POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART CEILING FAN CLEANER

TEOH WEI ZHI

08DKA21F2053

JABATAN KEJURUTERAAN AWAM

SESI 1:2023/2024

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART CEILING FAN CLEANER

TEOH WEI ZHI

08DKA21F2053

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

SMART CEILING FAN CLEANER

1. Saya, TEOH WEI ZHI (031201-07-0569) adalah pelajar Diploma Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah, yang beralamat di Persiaran Usahawan, Seksyen U1, 40150 Shah Alam, Selangor
(Selepas ini dirujuk sebagai 'Politeknik tersebut')

2. Saya mengakui bahawa 'Smart Ceiling Fan Cleaner' 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 'Smart Ceiling Fan Cleaner' kepada 'Politeknik tersebut' bagi memenuhi keperluan untuk menganugerahan Diploma Kejuruteraan Awam kepada kami.

Diperbuat dan dengan sebenar-benarnya diakui)
oleh yang tersebut;)
TEOH WEI ZHI) ……
(No. Kad Pengenalan: 031201-07-0569),) TEOH WEI ZHI
Di hadapan saya, PUAN ZURINA BINTI)
SAFEE ( ) sebagai) ……
penyelia projek pada tarikh: / /2024)

Click or tap here to enter text.

ACKNOWLEDGEMENT

This project succeeded due to the assistance and backing of numerous individuals. I would like to express my gratitude to everyone for their support.

Madam Zurina Binti Safee, who oversaw our studies and research, is the first individual we wish to express our gratitude for her invaluable assistance and support. We appreciate the time and dedication she invested in helping us complete this project, particularly during the research and report compilation stages. Her patience and backing throughout this endeavor were truly commendable.

Additionally, the project coordinator for the final year, along with all the lecturers, were commended for their dedication to delivering insights and presentations on the project.

At the end of our study, we wish to extend our gratitude to our parents, siblings, relatives, and closest friends for their consistent support and encouragement. Our project's success would not have been possible without their steadfast backing.

ABSTRACT

Nowadays, many individuals like homemakers and cleaning professionals struggle with cleaning ceiling fans. They often rely on outdated methods, such as using ladders or disassembling the fan blades before cleaning. Additionally, they use inadequate cleaning tools like rags, brooms, and even feathers. These methods and tools are problematic due to safety concerns, extended cleaning time, and inconsistent cleaning results. While previous research has highlighted these challenges, comprehensive solutions remain elusive. This study aims to address these cleaning difficulties by proposing innovative solutions. We surveyed community members, particularly homemakers and cleaning professionals, to understand their cleaning challenges better. Based on the feedback received several improvements to the fan cleaner have been suggested, including an extendable rod up to 3 meters, a rotating brush, and a drainage system for easy cleaning. For enhancements to this tool, consider using a more lightweight rod to lessen the weight, and for cleaning, implement a fabric-wrapped roller that effectively captures more dust.

ABSTRAK

Kini, ramai individu seperti suri rumah dan profesional pembersihan menghadapi kesukaran dalam membersihkan kipas siling. Mereka sering bergantung pada kaedah lama, seperti menggunakan tangga atau membongkar bilah kipas sebelum membersihkan. Selain itu, mereka menggunakan alat pembersihan yang tidak sesuai seperti kain lap, penyapu, dan malah bulu. Kaedah dan alat ini membawa masalah keselamatan, masa pembersihan yang lama, dan keputusan pembersihan yang tidak konsisten. Walaupun penyelidikan sebelum ini telah menyoroti cabaran-cabaran ini, penyelesaian yang menyeluruh masih belum ditemui. Kajian ini bertujuan untuk menangani kesukaran pembersihan ini dengan mencadangkan penyelesaian inovatif. Kami menjalankan tinjauan terhadap ahli komuniti, khususnya suri rumah dan profesional pembersihan, untuk memahami cabaran pembersihan mereka dengan lebih baik. Berdasarkan maklum balas yang diterima, beberapa penambahbaikan kepada pembersih kipas telah dicadangkan, termasuk rod yang boleh diperluas hingga 3 meter, berus yang boleh berputar, dan sistem pengaliran untuk pembersihan yang mudah. Untuk peningkatan kepada alat ini, pertimbangkan untuk menggunakan rod yang lebih ringan untuk mengurangkan beratnya, dan untuk pembersihan, implementasikan roller yang dilapisi dengan kain yang dapat menangkap lebih banyak habuk.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

LIST OF SYMBOLS

SYMBOL	
s	second
m	minutes

LIST OF ABBREVIATIONS

PSA	Politeknik Sultan Salahuddin Abdul Aziz Shah
SCFC	Smart Ceiling Fan Cleaner

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The purpose of the introduction is to provide readers with key background details about the subject and prepare them for the main content. It grabs attention, underscores the topic's importance, and frequently introduces the central argument or main point. In academic writings, speeches, or presentations, it aims to captivate the audience, offer context, and highlight the forthcoming content, seamlessly transitioning them into the core part of the text or discussion. Smart Ceiling Fan Cleaner is an innovative project to solve the issue of safety and cleaning ceiling fan blade problems in households. These chapters will elaborate on the background of the project, the objective, and the scope of the study.

1.2 PROJECT BACKGROUND

A ceiling fan is a mechanical device suspended from the ceiling of a room, typically with blades that rotate to circulate air within the space. It is designed to improve air circulation and create a cooling effect by moving air around the room. Ceiling fans are commonly installed in residential and commercial spaces and are available in various designs, styles, and sizes to suit different preferences and room sizes. They are a popular and energy-efficient alternative to air conditioning, as they consume less electricity and can contribute to energy savings by helping to maintain a comfortable environment (MK Think, 2017).

A ceiling fan cleaner is a specialized tool or cleaning product designed to make the task of cleaning ceiling fans more efficient and effective. Cleaning ceiling fans can be challenging due to their elevated position and the accumulation of dust on both the blades and the fan motor housing. A ceiling fan cleaner is intended to simplify this process and may come in various forms. Here are a few common types. At present, numerous individuals including housewives, cleaning contractors, and others encounter challenges when cleaning the ceiling fan. The existing methods involve outdated practices like climbing stairs before starting the cleaning process. Climbing on furniture or using unstable ladders to reach the fan can pose a safety risk. Falls can result in injuries, so it's crucial to use appropriate equipment and take necessary precautions to ensure personal safety. 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).

Nowadays, many housewives are still using the traditional method to clean the ceiling fan blades. It is takes more time and energy compare to the cleaning tool that already have in the market. The cleaning tools that already have in the market such as chicken feather, microfiber flexible duster and others is good in using but still need improvements while cleaning the ceiling fan. The new innovation product need to be created to eliminate defective cleaning tools and this new innovation product should be more effective and suitable for use to clean the ceiling fan blades.

1.3 PROBLEM STATEMENT

The ceiling fan blades accumulate dirt over time due to prolonged use without cleaning. Therefore, it is essential for people to clean them regularly to ensure proper functionality. When using traditional cleaning methods, there is a significant risk that people may not be able to reach the necessary height to clean the blades effectively (Frazana, 2019). It is because normally the ceiling fans are installed at least 3m above the ground level. It is a height that humans simply cannot reach. So, when a human uses the traditional method to clean the ceiling fan blades which is using a ladder to climb upward for the purpose of cleaning the ceiling fan blades, there is a high risk of an accident happening during the cleaning process. As an example, the news reported in India, a 40-year-old woman died after falling down while cleaning the ceiling fan blades in her residence. It is dangerous, especially for old people and children. During the cleaning process of the ceiling fan blades, there might be a cloud of dust falling down into your eyes and nose causing us discomfort (Ahmedabad Mirror, 2017). So, after the research, it is necessary to create a new innovative product that can facilitate the process of cleaning the ceiling fan blades.

Based on the data online survey, most respondents agreed that the dust will fall down to the eyes and noise while cleaning the ceiling fan blades by using the traditional method. Furthermore, there are also happening some accidents that can lead to injury when climbing up the ladder to reach the level of ceiling fan blades for the purpose of the cleaning process.

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

The scope of the project are state below:

I. Smart Ceiling Fan Cleaner is designed based on standard fans of household.
II. The material and tool use to produced Smart Ceiling Fan Cleaner:
    - Roll cleaning cloth
    - Aluminum
    - Basin
    - Locker
    - Handle

- Adjustable rod
- Screw & Rivet
- Steel

III. The Smart Ceiling Fan Cleaner will be tested by two types of test which is :

- Workability test:
  - 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.

- Effectiveness test:
  - 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

The conventional method are lack of the effectiveness in cleaning and prove to the accident.The Smart Ceiling Fan Cleaner will reduce the safety issue since we do not need to climb the stair to clean the ceiling fan blades.While various methods, including the use of chicken feathers and brooms, have been attempted to clean ceiling fans, these approaches lack a guarantee of safety and can pose challenges for users. In contrast, the Smart Ceiling Fan Cleaner introduced here addresses these concerns. This innovation is poised to make a positive contribution to the community by providing an effective solution for ceiling fan cleaning, ultimately diminishing the risk of accidents during the cleaning process.

1.8 IMPORTANCE OF THE WORK

- Safety guarantee since users doesn’t need to climb the stairs for the purpose of clean the ceiling fan blades.
- Time saving because the roller will clean the ceiling fan blades with continuous turning.
- Energy saving since users just need to stand downward the ceiling fan and move the holder of the ceiling fan cleaner to start the cleaning process.

1.9 SUMMARY

The introduction provides an overview of the genesis of this project title. The inspiration for this initiative arose from a widespread challenge encountered by numerous individuals when cleaning ceiling fans. Recognizing the prevalent issues faced by people in this regard compelled researchers to address the problem. The hazardous nature of ceiling fan cleaning became apparent, particularly when users had to ascend unstable stairs, raising concerns about safety. Furthermore, individuals experiencing backaches found the task uncomfortable, emphasizing the need for a solution to enhance both safety and comfort during the ceiling fan cleaning process.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review entails a thorough examination and analysis of existing scholarly literature pertaining to a specific topic or research inquiry. Its primary functions include providing context, pinpointing areas of deficiency, assessing methodologies, amalgamating discoveries, recognizing patterns, and bolstering hypotheses or assertions within a particular academic domain. The process of conducting a literature review initiates with researchers delineating the scope of their investigation, followed by a systematic exploration of pertinent literature from diverse academic outlets like journals, texts, and databases. Employing critical scrutiny, researchers meticulously assess these sources, meticulously selecting and structuring them in a thematic or chronological manner to scrutinize and amalgamate key discoveries, methodologies, and arguments. Subsequently, the literature review is articulated, integrating summaries, analyses, and evaluations of the chosen sources, organized in alignment with the adopted structural framework. Ultimately, a meticulously executed literature review enriches scholarly discourse, provides guidance for future research endeavors, and facilitates the contextualization of researchers' contributions within the broader academic landscape.

2.2 FAN CLEANER

A fan cleaning device serves the purpose of maintaining and tidying up various kinds of fans present in residential or industrial environments. Available in diverse

forms, such as brushes, dusters, sprays, and vacuum attachments, these tools are tailored to effectively eliminate dust, dirt, and debris from fan blades, grilles, and other parts. The cleaning procedure typically commences with the fan's preparation, ensuring it is turned off and unplugged for safety. Employing a fan duster or a soft-bristled brush, loose particles are delicately removed from the blades, motor housing, and grilles. For a more thorough cleaning, specialized cleaning solutions or sprays can be utilized and applied cautiously to prevent any harm to the fan's motor or electrical components. Vacuum attachments equipped with brush or crevice tools further aid in the removal of dust and debris from internal components. Subsequently, wiping down the blades, motor housing, and grilles with a damp cloth and allowing ample time for drying completes the cleaning process. Regular maintenance and cleaning not only enhance the fan's performance and lifespan but also contribute to a healthier indoor environment by minimizing the circulation of dust and allergens. Manufacturer-specific cleaning instructions and recommendations may vary based on the type and model of the fan (Bonnie G. Horne, 1994).

2.2.1 FEATHER SWEEP

Chicken Feather sweeping, an age-old tradition observed in diverse cultures globally, entails the ceremonial and practical use of feathers to purify and cleanse spaces, objects, or individuals. This ritualistic act involves delicately sweeping with feathers sourced from birds such as ostriches or peacocks, with the intention of dispelling negative energies, warding off malevolent spirits, and inviting positive vibrations. Typically conducted in sacred settings like temples or homes during spiritual rituals, feather sweeping is often accompanied by prayers, chants, or customs passed down through generations. Beyond its spiritual significance, this ancient practice also serves pragmatic purposes, effectively removing dust, debris, and impurities from surfaces without causing harm. As the feather glides gracefully, it symbolizes a profound connection to nature, harmony, and equilibrium, embodying a timeless tradition that continues to resonate across cultures worldwide (GillianS.Holmes, 2024).

