4], which means the respondent are “Strongly agree”, also reflects the average feedback from users on “Time”

II. Analysis of section B: Safety

	Q1	Q2	Q3	Q4	Q5
P1	4	5	5	5	4
P2	5	2	5	5	5
P3	5	5	5	5	5
P4	5	4	5	5	4
P5	4	2	4	4	4
P6	3	3	4	3	4
P7	3	5	5	5	3
P8	5	5	5	5	5
P9	4	4	4	4	4
P10	5	5	5	4	4
P11	5	5	5	4	5
P12	5	4	5	3	5
P13	4	5	5	5	4
P14	5	2	5	4	4
P15	5	5	5	4	4
P16	4	3	4	4	3
Average	4.44	3.86	4.75	4.31	4.18

Table 4.2[f]: Result analysis in terms of safety

At this section is about the feedback of the problem of safety are solved by Smart Ceiling Fan Cleaner. This data is a result of statistics collected through questionnaire. The questions and scoring standards are as follows:

1. 'SCFC" can prevent dust from entering the eye sight and breathing.
2. The use of 'SCFC' allows to reach the difficult areas on the fan blades to be cleaned safely.
3. 'SCFC" can prevent height problems during cleaning
4. It's the "SCFC" prevent consumers from health and safety problems?
5. It's the height problems be overcome by this product effectively?

No	Mean score	Interpretation of mean
Q1	4.44	Strongly agree
Q2	3.86	Strongly agree
Q3	4.75	Strongly agree
Q4	4.31	Strongly agree
Q5	4.18	Strongly agree
Total Average	4.31	

Table 4.2[g]: The interpretation of mean

Mean score	Interpretation of mean
Disagree	1.00 ~ 2.33
Agree	2.34 ~ 3.66
Strongly agree	3.67 ~ 5.00

Table 4.2[h]: The standard of interpretation mean score

The questionnaires were designed with a rating score (table 4.2[e]), to manage the data collection and evaluation in analysis stages. From the data above, it can be seen that ratings of 3,4, and 5 are more frequent, ratings of 2 come out a few at question 2, while ratings of 1 is almost non-existent. At least so far, the user's feedback on the product is quite positive.

Of course, to obtain the average rating for "safety effectiveness" of product (SCFC), another standard is set (table 4.2(f)). Ratings of 1.00~2.33 are "Disagree", 2.34~3.66 are "Agree", and 3.66~5.00 are "Strongly agree". From the performance of the results, the value of the mean score is 4.31[Q1-Q5], which means the medium value of the mean also reflects the average feedback from users on "Safety".

III. Analysis of section C: Cleanliness

	Q1	Q2	Q3	Q4
P1	4	4	5	4
P2	3	4	3	3
P3	5	5	5	5
P4	4	4	4	2
P5	4	2	3	2
P6	4	3	3	3
P7	4	5	4	4
P8	5	5	5	5
P9	4	4	4	4
P10	4	4	4	4
P11	4	4	5	5
P12	5	3	4	4
P13	5	5	4	4
P14	4	4	3	3
P15	5	5	5	5
P16	4	4	3	4
Average:	4.25	4.06	4	3.81

Table 4.2[i]: Result analysis in terms of cleanliness

At this section is about the feedback of the problem of cleanliness are solved by Smart Ceiling Fan Cleaner. This data is a result of statistics collected through questionnaire. The questions and scoring standards are as follows:

The question from the questionnaire:

1. Is the Smart Ceiling Fan Cleaner capable to clean ceiling fan?
2. Does the ceiling fan spin faster after cleaning by using "SCFC"?
3. Are you satisfied with the cleanliness of the ceiling fan after the cleaning process by using "SCFC"?
4. Could the dust on the ceiling fan blades completely cleaned by using "SCFC"?

No	**Mean score**	**Interpretation of mean**
Q1	4.25	Strongly agree
Q2	4.06	Strongly agree
Q3	4	Strongly agree
Q4	3.81	Strongly agree
Total Average	4.03	

Table 4.2[j]: The interpretation of mean

Mean score	Interpretation of mean
Disagree	1.00 ~ 2.33
Agree	2.34 ~ 3.66
Strongly agree	3.67 ~ 5.00

Table 4.2[k]: The standard of interpretation mean core

From the data above, it can be seen that ratings of 3, 4, and 5 are more frequent, ratings of 2 are the minimum, and the ratings of 1 is almost non-existent. So far, the user's feedback on product is quite positive.