Figure 2.1: Chicken feather sweep

Figure 2.2: Plastic feather sweep

2.2.2 VACUUM MACHINE

A vacuum machine, commonly referred to as a vacuum cleaner, stands as an essential household apparatus engineered to efficiently clear floors, carpets, upholstery, and various surfaces by generating suction to draw in dirt, dust, and debris. This indispensable contraption comprises key elements, including a motor, a fan or impeller, a filtration mechanism, and an array of attachments such as brushes and nozzles. Upon activation, the motor initiates suction, pulling air along with dirt and debris into the device with the assistance of the fan. Subsequently, the filtration system captures these particles while permitting clean air to be discharged back into the surroundings. Vacuum cleaners are available in diverse types, encompassing upright, canister, handheld, and robotic variants, each offering distinctive features and benefits tailored to different cleaning requirements and preferences. With technological advancements,

contemporary vacuum machines often integrate additional functionalities such as bagless operation, adjustable suction capabilities,high efficiency particulate air filtration for allergen elimination, and smart features like automated navigation and remote control operation. Whether utilized for routine domestic cleaning or professional purposes, vacuum machines play a pivotal role in upholding cleanliness and hygiene within indoor spaces, thereby fostering a healthier and more comfortable living environment (Gantz, Carroll, 2012).

Figure 2.3: Vacuum machine

2.3 ROLL CLEANING CLOTH

Roll cleaning cloths are tailor-made cleaning products engineered for the upkeep and preservation of a wide array of rolls employed in industrial operations. These rolls are integral components in a multitude of applications, spanning from printing presses to manufacturing machinery and other industrial apparatuses where rolls play a crucial role (Norman Breakey, 1975).

2.3.1 MICROFIBER

Microfiber, a synthetic material formed from a combination of polyester and polyamide, consists of ultra-fine fibers approximately one-sixteenth the diameter of a

human hair. These minuscule fibers operate akin to 'hooks,' adeptly capturing and retaining dust, dirt, and grime. Furthermore, it stands as a superb substitute for cotton. In contrast to cotton fibers, which merely redistribute dirt and trap it on the surface, microfiber actively seizes undesirable particles, leaving no residue in its wake.

The applications of microfiber are broad-ranging, encompassing household cleaning tasks and automotive upkeep alike. Whether employed to eliminate smudges or stains from glass surfaces using a microfiber cloth or to achieve superior floor cleanliness compared to conventional cotton mops with a microfiber mop, the versatility of microfiber is unmistakable (Mukhopadhyay, Samrat, September 2002).

2.3.2 COTTON FIBERS

Cotton fibers, being natural and hollow, serve as a primary material for woven goods such as clothing, quilts, and fabrics. Remarkably, these fibers possess the ability to absorb water up to 24 - 27 times their weight. They exhibit strength, excellent dye absorption, and resilience against abrasion and elevated temperatures. Additionally, cotton fibers do not generate static electricity, nor do they conduct electrical currents, making them ideal for producing high-quality products using cost-effective materials (Navin Chand, Mohammed Fahim, 2021).

2.3.3 MICROFIBER VS COTTON FIBER

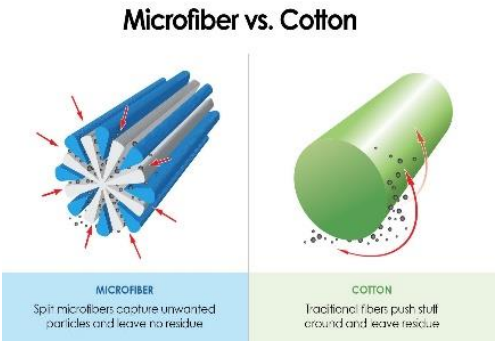


Figure 2.4: Microfiber vs Cotton fiber

Microfiber possesses pores and voids within its fibers that aid in trapping particles and minimizing residue left on surfaces post-cleaning. These openings enable the fibers to function as hooks, delicately lifting dirt, grime, and bacteria. In contrast, conventional cleaning materials employing cotton fibers lack these minuscule spaces, thus failing to trap particulates in a similar manner. Instead, cotton fibers tend to redistribute dirt rather than effectively capture it(Tim Charlet, 2021).

2.4 ALUMINIUM

Aluminium boasts exceptional recyclability, with the recycling process demanding merely a fraction of the energy necessary for initial production. This recyclable feature enhances its sustainability and aligns with worldwide initiatives aimed at lessening environmental harm. The distinct amalgamation of traits found in aluminum, such as its lightweight quality, resistance to corrosion, and adaptability, positions it as an essential material across various sectors. It plays a central role in contemporary technological progressions and the adoption of eco-friendly methodologies (Philadelphia, H. C. Baird & co., 1896).

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

Aluminium comes in various forms and grades, with the choice of grade contingent upon its intended application. For instance, aluminium alloy 2024 finds extensive utilization in aircraft construction, particularly for components like wing and fuselage structures subjected to tension. Aluminium alloy 6063 is favored in visible architectural projects such as window and door frames, roofs, and sign frames. Meanwhile, aluminium alloy 3003 is employed for general fabrication purposes or in chemical applications like cooking utensils, food containers, chemical equipment, pressure vessels, sheet metal fabrication, hardware, tanks, and cabinets. This alloy boasts medium strength, excellent resistance to atmospheric corrosion, superb weldability, and cold formability. Additionally, it exhibits superior mechanical properties, particularly at higher temperatures compared to alloys in the 1000 series.

Aluminium alloy 3003, renowned for its lightweight nature, is ideal for commercial use and serves as a standard universal thread, making it well-suited for applications such as aluminum broomsticks or mop handles. These aluminum alloy sticks typically measure 25mm in diameter and 1.5m in length (Christian Cavallo, 2020).

Figure 2.5: Aluminium Alloy 3003

2.5 STEEL

Steel represents a flexible and essential alloy pivotal in molding the contemporary industrial scenery. Consisting predominantly of iron and carbon, alongside other elements in diverse compositions, steel showcases outstanding robustness, longevity, and a vast array of uses spanning multiple sectors (Encyclopaedia Britannica, 2022).

2.5.1 STAINLESS STEEL

The attributes of stainless steel include corrosion resistance, high tensile strength, and exceptional durability. Being fashioned from stainless steel, the handle is lightweight, easy to store, grippable, and sturdy. Additionally, it carries a weightless feel due to its stainless-steel composition (Aperam, 2022).

Figure 2.6: Stainless Steel

2.6 PREVIOUS RESEARCH

Previous research encompasses a body of scholarly work conducted by researchers in a specific field before the current study. This research serves as the foundation upon which new investigations are built, providing valuable insights, methodologies, and findings that contribute to the broader understanding of a particular subject. Previous research can include literature reviews, experimental studies, theoretical frameworks, case studies, and meta-analyses, among other types of scholarly output. Researchers often consult previous studies to build upon existing knowledge, identify gaps in the literature, formulate research questions, design methodologies, and interpret findings. Additionally, previous research helps establish the context for new studies, allowing researchers to situate their work within the existing body of knowledge and contribute meaningfully to the advancement of their field (Sowjanya Pedada, 2022.)

2.6.1 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 implements are essential household necessities in India. Presently, there are only a handful of tools available in the market for removing dust from ceiling fans. However, these products have not gained traction among users due to various ergonomic and usability issues. Surprisingly, there is a lack of research articles addressing this matter.

Initially, market research was conducted to grasp the users' needs and expectations regarding cleaning methods and existing equipment. A user survey was deployed through a questionnaire to gain deeper insights into the design process. This survey encompassed several inquiries concerning the aforementioned issues related to ceiling fan cleaning. Through brainstorming sessions, numerous concepts were generated, leading to the development of new conceptual designs for cleaning tools aimed at addressing user needs, both functional and aesthetic.

The results revealed that users experienced discomfort in certain body regions such as the neck, shoulders, arms, and significant strain on the lumbar area during the cleaning process. Additionally, concerns regarding accessibility, ease of use, and product interaction were noted with existing ceiling fan cleaning tools. Taking these user concerns into account, several concept designs were proposed to offer improved solutions for the dust removal process of ceiling fans.

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

(International conference on advances in mechanical engineering, 2022)

This study examines the impact of various factors on ceiling fan performance, such as blade shape, airflow patterns, and blade materials. Blade design affects stability and efficiency, with room for improvement in current designs. Fan geometry, including blade size and angle, significantly influences airflow and circulation. Materials like wood and plastics are becoming popular due to their weight and cost advantages over steel and aluminum. Noise reduction is crucial, with symmetrical and balanced blades producing less noise. Three types of fan noise were identified: aerodynamic, electromagnetic, and mechanical. The interface between the blade and rotor needs optimization to simplify cleaning and maintenance, as the current design complicates these tasks. Enhancing the rotor-blade interface can improve user experience and guide future research in ceiling fan design and efficiency.

2.6.3 Design And Fabrication Of Ceiling Fan Blades Cleaner

(Norfarahanim Binti Muhamad, November 2007)

The Flexible Static Duster simplifies dusting tasks with its electrostatic fibers that attract dust effectively. Its flexible head is ideal for cleaning ceiling fans, high ledges, chandeliers, and other inaccessible areas. There's no need to move objects; simply dust around them. Then, the handle extends up to 60 inches, ensuring nothing is beyond reach. Alternatively, the duster head can be detached for tabletop cleaning.

2.7 SUMMARY

Fan cleaning tools are indispensable implements or techniques employed to eliminate built-up dust from the blades of electric fans. Consistent cleaning and upkeep of ceiling fans are essential to preserve their functionality. Dust gradually accumulates on fan blades over time due to the static electricity they generate during operation, attracting fine airborne particles from the surrounding environment.

The selection of primary materials represents a critical aspect of any project, as it shapes the eventual outcome of the finished product. This process involves thorough research, analysis, and evaluation of various materials. Previous consultations have yielded a wealth of literature, enabling an in-depth exploration of the field, which constitutes a crucial component of the literature review.

The market trend for the existing smart ceiling fan cleaner is becoming more cheaper and reasonable price. The people can buy ceiling fan cleaning tools with many types of designs and prices. The ceiling fan cleaning tools also have been created with all functions in one, not only for cleaning the ceiling fan but also for cleaning the window, door, and others.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Methodology stands as a paramount approach in conducting research and determining effective procedures to address research problems. This chapter typically comprises an introduction, research design, data collection methods, data analysis techniques, research instruments, sampling techniques, and a chapter summary. However, a crucial subtopic within this chapter pertains to the type of product to be produced, which may necessitate more detailed discussions regarding research design and instrumentation.

In the field of engineering, methodology holds significant importance in product development, serving as a guide for selection and analysis methods. It ensures that products are crafted meticulously and with excellence. Additionally, methodology serves as a method and technique for designing, collecting, and analyzing data to provide evidence supporting the research. It elucidates the research problem, as well as the rationale behind the methods and techniques employed in the study.

3.2 METHODOLOGY FLOW CHART

A methodology flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task. **Figure 3.1** shows each step to build a Smart Ceiling Fan Cleaner.

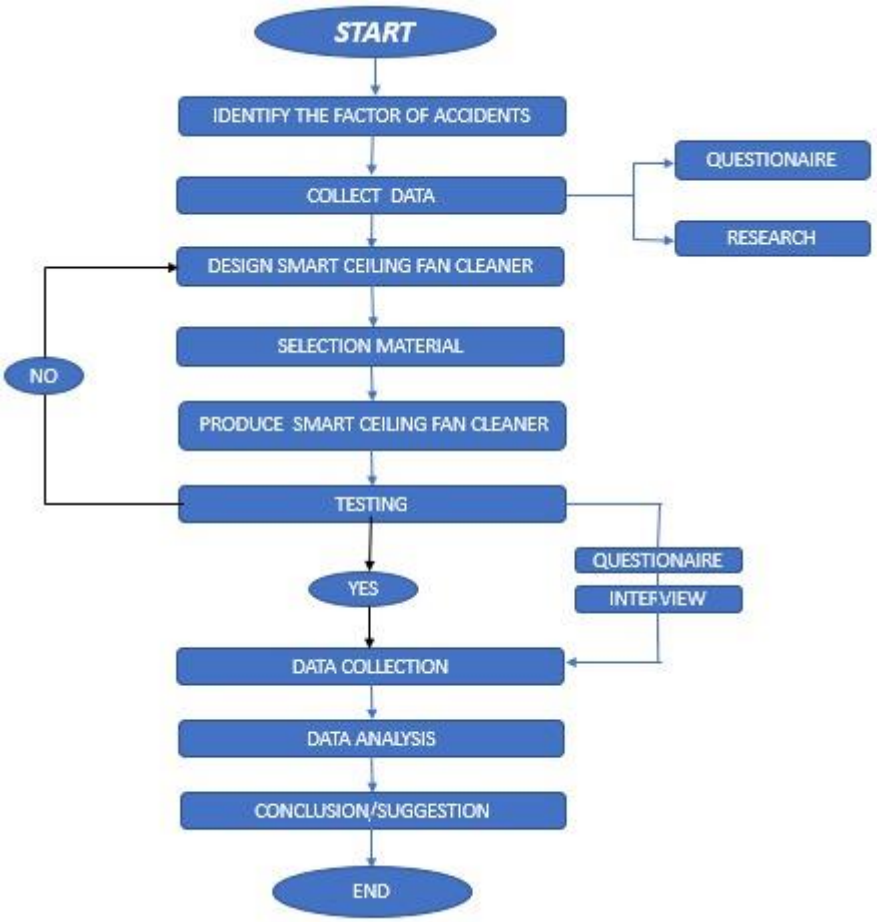


Figure 3.1: Methodology Flow Chart

3.3 IDENTIFYING PROBLEMS

Ceiling fan blades accumulate dirt over time, necessitating regular cleaning to maintain functionality. Traditional cleaning methods, such as using a ladder to reach fans typically installed at least 3 meters above the ground, pose significant risks,

including falls. This task is particularly hazardous for the elderly and children, and can also cause discomfort due to dust falling into the eyes and nose. Therefore, there is a need for an innovative product to facilitate safer and more effective cleaning of ceiling fan blades.

3.4 ANALYSIS ON SURVEY

A questionnaire is administered to evaluate and demonstrate the effectiveness of this product, ensuring that the project's objectives are met. The form provided to respondents is divided into four sections which are A, B, C, and D.

i. Section A: Background of respondents
ii. Section B: Problems encountered during the conventional method of cleaning process
iii. Section C: Risk faced when cleaning the ceiling fan blades conventionally
iv. Section D: Suggestion and comment

All the data that has been collected from the questionnaire will be analyzed using Microsoft Excel Software. **Table 3.1** shows the score scale and level in the survey response through the Google Form and **Table 3.2** shows the mean score scale and interpretation of mean.

Table 3.1: Score scale and level in survey response

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

Table 3.2: Mean score scale and interpretation of mean

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

Source: Dr Jamil Ahmad (2002)

3.4.1 ANALYSIS ON SURVEY RESPONSE

i. Analysis Section A: Background of respondents

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

2. Age – The respondent's age is between 20-30 years old with 60.2% and 15.4% around 10-20 years old followed by the least 7.7% between 50-60 years old.

3. Status - The data shows that the total of the respondents 75% are single and 25% are married.

4. Work Status - The data shows that 84.6% of respondents are not working and 15.4% of respondents are working and students.

5. Fan Cleaning Frequency – The data shows that there are 46.2% of respondents clean the ceiling fan once monthly and 23.1% clean it if there is a celebration.

ii. Analysis Section B: Problems encountered during the conventional method of cleaning process

1. Cleaning ceiling fans takes a long time
2. Requires a lot of energy when cleaning the fan
3. Dust flies around when cleaning the fan
4. Difficult to clean the fan effectively
5. A fan that is too high makes the cleaning process difficult

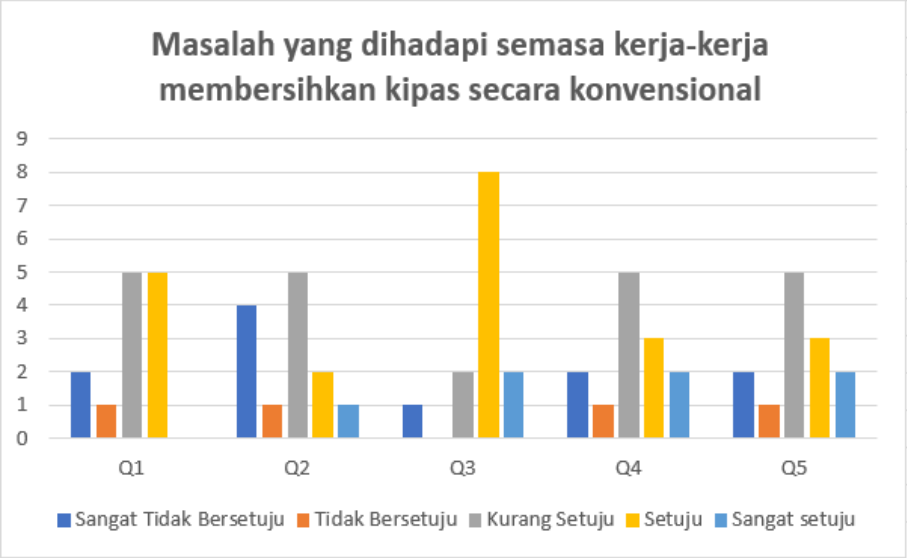


Figure 3.2: Problems encountered during the cleaning process

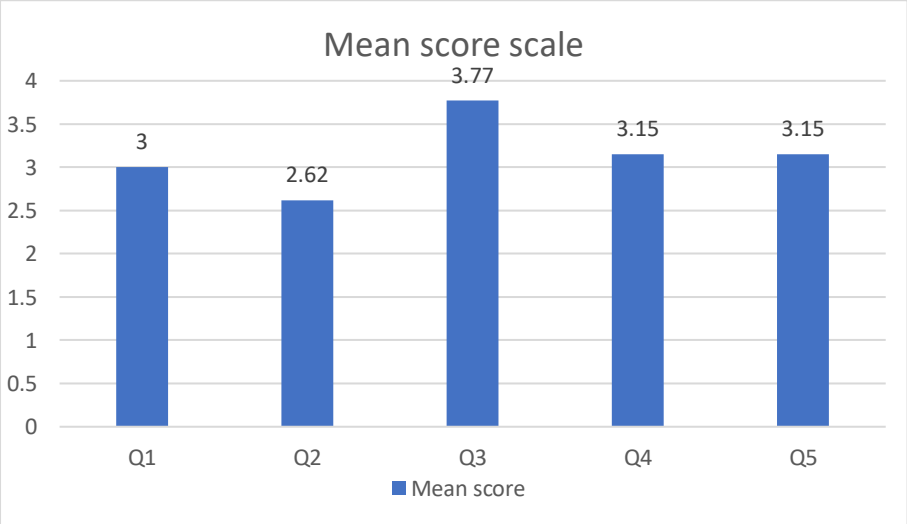


Figure 3.3: Mean score data for problems encountered during the cleaning process

Table 3.3: Mean score scale and interpretation of mean for the problem encountered

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

Figure 3.2 shows the total number of respondents with the level of satisfaction. **Figure 3.3** shows the mean score data for problems encountered during the cleaning process. **Table 3.3** shows the mean score scale and interpretation of mean for the problem encountered during the cleaning process. Based on the result in **Table 3.3**, the highest mean score scale is 3.77 which means the respondents strongly agree that the dust will fly around when cleaning the ceiling fan blades.

iii. Analysis Section C: Risks faced when cleaning the ceiling fan blades conventionally

1. Cleaning fan blades using conventional methods carries a high risk of injury
2. Cleaning ceiling fan blades can expose to accidents
3. Conventional cleaning of fan blades will expose users to health problems
4. The dust that flies around while cleaning ceiling fans can disrupt vision and breathing.
5. The design of sharp-edged fan blades tends to increase the likelihood of accidents.

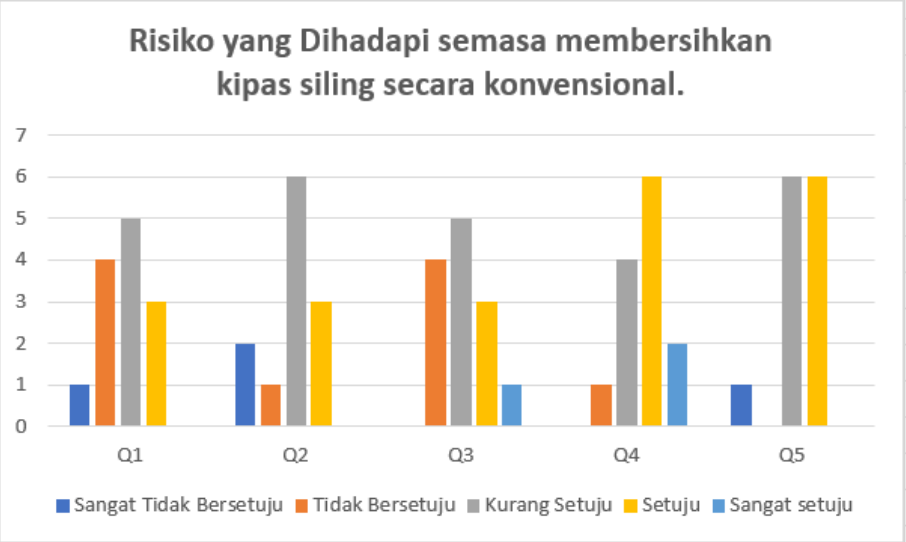


Figure 3.4: Risks faced when cleaning the ceiling fan blades conventionally

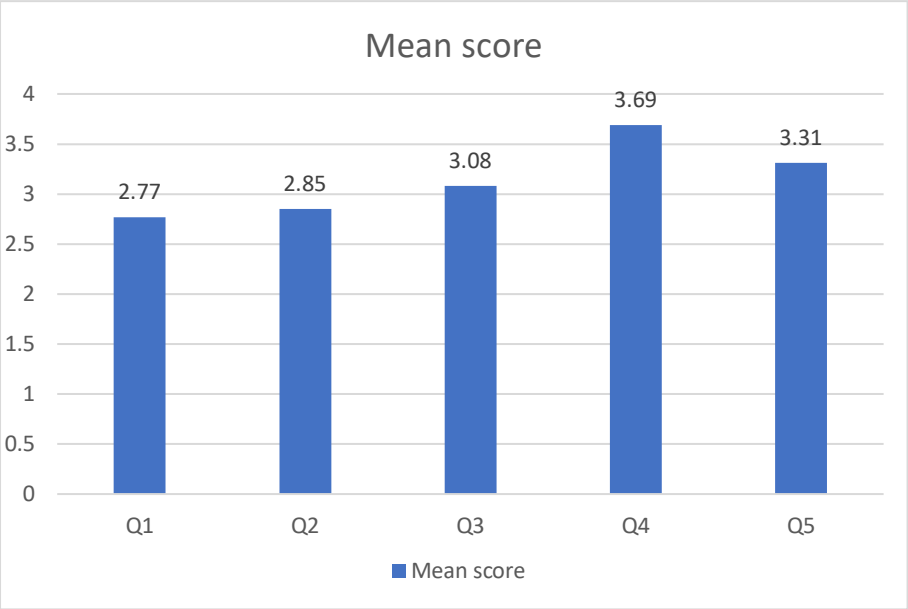


Figure 3.5: Mean score data for risk faced when cleaning the ceiling fan blades

Table 3.4: Mean score scale and interpretation of mean for the risk faced

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

Figure 3.4 shows the total number of respondents with the level of satisfaction. **Figure 3.5** shows the mean score data for risk faced when cleaning the ceiling fan blades. **Table 3.4** shows the mean score scale and interpretation of mean for the riswk faced when cleaning the ceiling fan blades. Based on the result in **Table 3.4**, the highest mean score scale is 3.69 which means the respondents strongly agree that the dust that fly around while cleaning ceiling fans can disrupt vision and breathing.

iv. Analysis Section D: Suggestions and comment

The feedback and recommendations from respondents are crucial in the research process as they contribute to the excellence, credibility, and progress of academic endeavors. Here's a condensed response from a participant regarding the inquiryon "**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 response to 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

The design is crafted with the intention of allowing for reflection before project implementation commences. By doing so, this design aims to offer comprehensive insights that will guide the production of a "SMART CEILING FAN CLEANER" with precision and detail.