To obtain the average rating for "cleaning efficiency" of product (SCFC), another standard has been set (table 4.2(h)). Ratings of 1.00~2.33 are "Disagree", 2.34~3.66 are "Agree", and 3.66~5.00 are "Strongly agree". From the performance of the results, the value of the total mean at this section, which is 4.03[Q1-Q4], "Strongly agree", also reflects the total average feedback from users on "cleaning effectiveness".

4.3 TESTING PROCEDURE

We have invited 16 participants in this test. There are using two different methods to cleaning the ceiling fan, product Smart Ceiling Fan Cleaner and the conventional/traditional methods.

At the same time, the times will be taking while they are proceeding cleaning process with two different ways, and record the duration. Looks for the result, product SCFC is more efficiency compare to traditional method because the time taken of SCFC is 60second/ 1 minute(average), and the traditional method takes 78.6second/ 1minute 18s (average).

People	Product SCFC	Conventional/Traditional method
P1	63s	80s
P2	52s	66s
P3	62s	72s
P4	59s	73s
P5	58s	74s
P6	63s	84s
P7	64s	76s
P8	58s	81s
P9	66s	75s
P10	65s	95s
P11	67s	88s
P12	55s	76s
P13	62s	90s
P14	70s	78s
P15	49s	70s
P16	50s	79s
Average	60s/1minute	78.6s/ 1minute 18s

Table 4.3: Time taken in between SCFC and conventional/traditional method.

4.4 SUMMARY

The respondents are satisfied with the time, cleanliness, and safety results that were gathered. Compared to the conventional method, the Smart Ceiling Fan Cleaner expedites the cleaning process.

The result can be concluded that the goal of the research has been achieve. First, to produce a Smart Ceiling Fan Cleaner. Second, to determine the effectiveness of the Smart Ceiling Fan Cleaner in terms of cleanliness and safety. Third, to measure the efficiency of the Smart Ceiling Fan Cleaner in terms of time.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 INTRODUCTION

The main goal of a research paper's discussion section is to explain and evaluate the findings while also offering perspectives on their importance. Firstly, it is imperative to place the results in the context of the body of existing literature, emphasizing how they advance or contradict existing knowledge. This section frequently explores the results' ramifications, going over how they may affect theory, practice, or policy more generally. The discussion may address any limitations or weaknesses of the study, offering suggestions for the future research directions to address these gaps and further advance knowledge in the field.

Finally, this section provides a brief summary of the main conclusions and their implications. Reiterating the study's primary contributions and highlighting their importance is a crucial step. In addition, the conclusion might provide useful suggestions for practitioners or policymakers based on the findings. In conclusion, it is customary to offer an analysis of the study's overall merits and limitations, highlighting areas in need of development and stressing the significance of further research in the field.

5.2 CONCLUSION

According to the result of effectiveness and efficiency test, the Smart Ceiling Fan Cleaner able to achieve the objective. however, the Smart Ceiling Fan Cleaner (SCFC), in terms of cleaning efficiency and effectiveness, is not inferior to traditional methods. While enhancing safety, it also addresses everyday cleaning problems. Additionally, SCFC can reduce dust accumulation, thereby decreasing allergens and improving indoor air quality, ultimately enhancing people's quality of life.

5.3 DISCUSSION

The Smart Ceiling Fan Cleaner [SCFC], the product has helped us accomplish most of our objectives. These recommendations came from outside supervisors, they came from industry, college, technical institute and others who assessed the product at the event “Final Year Project Competition and Exhibition” organized by Polytechnic, they suggested making the product's overall weight better and including a spring between the two cleaning roll brushes.

Because of the leverage principle, when the SCFC stretches too far, its weight is distributed unevenly, which makes it challenging for users to use. The majority of tools available today still don't have a solution for this issue.

The suggestions from the outside supervisors, they are suggested the part in between roll cleaner, can added a “spring” mechanism, to enhance the flexibility between the two rolls and effectively avoid the risk of the fan blades being bent. This "spring" mechanism can also adjust according to the thickness of dust between the fan blades, improving its flexibility and cleanliness.

Secondly, the weight performance of the SCFC needs improvement. While it can reach the required position when extended, it becomes excessively heavy due to the leverage principle. This is a challenge we're currently facing, and we haven't found an effective solution yet.