3.5.1 DESIGN DRAWING

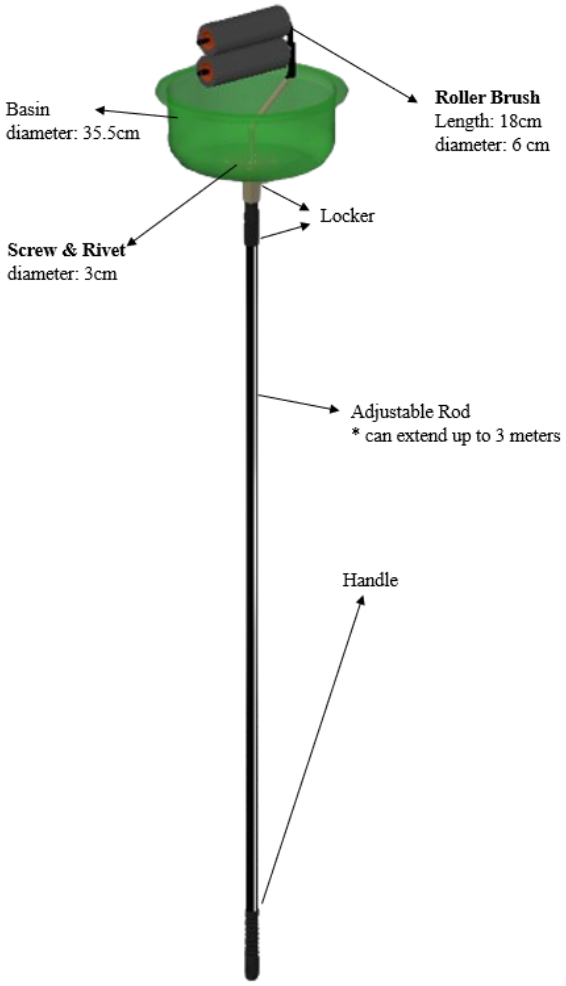


Figure 3.6: Design drawing of Smart Ceiling Fan Cleaner

3.5.2 PRODUCT MANUFACTURING

The Smart Ceiling Fan Cleaner was designed by researchers, who divided the construction process of the product into defined parts, as depicted in **Figure 3.6.**

Initially, gather all necessary materials before commencing the production of the product. Next, construct the upper frame using aluminum, which will serve as the connecting point for the roller brush. Subsequently, affix the adjustable rod to the upper frame. Following this, attach the burlap sack bag to both ends of the aluminum frame. Additionally, mount the first roller brush onto the aluminum frame separately. Lastly, secure all components together using screws and rivets.

3.6 PRODUCT DEVELOPMENT

This project entails three primary phases for its execution, commencing with planning, followed by implementation, and concluding with testing. All methodologies employed are aimed at gathering and analyzing data from relevant projects. The product development process is delineated into three steps as follows:

Step 1: Planning and design

Initially, guided by the culmination of user needs identified during the empathy phase, the research process transitions into the design project. In this phase, the initial stage of design has been concluded. Following this, efforts were directed towards identifying suitable small-scale factories to collaborate with. Visiting a metal workshop, we engaged with a skilled technician named Mr. Razak. Upon explaining the purpose

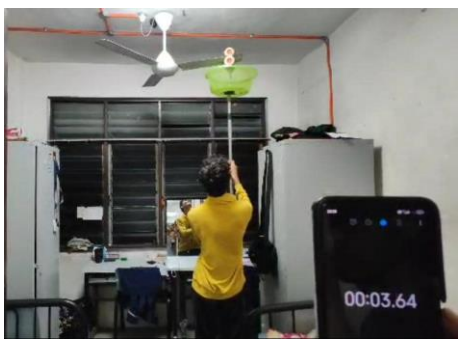
of our visit, we presented him with our design drawings. Upon examination, Mr. Razak leveraged his expertise to provide insights and recommendations for refining our design. Subsequently, we incorporated Mr. Razak's suggestions into our design and presented the revised concepts to our supervisor, marking the second phase of design adjustments.

Step 2: Project execution



After deliberation, the definitive design for the Smart Ceiling Fan Cleaner has been established. The materials have been selected, and the design illustrations are ready for production. The workshop is well-equipped, with an ample inventory of tools, and staffed by competent professionals overseeing our operations. With their expert guidance throughout the production phase, the entire process proceeded seamlessly, and our project was successfully completed within the designated timeframe.

Step 3: Analysis of performance and Identify Conclusion



After the successful creation of the product, the Smart Ceiling Fan Cleaner will undergo testing. The testing procedure covers cleaning contractors, students, and other community members to determine the efficiency of Smart Ceiling Fan Cleaner in terms of time. The questionnaire also will be given to the respondents to determine the effectiveness of the Smart Ceiling Fan Cleaner in terms of cleanliness and safety. The data collected will be analyzed and used for the further process.

3.6.1 MATERIAL SELECTION

During the item selection process for constructing a Smart Ceiling Fan Cleaner, it is crucial to meticulously ensure the suitability of every aspect of the chosen items. This selection procedure must be conducted with care to minimize waste and ensure that the materials utilized are both safe and durable, capable of enduring over an extended period.

1) ADJUSTABLE RODS

Figure 3.7: Adjustable rods

Adjustable rod is one of the materials because it is made of aluminum and has characteristics such as cheap price, lightweight, and can be adjusted according to the height of the fan in the house.

2) ROLLER BRUSH

Figure 3.8: Roller brush

Roller brush can scrub all the dust on the fan blade because it is made of fabric and is low price. Roller brushes can clean multiple blades simultaneously, reducing the time and effort required for cleaning compared to manual methods.

3) SCREWS & RIVET

Figure 3.9: Screw & Rivet

For material connection, this product uses screws and rivets to make the product stronger and safer to use. Both screws and rivets provide a secure and stable connection between parts, preventing them from coming loose over time.

4) ALUMINUM

Figure 3.10: Aluminum

Aluminum is a connecting tool to several parts because of its lightweight and easy to handling.

5) BASIN

Figure 3.11: Basin

A basin acts as a container to gather and collect the dust particles. It is lightweight and easy to clean.

6) STEEL

Figure 3.12: Steel

Steel is valued for its robustness, longevity, and adaptability. It resists corrosion, is recyclable, and offers cost-efficiency. Its fire resilience and sustainability make it well-suited for diverse sectors, from construction to manufacturing.

3.7 COST ITEM

The price of materials is just an initial rough estimate to build our product which is the Smart Ceiling Fan Cleaner.

Table 3.5: Estimate Cost

Material	Unit	Price
Adjustable Rods	1	RM 13.50
Roller Brush	2	RM 11.80
Screws & Rivet	1(Box)	RM 5.00
Aluminum	1	RM 20.00
Steel	3	RM 15.00
Basin	1	RM 7.90
Extra Cost		RM 15.00+
Total		RM 88.20+

3.8 METHODS OF DATA COLLECTION

Data collection refers to the systematic process of gathering, measuring, and analyzing precise data for research purposes using appropriate methodologies. It enables researchers to assess their hypotheses based on the collected data, often serving as a pivotal step in research endeavors. The selection of data collection methods varies across fields of study and is contingent upon the specific information sought. The primary aim of data collection is to ensure the acquisition of data for analysis, facilitating evidence-based decision-making in research. Various methods of data collection exist, including interviews, email surveys, telephone surveys, and online/web surveys. In this study, the online/web survey method or questionnaires are employed

due to their ease of dissemination via smartphone-enabled online platforms. This approach facilitates efficient information gathering and survey administration while minimizing the likelihood of data errors.

3.8.1 RESEARCH TECHNIQUES

Instrument is a general term used by researchers for measuring devices (surveys, tests, questionnaires, etc.). Instruments and instrumentation are different things. The instrument is a device and the instrumentation is the course of action (the process of developing, testing, and using the device). In the study section of this study instrument, a questionnaire method was selected. The selection of respondents consisted of housewives cleaning workers, the public, and students of Sultan Salahuddin Abdul Aziz Shah Polytechnic (PSA).

3.8.2 SAMPLE DATA

Following the completion of data collection via questionnaires and sampling, the software will analyze the study-related questions. Subsequently, the gathered data will serve as a pertinent reference point throughout the product manufacturing process.

3.8.3 METHODS OF DATA ANALYSIS

Data analysis involves transforming raw data into actionable information that aids users in making informed decisions. It encompasses collecting and scrutinizing data to address inquiries, validate hypotheses, or refute theories. In the context of this project,

data analysis entails examining the collected data and presenting the outcomes through various visual aids such as pie charts, bar graphs, and tables.

3.8.3.1 QUESTIONNAIRE

The questionnaire is created and given to the respondents to determine the effectiveness of Smart Ceiling Fan Cleaner in terms of cleanliness and safety. The results collected will be analyzed by using a mean score to make a conclusion.

3.8.3.2 INTERVIEW

The interview session is held to get the comments and suggestions for improvements to the Smart Ceiling Fan Cleaner. Recommendations from the respondents are vital to the project's success and can act as a source of solving the problems faced by the community.

3.9 DATA ANALYSIS

i. Analysis Section A: Time

1. Smart Ceiling Fan Cleaner take longer time 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 after use is faster.
4. Users are faster to clean each fan blade by using 'SCFC'

Table 3.6: Results on response in terms of time

	Q1	Q2	Q3	Q4
Person 1				
Person 2				
Person 3				
Average				

ii. Analysis Section B: Safety

1. 'SCFC' can prevent dust from entering the eyesight and breathing.
2. The use of 'SCFC' allows hard-to-reach areas on the fan blades to be cleaned safely.
3. 'SCFC' can prevent height-related issues during cleaning.
4. Can 'SCFC' prevent consumers from health and safety problems?
5. Can 'SCFC' overcome height problems effectively?

Table 3.7: Results on response in terms of safety

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

iii. Analysis Section C: Cleanliness

1. Is 'SCFC' capable of cleaning ceiling fans?
2. Does the ceiling fan spin faster after cleaning using 'SCFC'?
3. Are you satisfied with the level of cleanliness of the ceiling fan after the cleaning process using 'SCFC'?
4. Can the dust on the ceiling fan blades be completely cleaned by using 'SCFC'?

Table 3.8: Results on response in terms of cleanliness

	Q1	Q2	Q3	Q4
Person 1				
Person 2				
Person 3				
Average				

3.10 SUMMARY

At the outset of the research stages, a systematic approach is taken to design the research and determine the data collection method, research techniques, sampling techniques, and data analysis method. This systematic approach aids in gathering factual information to support the research and provides a clear visualization of the project.

Following the completion of data analysis, it becomes crucial to summarize and draw conclusions from the results and hypotheses, assessing the effectiveness of the cleaning tool. This step serves as a pivotal point to progress to the next stage of product development. The objective of this phase is to highlight the importance of our products to users and showcase the improvements made to address the shortcomings of other cleaning tools.

CHAPTER 4

FINDINGS AND DISCUSSION

4.1 INTRODUCTION

Research involves both creative and methodical efforts aimed at expanding our understanding, encompassing insights into human behavior, culture, and society, as well as leveraging this understanding to develop innovative applications. It serves to confirm or substantiate existing knowledge, build upon previous findings, and address new or ongoing challenges. The findings obtained from the survey will be analyzed, offering a range of responses that can be utilized in the study. Furthermore, the investigation's outcomes are enriched by employing analytical techniques to interpret the data provided by respondents regarding the Smart Ceiling Fan Cleaner. The study aims to produce the Smart Ceiling Fan Cleaner in order to solve the problems faced in the community. The data collected via the questionnaire will be analyzed to determine the effectiveness of the Smart Ceiling Fan Cleaner in terms of cleanliness and safety. The testing results of the cleaning process help to measure the efficiency of the Smart Ceiling Fan Cleaner in terms of time.

4.2 RESEARCH FINDINGS

A survey was carried out to pinpoint issues and gather feedback on using the Smart Ceiling Fan Cleaner for cleaning ceiling fans. The respondents included employed women, stay-at-home mothers, students, and cleaning professionals based in Malaysia. The data collected will be analyzed with the presence of a table.