5.4 SUMMARY

The summarize of discussion and conclusion, The Smart Ceiling Fan Cleaner (SCFC) has achieved most objectives but requires further development based on feedback from external supervisors and industry experts at the "Final Year Project Competition and Exhibition" organized by Polytechnic. Recommendations include improving the overall weight distribution and incorporating a spring mechanism between the cleaning roll brushes to enhance flexibility and prevent fan blade damage. Despite reaching the desired position when extended, the SCFC's weight becomes problematic due to the leverage principle, posing usability challenges. Efforts to address this issue are ongoing, but a viable solution has yet to be found.

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APPENDIX

GANTT CHART:

PROJECT 1

Activities	s														
Week		w1	w2	w3	w4	w5	w6	w7	w8	w9	w10	w11	w12	w13	w14
Project selection	P														
	I														
Literature review	P														
	I														
Survey	P														
	I														
Kos estimate	P														
	I														
Proposal	P														
	I														
3d object	P														
	I														
Methodology	P														
	I														
Gant chart	P														
	I														
Presentation	P														
	I														

TABLE 6.1: Timeline Project 1

A chart throughout the project's process is one that shows planning in blue and is followed by smooth progress in red.

PROJECT 2

ACTIVITIES/WEEK	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SURVEY	P														
	A														
DISCUSSION	P														
	A														
FINDING	P														
	A														
PURCHASE MATERIAL	P														
	A														
PROJECT MAKING	P														
	A														
PROPOSAL	P														
	A														
E-POSTER	P														
	A														
TESTING	P														
	A														
ABSTRACT	P														
	A														
PRESENTATION	P														
	A														

TABLE 6.2: Timeline Project 2

DATA ONLINE SURVEY-

CHAPTER 3[METHODOLOGY]-

RESEARCH OF CEILING FAN- QUESTIONNAIRE

Background check

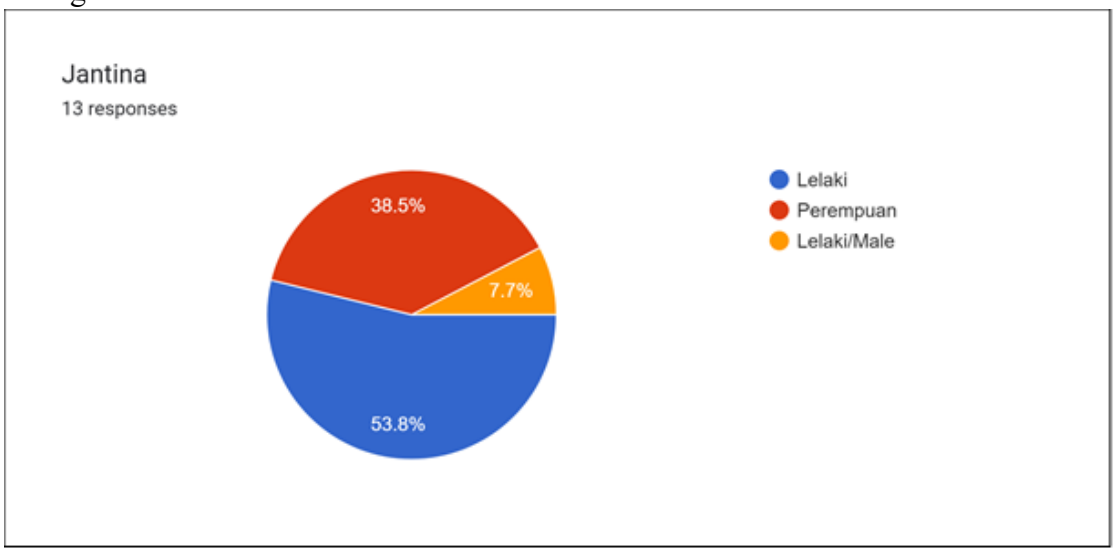

Figure 3.1: Gender of respondents

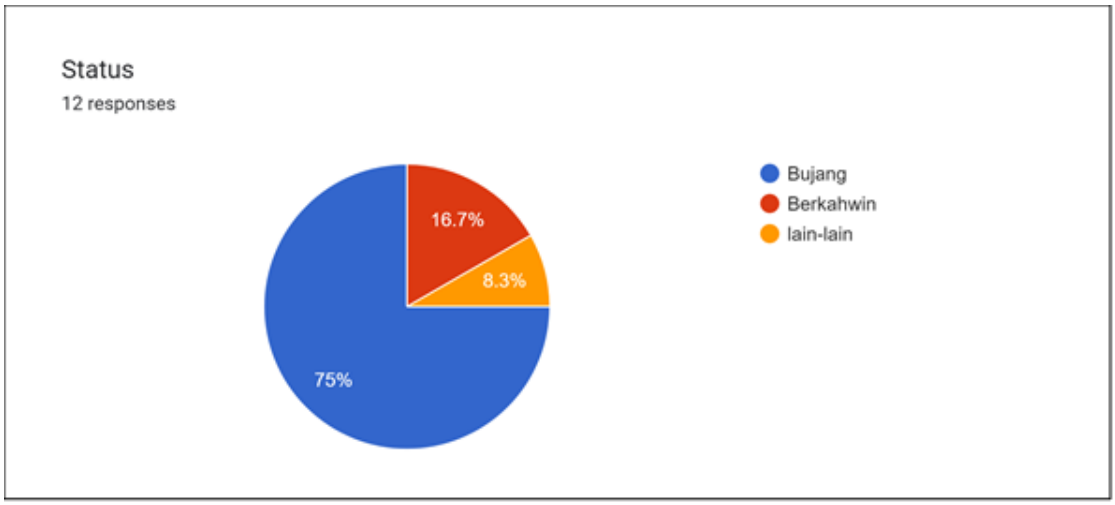

Figure 3.2: Age of respondents

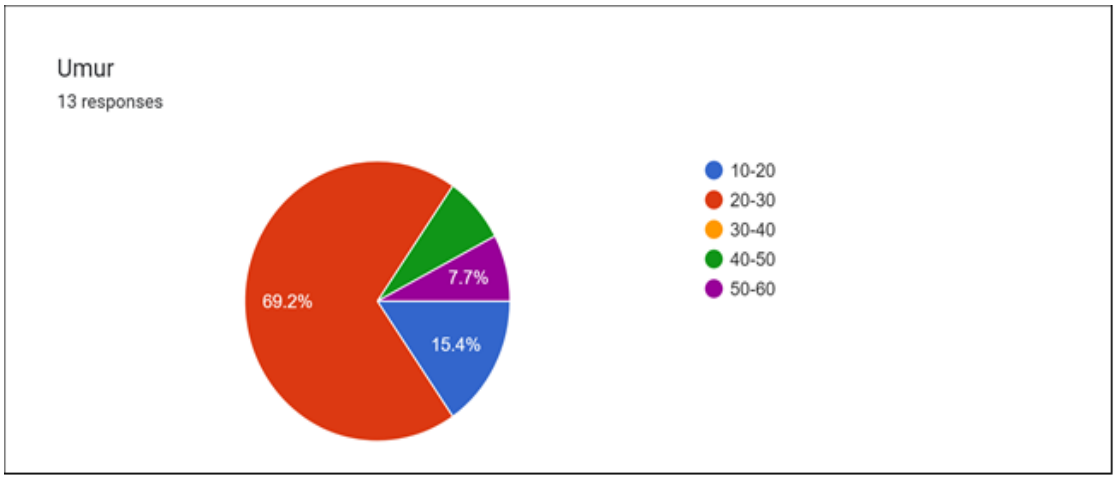

Figure 3.3: Status of respondents

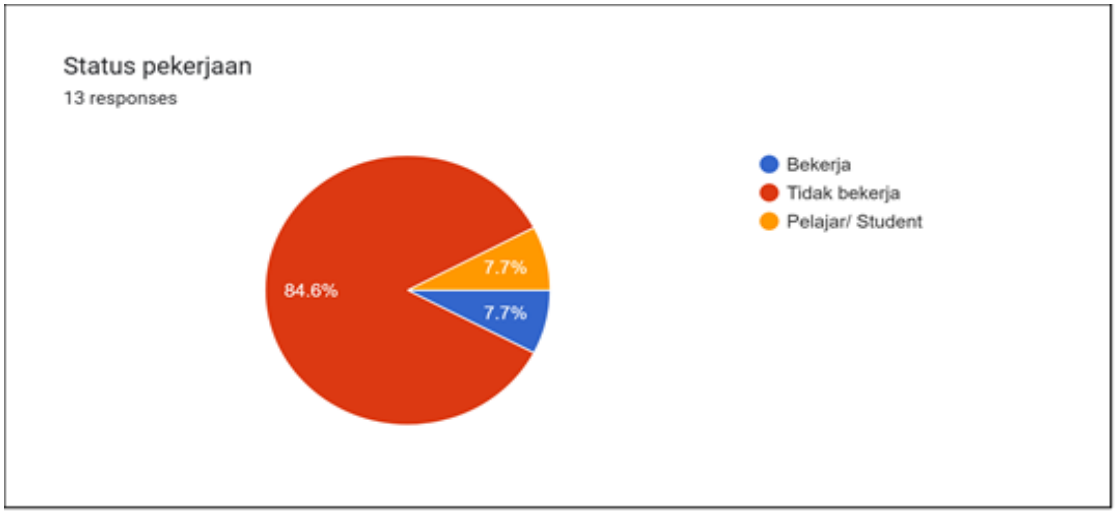

Figure 3.4: Work Status

Figure 3.5: Questionnaire

Asked the respondent if the conventional method of cleaning the fan consumes a lot of energy and time.