Table 4.1: Score scale and level in survey response

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

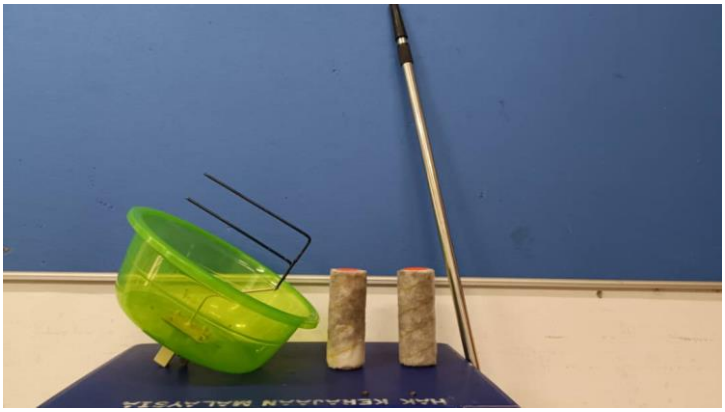
Table 4.2: Mean score scale and interpretation of mean

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

Source: Dr Jamil Ahmad (2002)

4.2.1 OBJECTIVE 1: TO PRODUCE THE SMART CEILING FAN CLEANER

The production of the Smart Ceiling Fan Cleaner is successfully created.



After the Smart Ceiling Fan Cleaner is successfully created, the objective has been achieved in this study.

4.2.2 OBJECTIVE 2: TO DETERMINE THE EFFECTIVENESS OF SMART CEILING FAN CLEANER IN TERMS OF CLEANLINESS AND SAFETY

4.2.2.1 ANALYSIS DATA IN TERMS OF CLEANLINESS

1. Is 'SCFC' capable of cleaning ceiling fans?
2. Does the ceiling fan spin faster after cleaning using 'SCFC'?
3. Are you satisfied with the level of cleanliness of the ceiling fan after the cleaning process using 'SCFC'?
4. Can the dust on the ceiling fan blades be completely cleaned by using 'SCFC'?

Table 4.3: Result of survey response in terms of cleanliness

	Question 1	**Question 2**	**Question 3**	**Question 4**
Person 1	4	4	5	4
Person 2	3	4	3	3
Person 3	5	5	5	5
Person 4	4	4	4	2
Person 5	4	2	3	2
Person 6	4	3	3	3
Person 7	4	5	4	4
Person 8	5	5	5	5
Person 9	4	4	4	4
Person 10	4	4	4	4
Person 11	4	4	5	5
Person 12	5	3	4	4
Person 13	5	5	4	4
Person 14	4	4	3	3
Person 15	5	5	5	5
Person 16	4	4	3	4
Average	**4.25**	**4.06**	**4.00**	**3.81**

Table 4.4: Mean score and interpretation of mean in terms of cleanliness

No.	**Mean score**	**Interpretation of mean**
Question 1	4.25	Strongly agree
Question 2	4.06	Strongly agree
Question 3	4.00	Strongly agree
Question 4	3.81	Strongly agree

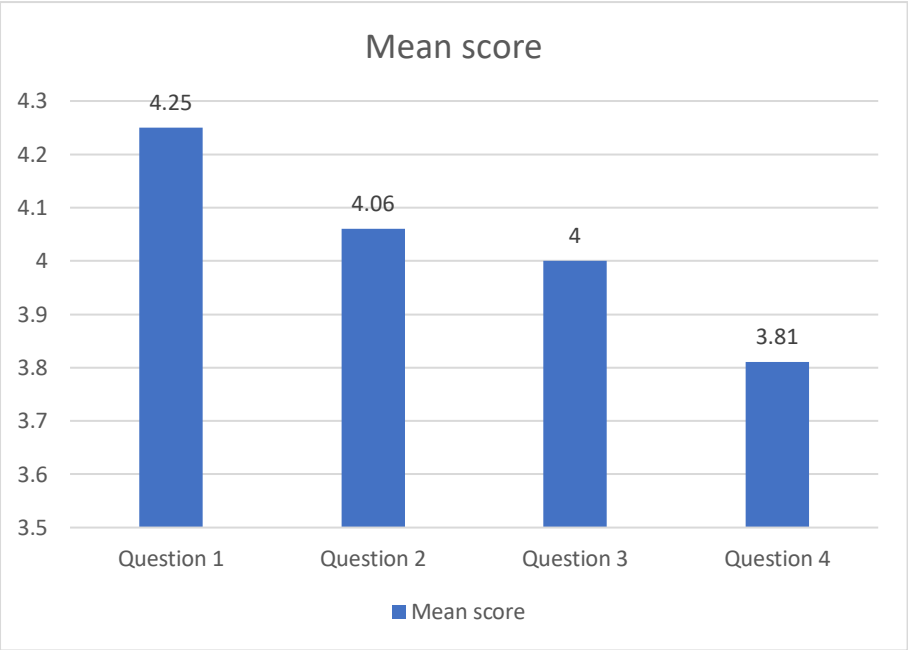


Figure 4.1: Mean score data in terms of cleanliness

Table 4.3 shows all the results collected in terms of cleanliness by using the questionnaire and the average result is tabulated in **Table 4.4**. **Table 4.4** shows that the highest mean score is 4.25 and the lowest mean score is 3.81 which are categorized as strongly agree. This can conclude that the respondents are strongly agree that the Smart Ceiling Fan Cleaner can clean the ceiling fan blades effectively.

4.2.2.2 ANALYSIS DATA IN TERMS OF SAFETY

1. 'SCFC' can prevent dust from entering the eyesight and breathing.
2. The use of 'SCFC' allows hard-to-reach areas on the fan blades to be cleaned safely.
3. 'SCFC' can prevent height-related issues during cleaning.
4. Can 'SCFC' prevent consumers from health and safety problems?
5. Can 'SCFC' overcome height problems effectively?

Table 4.5: Result of survey response in terms of safety

	Question 1	Question 2	Question 3	Question 4	Question 5
Person 1	4	5	5	5	4
Person 2	5	2	5	5	5
Person 3	5	5	5	5	5
Person 4	5	4	5	5	4
Person 5	4	2	4	4	4
Person 6	3	3	4	3	4
Person 7	3	5	5	5	3
Person 8	5	5	5	5	5
Person 9	4	4	4	4	4
Person 10	5	5	5	4	4
Person 11	5	5	5	4	5
Person 12	5	4	5	3	5
Person 13	4	5	5	5	4
Person 14	5	2	5	4	4
Person 15	5	5	5	4	4
Person 16	4	3	4	4	3
Average	**4.44**	**3.86**	**4.75**	**4.31**	**4.18**

Table 4.6: Mean score and interpretation of mean in terms of safety

No.	Mean score	Interpretation of mean
Question 1	4.44	Strongly agree
Question 2	3.86	Strongly agree
Question 3	4.75	Strongly agree
Question 4	4.31	Strongly agree
Question 5	4.18	Strongly agree

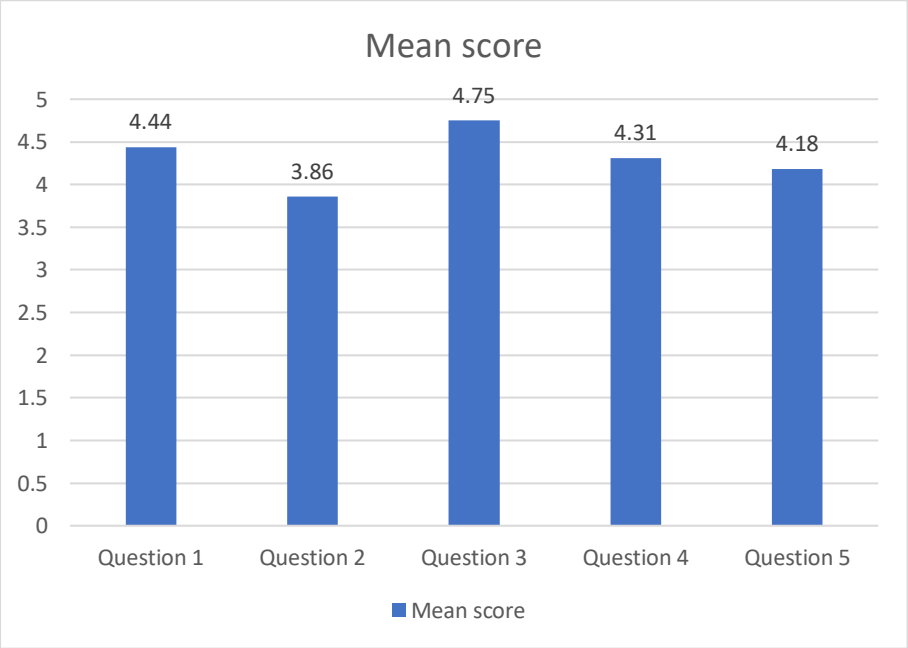


Figure 4.2: Mean score data in terms of safety

Table 4.5 shows all the results collected in terms of safety by using the questionnaire and the average result is tabulated in **Table 4.6**. **Table 4.6** shows that the highest mean score is 4.75 and the lowest mean score is 3.86 which are categorized as strongly agree. This can conclude that the respondents are strongly agree that the Smart Ceiling Fan Cleaner are safe to use for the cleaning process of ceiling fan blades.

4.2.3 OBJECTIVE 3: TO DETERMINE THE EFFICIENCY OF THE SMART CEILING FAN CLEANER IN TEMS OF TIME

4.2.3.1 ANALYSIS DATA IN TERMS OF TIME

1. Smart Ceiling Fan Cleaner take longer time 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 after use is faster.
4. Users are faster to clean each fan blade by using 'SCFC'

Table 4.7: Result of survey response in terms of 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 4.8: Mean score and interpretation of mean in terms of time

No.	Mean score	Interpretation of mean
Question 1	4.13	Strongly agree
Question 2	4.38	Strongly agree
Question 3	3.94	Strongly agree
Question 4	4.31	Strongly agree

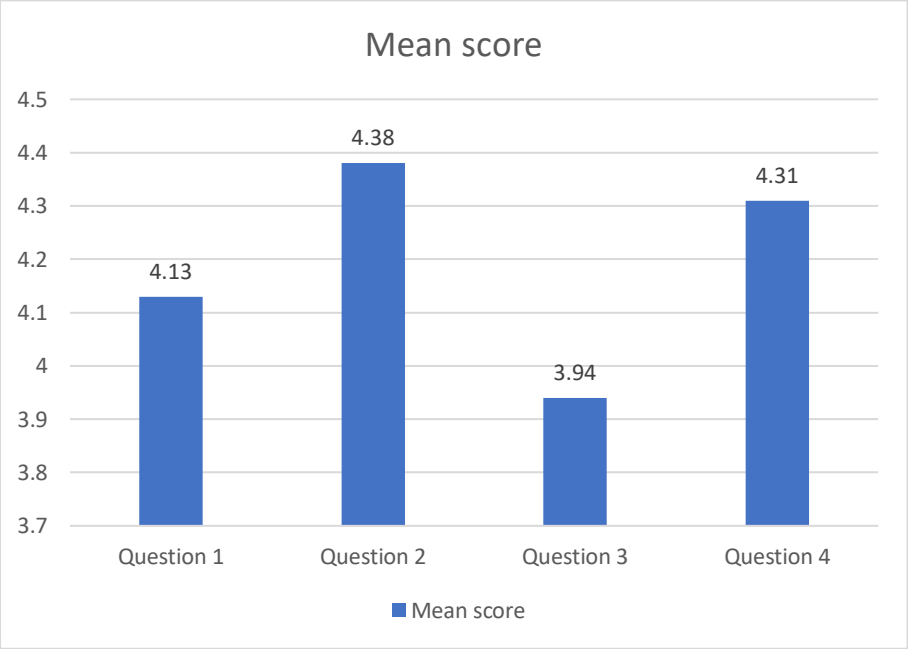


Figure 4.3: Mean score data in terms of time

Table 4.9: Result collected from product testing

People	Smart Ceiling Fan Cleaner	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/1 minute**	**78.6s/1 minute 18s**

Table 4.7 shows all the results collected in terms of time by using the questionnaire and the average result is tabulated in **Table 4.8**. **Table 4.8** shows that the highest mean score is 4.38 and the lowest mean score is 3.94 which are categorized as strongly agree. This can conclude that the respondents are strongly agree that the Smart Ceiling Fan Cleaner saves time to use for the cleaning process of ceiling fan blades. Table 4.7 shows the results collected in the testing of the product in terms of time. The time recorded is taken when the cleaning process starts until finish by using the time recorder. Based on the **Table 4.9**, the average time recorded for cleaning the ceiling fan blades by using the Smart Ceiling Fan Cleaner is 60 seconds while the time recorded for cleaning the ceiling fan blades by using the traditional method is 78.6 seconds. It can be concluded that the Smart Ceiling Fan Cleaner saves more time compared to the traditional method in cleaning the ceiling fan blades.