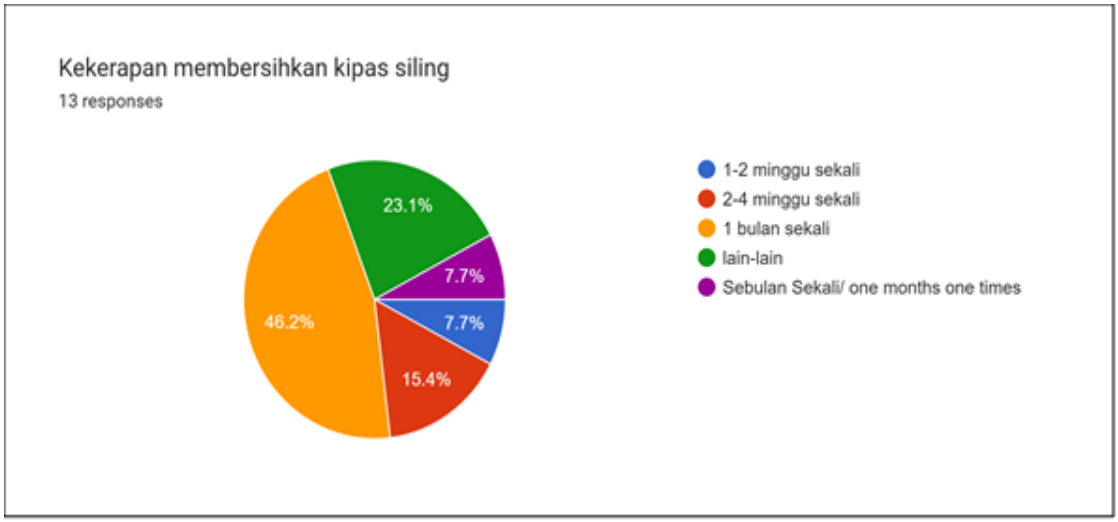

Figure 3.6: Questonnaire

Asking respondents how long to do the cleanning process for ceiling fan

Part B: Problems faced during conventional fan cleaning works.

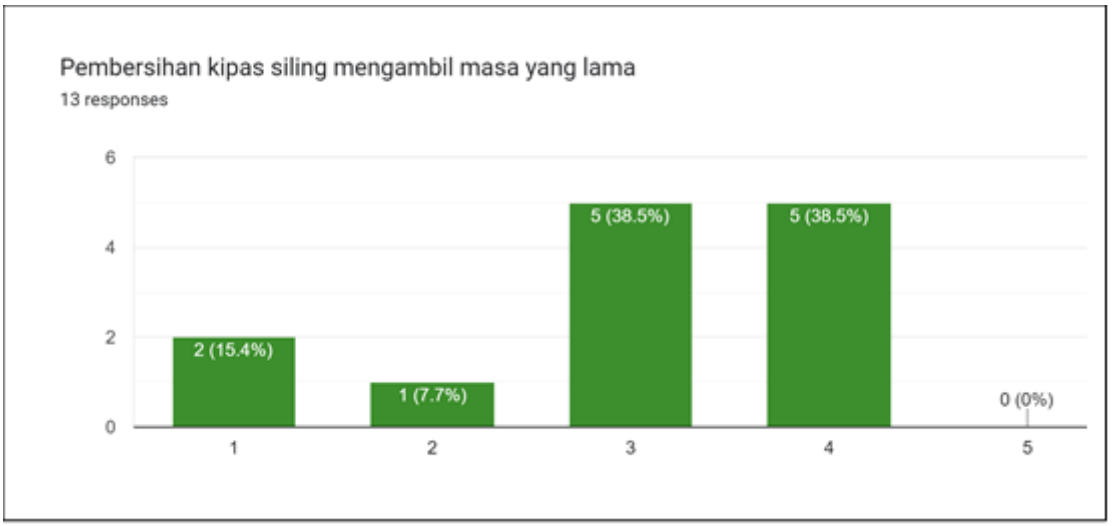

Figure 3.7: Time

The figure shows that most respondents choose 3 and 4 which is agree and natural.

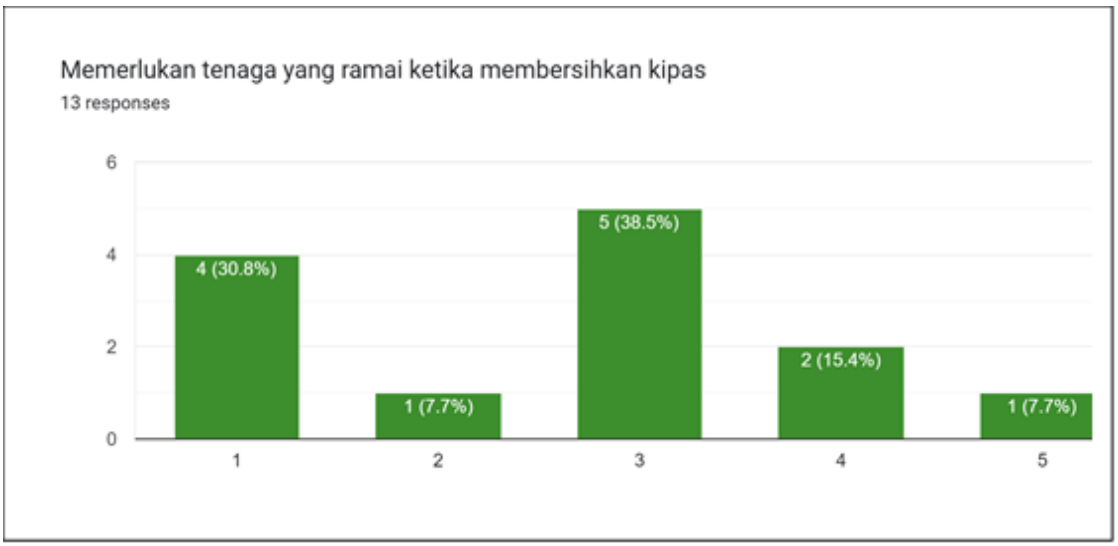

Figure 3.8: Manpower

The highest value recorded is number 3 which is 38.5 percent.

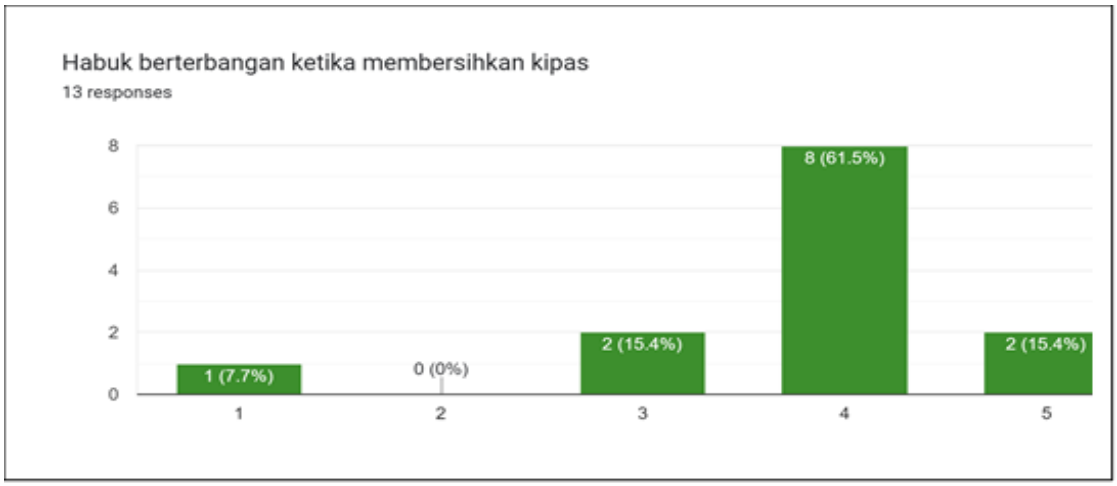

Figure 3.9: Falling dust

in our respondent, they are a lot of agree that during the cleaning process, the fan increases the amount of dust that falls.