4.3 DISCUSSION

In this study, the Smart Ceiling Fan Cleaner has been created to solve the problems faced in the community. Based on the data collected, the Smart Ceiling Fan Cleaner can clean the ceiling fan blades effectively with the complete material. However, the Smart Ceiling Fan Cleaner still has defects and needs improvements such as the change of design and selection of materials. The selection of material should be lightweight and reasonable price to prevent the product is overweight and over budget. After the successful completion of the Smart Ceiling Fan Cleaner, the recommendation is given by the outside supervisor, industry, and professionals to make improvements to become better. During the testing of Smart Ceiling Fan Cleaner in terms of time, the time taken is recorded by the handphone time recorder. So, there might be have some human error when at the starting point of testing Smart Ceiling Fan Cleaner.

4.4 SUMMARY

The results collected in terms of time, cleanliness, and safety are satisfied by the respondents. The time taken for the cleaning process is faster when using the Smart Ceiling Fan Cleaner compared to the traditional method. It can be concluded that the objective of this study is achieved. In addition, the Smart Ceiling Fan Cleaner still has improvements and refinements to achieve the perfect condition that can solve all the problems faced in cleaning the ceiling fan blades.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The smart ceiling fan cleaners represent a groundbreaking shift in household upkeep technology. These cutting-edge gadgets offer convenience, efficiency, and efficacy in preserving the cleanliness of ceiling fans, thereby improving indoor air quality and extending the lifespan of fan components. As technological advancements continue to evolve, smart ceiling fan cleaners are rapidly integrating into contemporary homes, providing automated solutions to a once labor-intensive chore.

Smart ceiling fan cleaners represent a notable advancement in home maintenance technology. These devices provide unmatched convenience, efficiency, and effectiveness in keeping ceiling fans clean and operational. As consumers increasingly seek ease and automation in their daily routines, smart ceiling fan cleaners are set to become vital tools for maintaining a healthy and comfortable living space. They enhance indoor air quality and prolong the life of fan components, offering significant benefits that meet the demands of modern homeowners.

5.2 CONCLUSION

The rise of smart ceiling fan cleaners signifies a significant progression in domestic maintenance technology. These devices deliver unparalleled convenience, efficiency, and effectiveness in preserving the cleanliness and functionality of ceiling fans. As consumers increasingly prioritize ease and automation in their daily routines,

smart ceiling fan cleaners are poised to become indispensable tools in maintaining healthy and comfortable living environments. With their capacity to enhance indoor air quality and prolong the longevity of fan components, smart ceiling fan cleaners offer tangible benefits that resonate with the needs of modern homeowners.

5.3 RECOMMENDATIONS

Smart Ceiling Fan Cleaner has a benefit for the user to clean the ceiling fan blades but at the same time, it also needs to be improved in many aspects. During the cleaning process, the ceiling fan blades are unstable and rotate when using the Smart Ceiling Fan Cleaner. A fan holder needs to be added to prevent the ceiling fan blades from rotating so that the fan cleaning process becomes better and easier. Furthermore, there might be a loss of energy when using the Smart Ceiling Fan Cleaner to clean the ceiling fan blades because of the continuous control of the roller brush forward and backward for the purpose of the cleaning process. It can be more save energy when the electric motor is added to rotate the roller brush to simplify the fan blades cleaning process.

5.4 LIMITATION PROJECT

The recommendations and suggestions given by the respondents and industry professionals are vital for the improvement of the Smart Ceiling Fan Cleaner to meet the needs of all users and satisfy this new innovative product. Due to the financial problems and lack of knowledge in making the new innovative product, Smart Ceiling Cleaner can add an electric motor to the roller brush or add a spring mechanism to the roller brush for better efficiency in cleaning the ceiling fan blades. Due to the unstable ceiling fan blades during the cleaning process, the fan blade holder can added to fix the position of the ceiling fan blades.

Smart Ceiling Fan Cleaner can add an electric motor to the roller brush to make the roller brush automatically continuously rotate for the purpose of cleaning the ceiling fan blades. It can save energy in cleaning the ceiling fan blades which the users don't need to hold the Smart Ceiling Fan Cleaner and push forward and backward to make the roller brush rotate to clean the ceiling fan blades. It also can save time in cleaning the ceiling fan blades where the electric motor rotates at a faster speed and can sweep down the dust which is difficult to clean.

Additionally, the Smart Ceiling Fan Cleaner could incorporate a spring mechanism to enhance flexibility between the two rollers, effectively preventing the risk of bending the fan blades. This spring mechanism can also adapt to the varying thickness of dust on the fan blades, thereby improving its flexibility and cleaning performance.

Furthermore, the fan blade holder can be added to the Smart Ceiling Fan Cleaner to stabilize the ceiling fan blades when cleaning the ceiling fan blades. It can facilitate the process of cleaning ceiling fan blades where the Smart Ceiling Fan Cleaner isn't affected by the ceiling fan blades shaking.

5.5 SUMMARY

According to the findings of conducted studies, the outcomes of this experiment align with the intended goals. Specifically, cleaning professionals, homemakers, and the wider community can achieve more efficient cleaning of fan blades. Moreover, this method can significantly reduce the time required for cleaning compared to traditional manual methods. A deeply grateful to all the people who participated and provided feedback for this research. At the end of the study, the objective of the project is achieved with the help of a cleaning professional, lecturer, and industry representative to develop a deeper about the topics of this study. A sincere thanks to all the people who always guide and motivate us throughout the development of this project. Hopefully, the Smart Ceiling Fan Cleaner can speed up the process of cleaning the ceiling fan blades and protect the safety of users in cleaning the ceiling fan blades. Future

advancements might include enhanced cleaning mechanisms, better integration with smart home systems, increased energy efficiency, and more intuitive controls. Additionally, improvements in design and technology could further boost their effectiveness in maintaining air quality and extending the lifespan of ceiling fans, making them even more indispensable in modern homes.

REFERENCE

Alexander Newman(2020), Data Collection Via Online Platform: Challenges and Recommendations for Future Research. Retrieved from https://www.researchgate.net/publication/347229882_Data_Collection_Via_Online_Platforms_Challenges_and_Recommendations_for_Future_Research. on the 2nd. February, 2024

Gembah.How to create a product. *Gembah Blog.* https://gembah.com/blog/how-to-create-a-product/

Hotjar. (2023). Product Research. https://www.hotjar.com/product-research/

Kloeckner, K. (Year). Why 3003 Aluminum Is the Most Common Aluminum Alloy. Kloeckner Metals Blog. https://www.kloecknermetals.com/blog/why-3003-aluminum-is-the-most-common-aluminum-alloy/

Kloeckner Metals. (2021). A Guide to the Most Popular All-Purpose Aluminum Alloys. Kloeckner Metals Blog. https://www.kloecknermetals.com/blog/a-guide-to-the-most-popular-all-purpose-aluminum-alloys/#:~:text=3003%20aluminum%20is%20the%20best,aluminum%20for%20moderate%20strength%20applications

BigRentz. (April 14,2023). Types of Steel. BigRentz Blog. https://www.bigrentz.com/blog/types-of-steel

Ceiling fan. (October 15,2023). In Wikipedia. https://en.wikipedia.org/wiki/Ceiling_fan

Wikipedia contributors. (2023, December 3). Ceiling fan. Wikipedia. https://www.ahmedabadmirror.com/woman-falls-to-her-death-while-cleaning-ceiling-fan/58565865.html

MK Think,Hawaii Natural Energy Institute. Ceiling Fan Study: Literature and Market Report. Hawaii Natural Energy Institute. https://www.hnei.hawaii.edu/wp-content/uploads/Ceiling-Fan-Study-Literature-and-Market-Report.pdf

Smart Living Advice. Smart Ceiling Fans. https://smartlivingadvice.com/smart-ceiling-fans/

"Feather Duster." How Products Are Made. Retrieved April 15, 2024, from Encyclopedia.com:https://www.encyclopedia.com/manufacturing/news-wires-white-papers-and-books/feather-duster

Gantz, Carroll. *The Vacuum Cleaner: A History*. McFarland & Company, 2012.

The Brandon Sun. (April 19, 1975). Man of mystery; Norman Breakey, paint roller inventor. Newspapers.com. Retrieved April 25, 2024, from https://www.newspapers.com/article/the-brandon-sun-man-of-mystery-norman-b/69007744/

Ceramic Pro. (2021). Exploring the facts about microfiber towels. Retrieved from https://ceramicpro.com/exploring-the-facts-about-microfiber-towels/

Mukhopadhyay, Samrat (2002). Microfibers-An overview. Retrieved from https://nopr.niscpr.res.in/bitstream/123456789/22858/1/IJFTR%2027%283%29%20307-314.pdf

Christian Cavallo. (2020). 6061 Aluminium. Retrieved from https://www.thomasnet.com/articles/me\tals-metal-products/6061-aluminum/

Encyclopaedia Britannica. (2022). Additional information about steel. Retrieved from https://www.britannica.com/technology/steel/additional-info#contributors

Aperam. (2022). What is stainless steel? Retrieved from https://www.aperam.com/stainless/what-is-stainless-steel/

Sowjanya Pedada. (2022). How to write previous study in research. Retrieved from https://mindthegraph.com/blog/how-to-write-previous-study-in-research/

Marilyn Supriya Albert, et al. (2022). User and Market Research with Proposed Concepts for Ceiling-Fan Dust Cleaning. Retrieved from https://link.springer.com/chapter/10.1007/978-3-030-94277-9_79 on the 8rd November 2023.

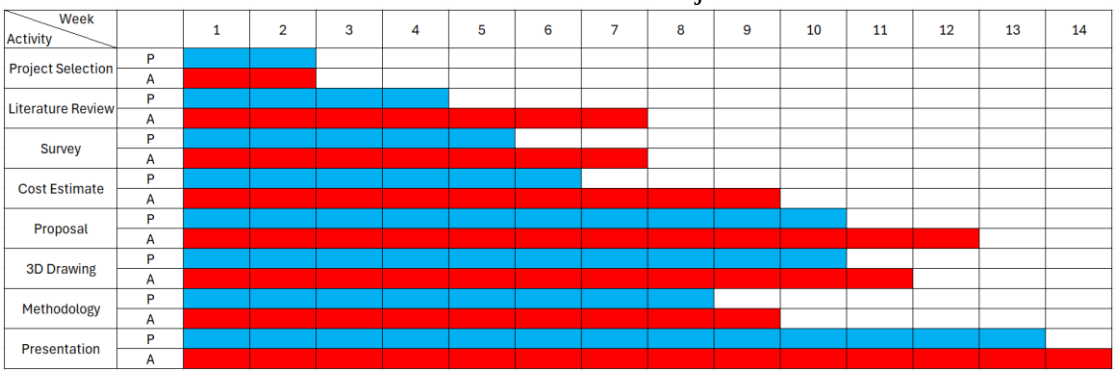
Norfarahanim. (2007). Design And Fabrication Of Ceiling Fan Blades Cleaner. Retrieved from http://umpir.ump.edu.my/id/eprint/2240/1/NORFARAHANIM_BT_MUHAMMAD@RAMLI.PDF

APPENDICES

GANTT CHART:

PROJECT 1

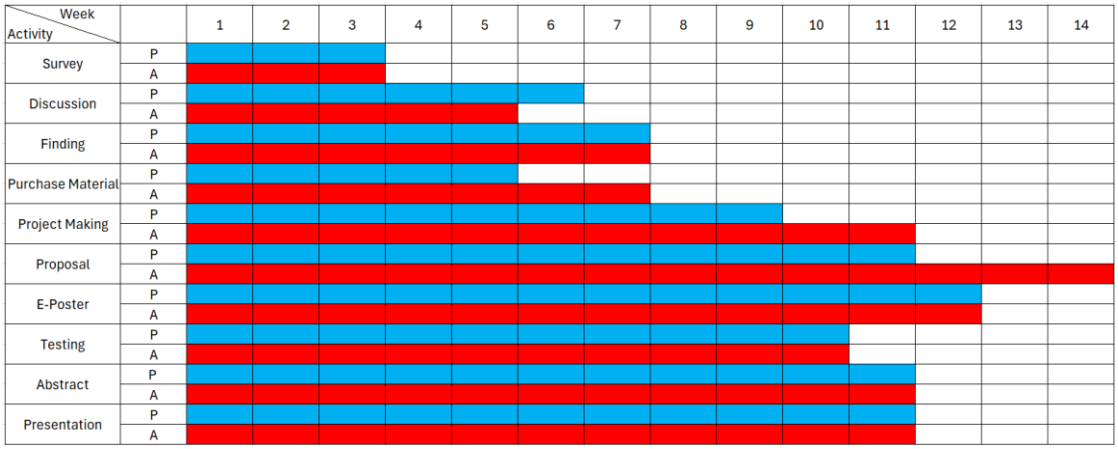
TABLE 6.1: Timeline Project 1



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

PROJECT 2

TABLE 6.2: 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.