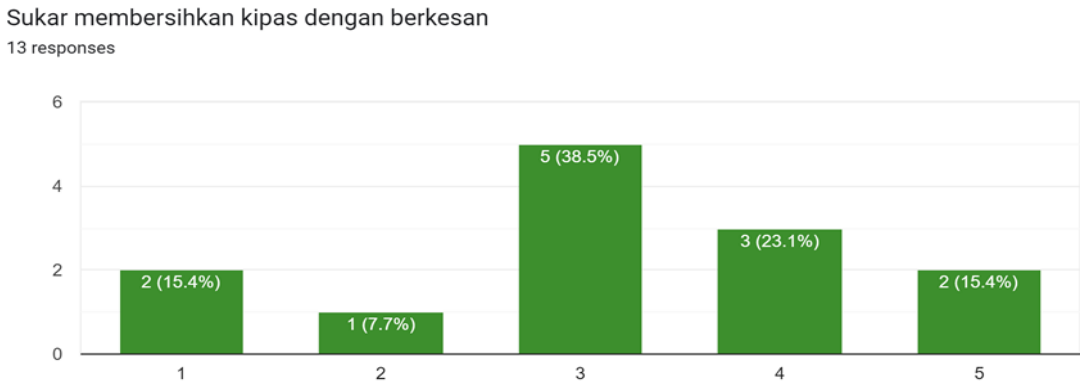

Figure 3.10: Difficulty

Figure 3.10.10 displays number 4 with 23.1 percent, number 5 with 15.4 percent, and the highest which is number 3 with 38.5 percent.

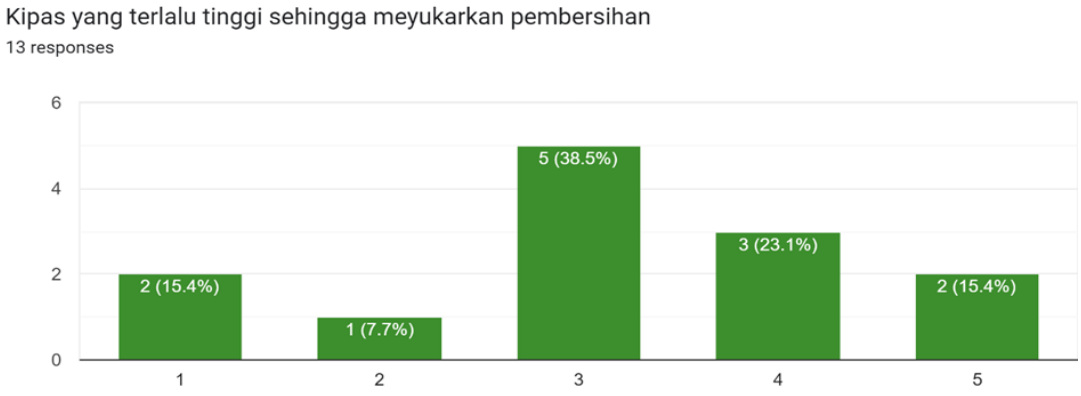

Figure 3.10.11: Height of fan

The most respondents chose 3 which is less agree at this part, while only 2 people chose 5 which is strongly agree in this part.

Part C: Risks Faced when cleaning ceiling fans conventionally.

Figure 3.10.12: Questionnaire

23.1 percent of people voted for 4 that agree when cleaning ceiling fans with method conversational is a risk of getting injured.

Figure 3.10.13: Questionnaire

The most respondents disagree or natural that cleaning the fan can expose them to accidents.

Figure 3.10.14: Questionnaire

The highest votes is disagree or natura, about the conventional fan cleaning will expose users to health problems.

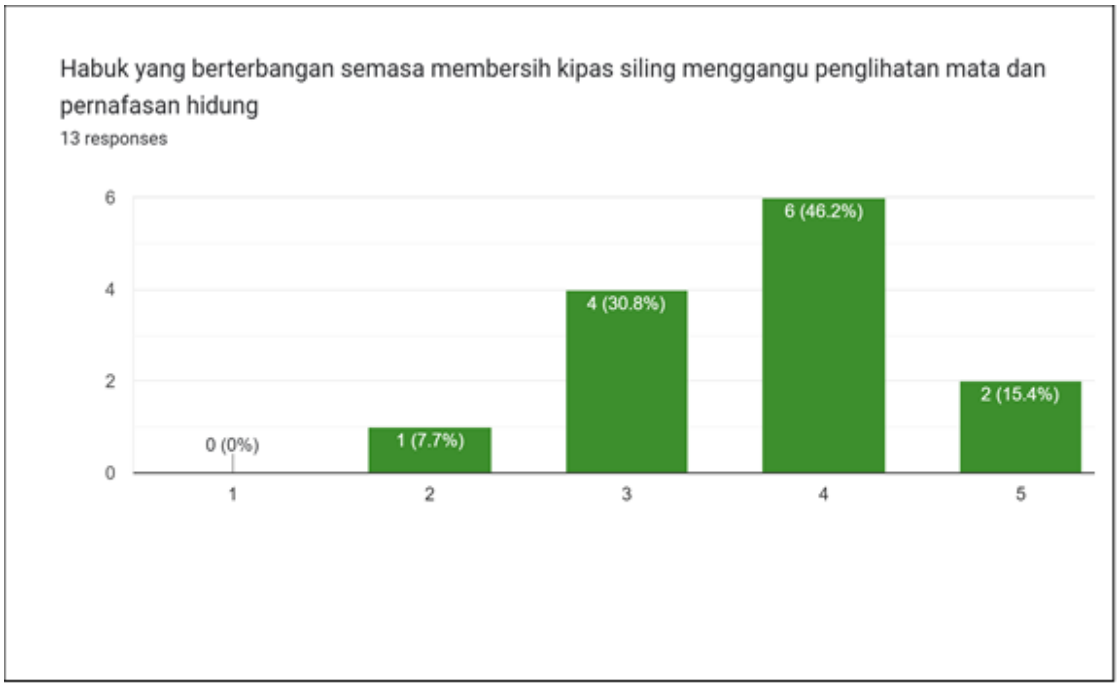

Figure 3.10.15: Questionnaire

6 people are agree that dust flying during cleaning can interfere with vision and breathing.

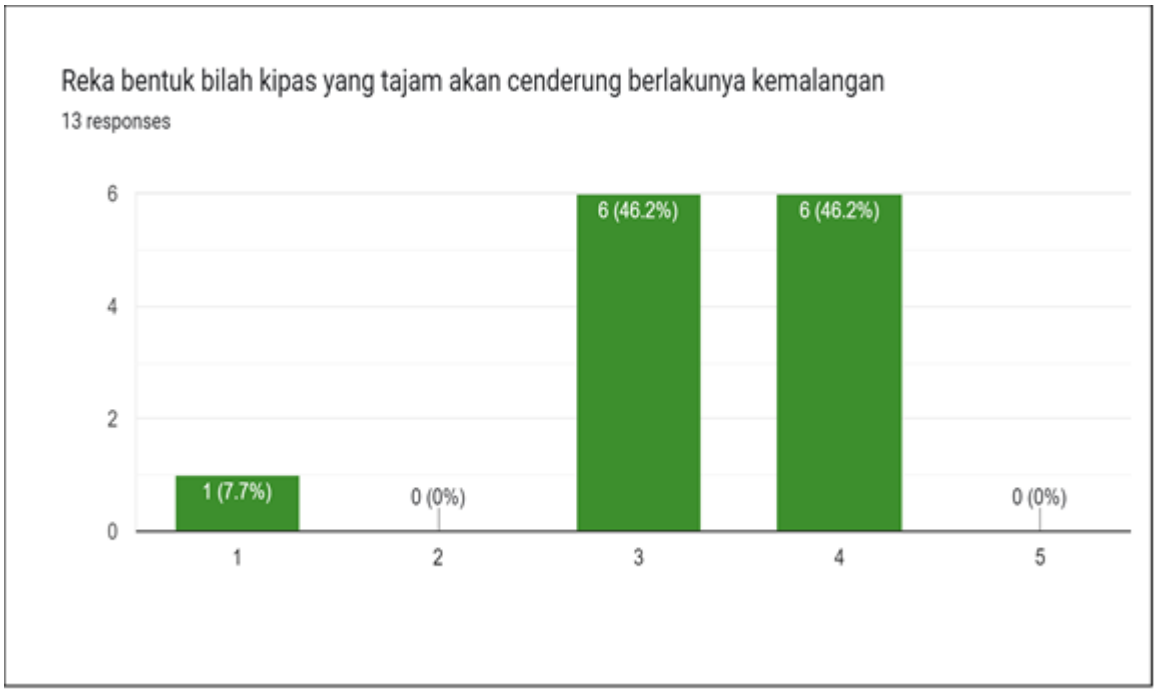

Figure 3.10.16: Questionnaire

3 and 4 achieve with the same number of votes which is 6 about the sharp fan blades will tend to cause accidents.