DATA ONLINE SURVEY

RESEARCH OF CEILING FAN- QUESTIONNAIRE

Part A: Background check

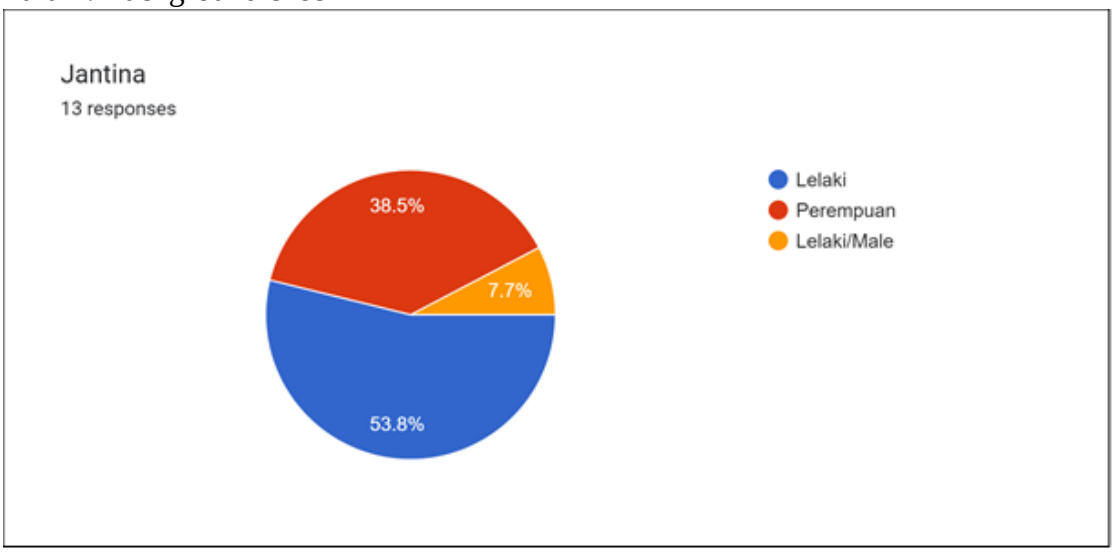


Figure 6.1: Gender of respondents

61.5% of respondents are male and 38.5% of respondents are female

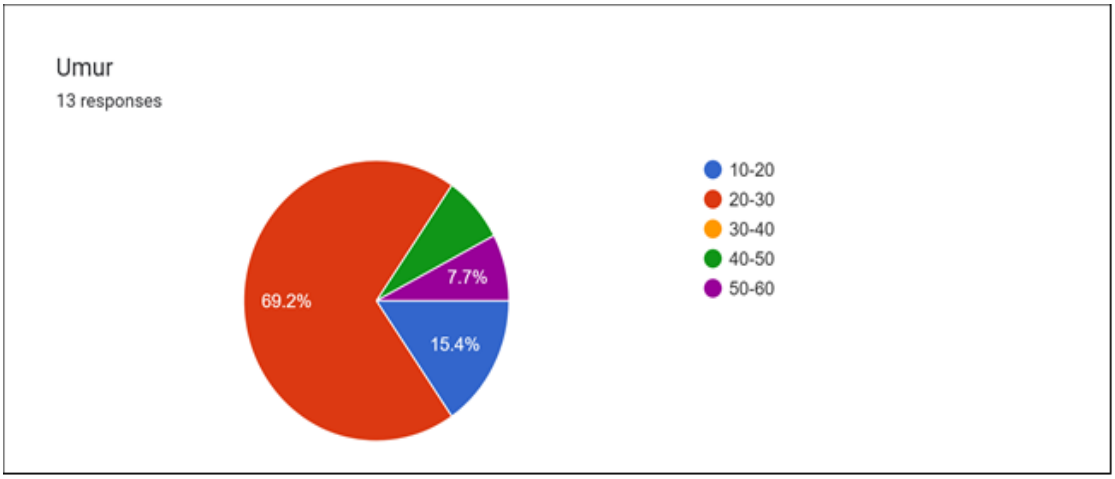


Figure 6.2: Age of respondent

Mostly respondents are between 20-30 years old

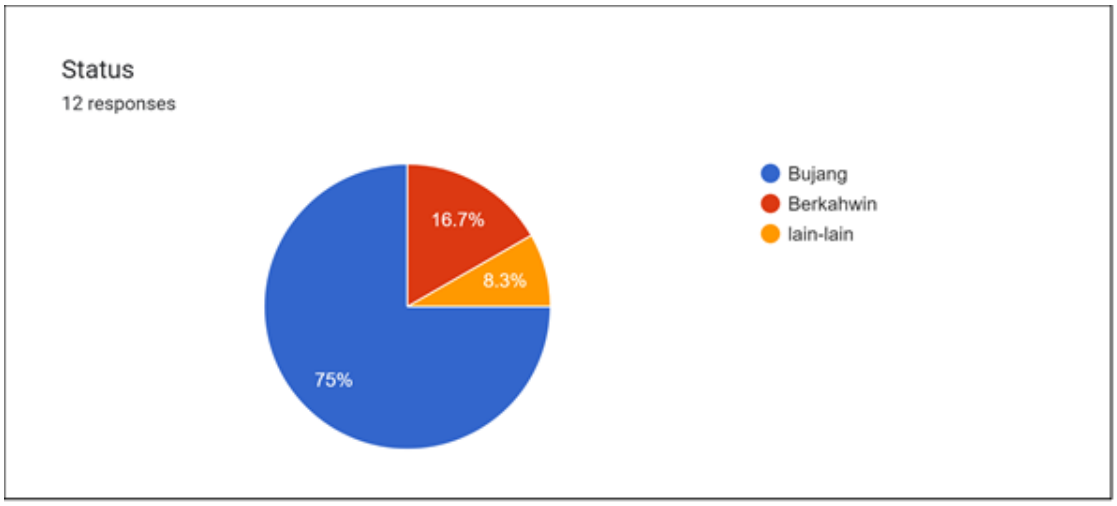


Figure 6.3: Status of respondents

75% of respondents are single and 16.7% are married

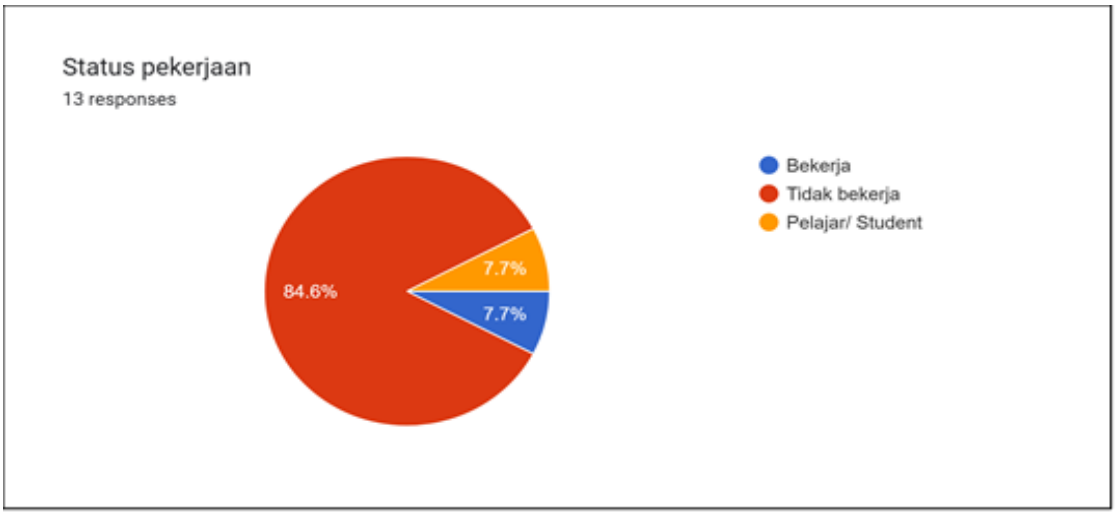


Figure 6.4: Work Status of respondents

84.6% of respondents are not working and 7.7% of respondents are students

Figure 6.5: Opinion of respondent

Asked the respondent if the old way of cleaning the fan consumes a lot of energy and time.

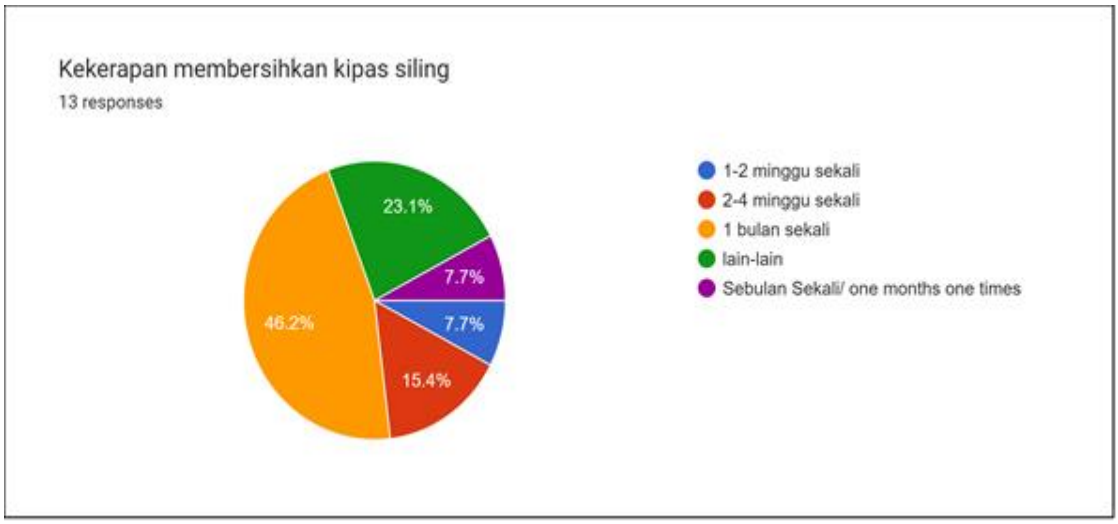


Figure 6.6: Frequency of clean the ceiling fan

Asking respondents how often they clean the ceiling fan

Part B: Problems faced during conventional fan cleaning works.

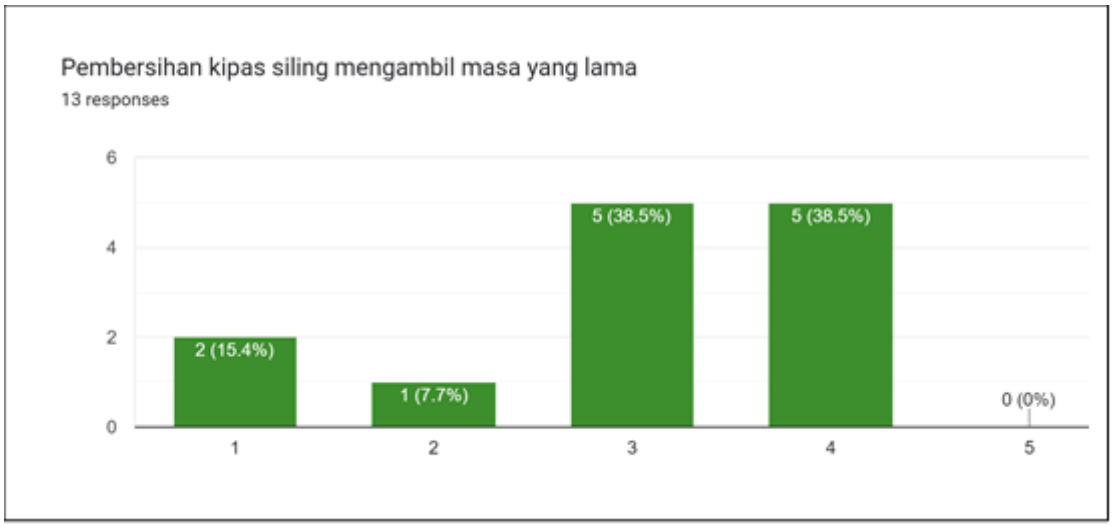


Figure 6.7: Time is taken longer when cleaning the ceiling fan

A total number of 5 respondent agree that the time taken to clean the ceiling fan is long

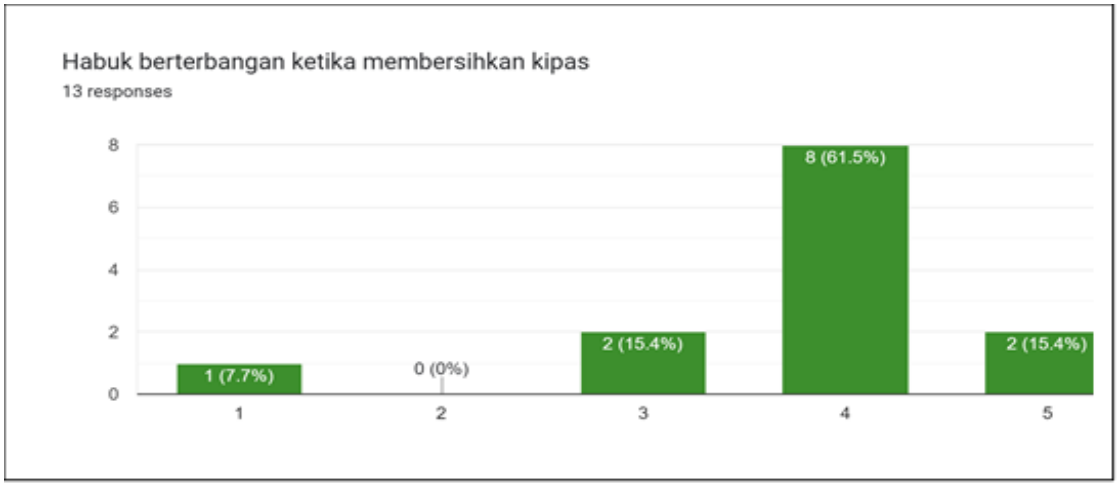


Figure 6.8: Falling dust

Many people agree that during the cleaning process, the fan increases the amount of dust that falls.

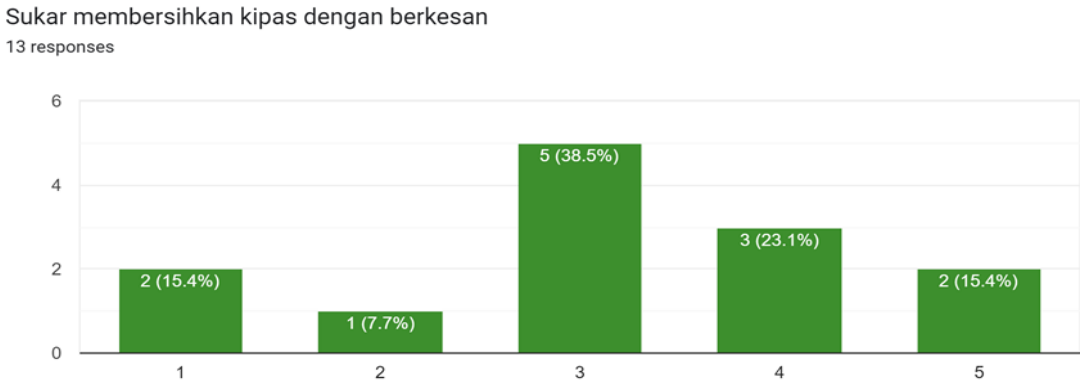


Figure 6.9: Difficulty in cleaning the fan

A total of 5 respondents disagree that are difficult to clean the fan

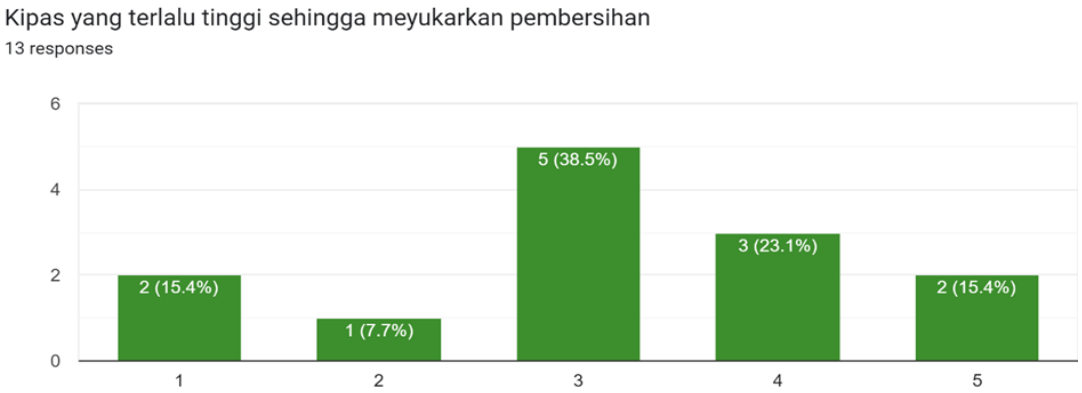


Figure 6.10: Height of fan

A total of 5 respondents chose 3 which is disagree while only 2 people chose 5 which is strongly agree.

Part C: Risks Faced when cleaning ceiling fans conventionally.

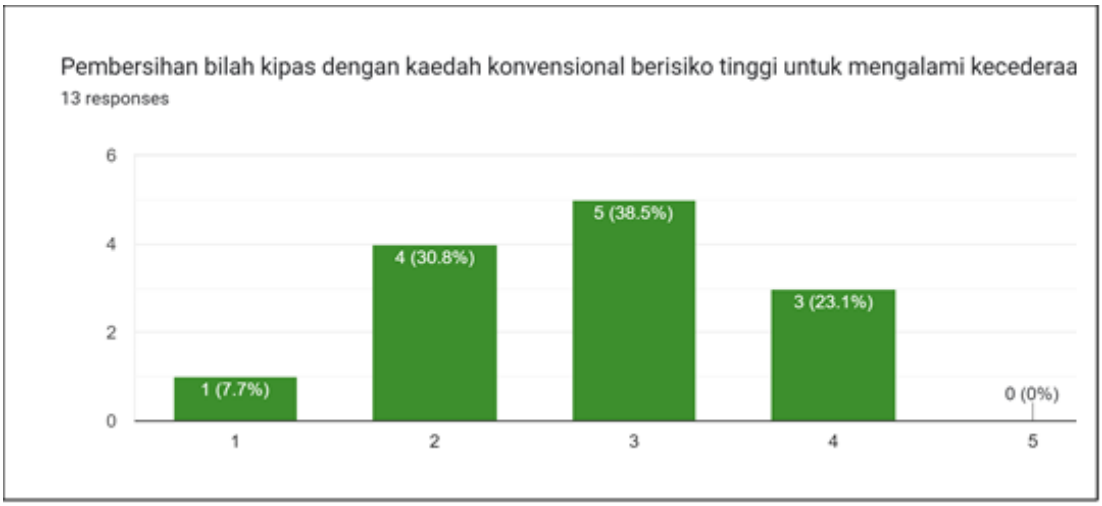


Figure 6.11: High risk of getting injury

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

Figure 6.12: Cleaning the ceiling fan expose to injury

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

Figure 6.13: Cleaning the ceiling fan will expose to health problems

A total of 5 respondents disagree that cleaning the ceiling fan will expose users to health problems.

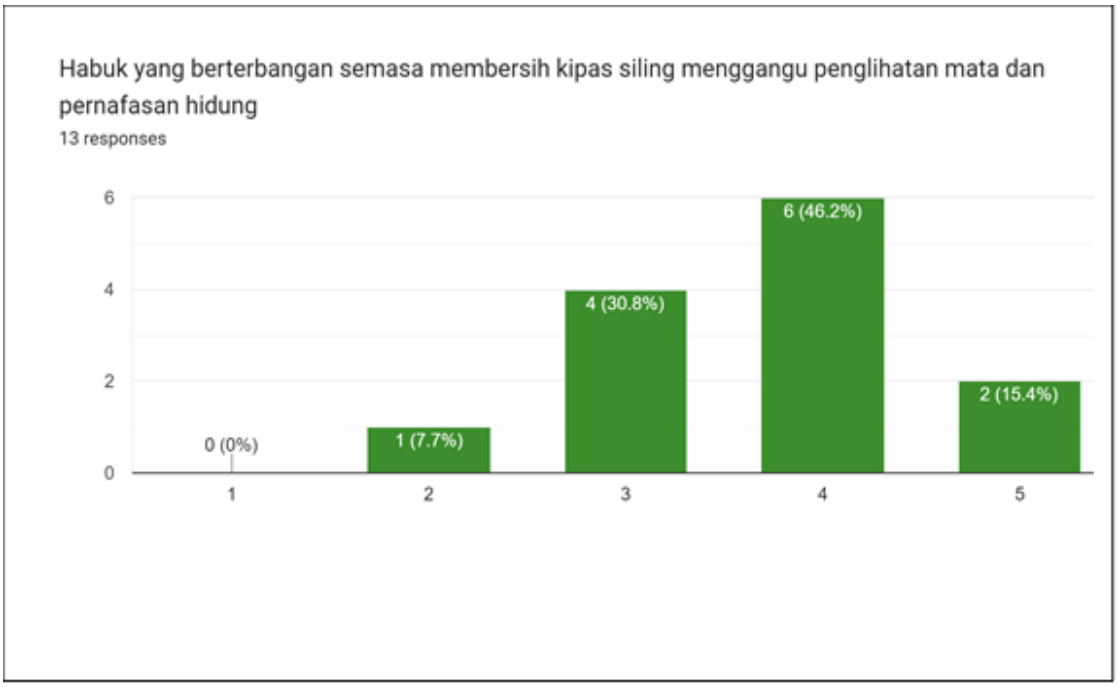


Figure 6.14: Dust flying around disrupts the vision and breathing

6 people agree that dust flying during cleaning can disrupt the vision and breathing.

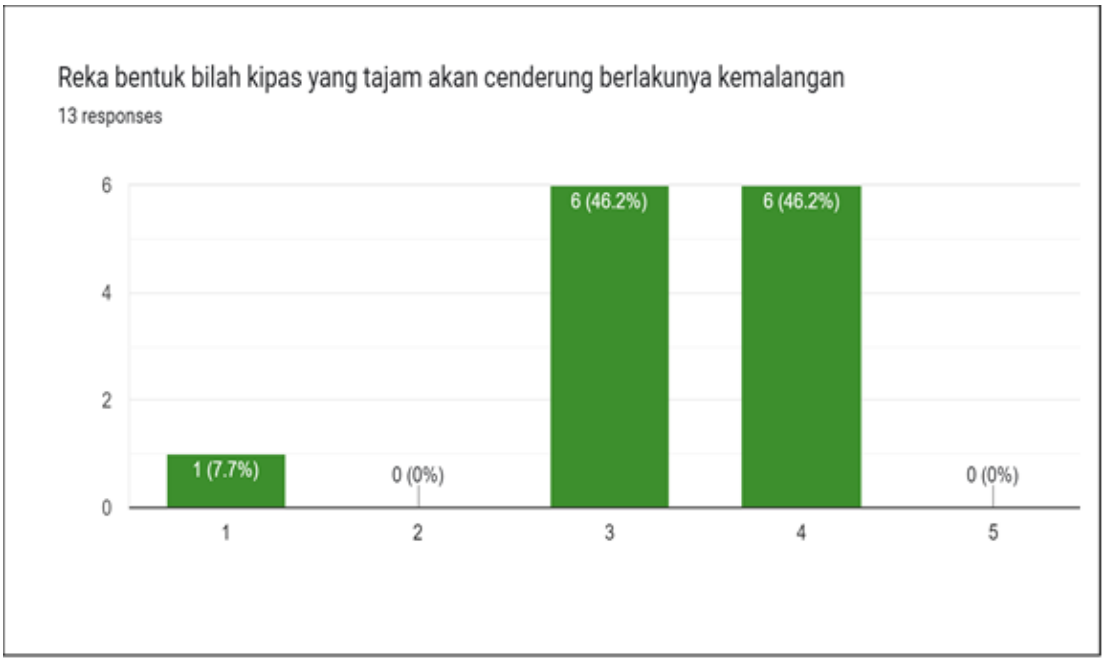


Figure 6.15: Design of the ceiling fan tends to cause accidents

A total of 6 respondents agree that the sharp edges of fan blades will tend to cause accidents.