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The Mask That Prevents The Effect Of Dew On Glasses And Reduce Breathless In People With Respiratory Disorders

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ABSTRACT

The present of the pandemic has given to a new habit that we call the New Normal. One of the habits we hear most often is wearing a mask. Ironically, the use of masks creates new problems for certain populations, for example, glasses users and people with respiratory problems. Eyeglass users complain of the effect of dew on the glasses when wearing a mask, sufferers of respiratory problems complain of shortness of breath when wearing a mask. This problem is the purpose of designing the design that the author did, namely preventing the effect of dew on the glasses, reducing shortness of breath in users with respiratory problems, because it has become a habit, the use of masks is expected to support appearance, and the design is in accordance with WHO health standards. To find the design solution, the author uses the data analysis method and experiments (trials) on the appropriate shape, structure, and material of the mask.

The results of this design succeeded in presenting the expected design solutions, namely preventing the effects of eyeglasses dew, reducing the effects of tightness when wearing a mask, a display that supports appearance, and meeting the WHO mask criteria. Presented in four basic color variants to make it easier to identify the color of the mask.

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1. INTRODUCTION

Covid-19 which first appeared in Wuhan, China at the end of 2019 and then spread throughout the world to this day, Indonesia itself began to feel its effects in March 2020. The presence of this pandemic has given birth to several new habits. with the 3M jargon, namely: wearing a mask, keeping a distance, and washing hands. In particular, the use of masks as a new habit has an effect that affects the activities of certain populations. People with a history of respiratory problems, the elderly, as well as those who wear glasses, are the population that has felt a significant impact from this new habit. People with this respiratory disorder admit that wearing a mask makes them feel even more breathless. Similarly, eyeglass wearers admit that wearing a mask can cause more vapor to form on their glasses – causing interference with their field of vision while on the move.

Several mask manufacturers try to answer this challenge, they make various types of masks that have been equipped with airflow valves, air filter systems, as well as mask materials that facilitate the exchange of airflow for users, such as scuba masks. Ironically, these solutions received a rebuttal from the WHO (World

Health Organization). WHO does not recommend the use of valve masks or the like of scuba because it is claimed to reduce the effectiveness of preventing transmission of the Corona virus through droplet splashes.

Likewise with the problems of eyeglass users, some overcome them by using contact lenses, there are those who replace glasses with anti-fog glasses, use anti-foam spraying on glasses, smear liquid soap on glasses, even the mask manufacturers have tried to answer these challenges by presents masks that are claimed to be anti-dew masks. For example, masks with a spatial design (3D), half face shield masks, and masks with a buffer in the nose area. However, there are things that need to be considered, looking at existing product solutions such as contact lenses, not all eyeglass users are comfortable using contact lenses, so this option is not an alternative to be studied further. The alternative of replacing anti-fog eyeglass lenses, which tend to cost three times the price of ordinary lenses, is considered too heavy for the general public. Likewise, the mask design solutions related to the dew effect of glasses, the solutions offered have not fully answered the challenges faced by eyeglass users, for example from the aspect of the design of the mask straps whose position is stacked with the glasses handle, thereby reducing the comfort of wearing glasses.

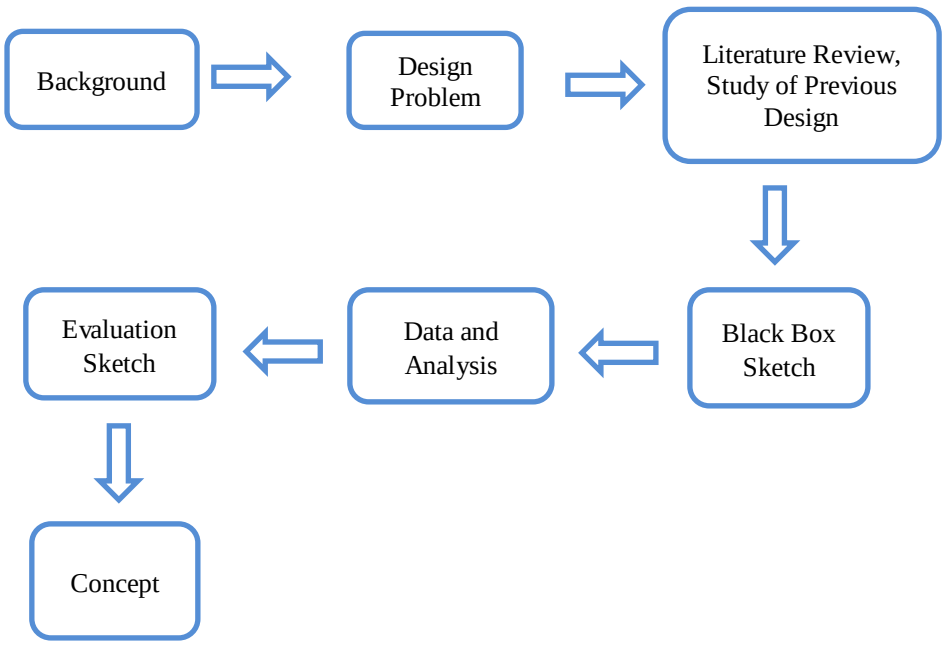
This seemingly simple problem, but for eyeglass users is an important thing, considering that the use of glasses for nearsighted people (myopia, hypermetropia, or both) has become part of their daily life. Without glasses, their daily activities will be disrupted, this can have an impact on their quality of life so that by answering the problems caused by using this mask, they can restore their quality of life as before.

Given the importance of answering this problem for the two population groups, a product that can answer these challenges is needed. The design of special masks as the beginning of this problem can be the closest alternative solution to overcome these problems. An important aspect that needs to be considered regarding this mask is the requirement for masks that are in accordance with World Health Organization (WHO) standards. [2, 5]

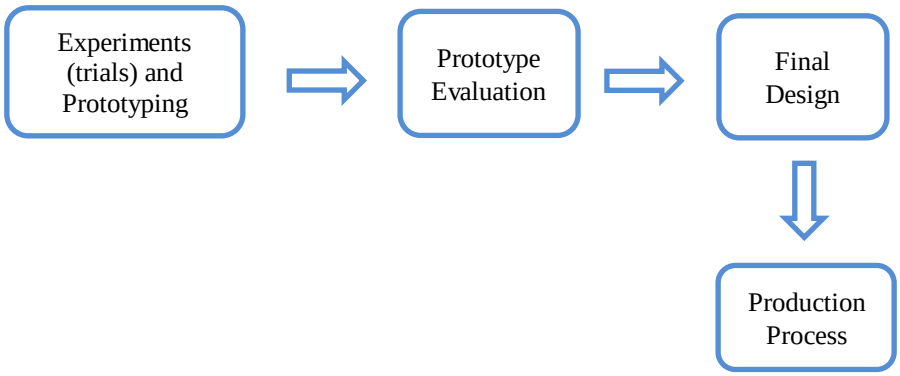
The thing that distinguishes the author's design from previous design solutions is the design problem that the author raises combines four aspects at once, namely the function of preventing the effect of dew on glasses, reducing tightness in users, providing a form that can support appearance and taking into account the recommendations of the World Health Organization (WHO) in Covid-19 prevention.

2. RESEARCH METHOD (10 PT)

2.1. Schematic Of The Design Process



2.2. Schematic Of Production Process



2.3. Data and Analysis

Mask Pattern

The 3D mask pattern is a mask pattern that presents a 3D shape after sewing. This 3D shape produces a spatial structure that adapts to the three-dimensional structure of the face. This space also provides a place for air circulation that is formed from the distance between the mask cloth and the surface of the mouth and nose. This space is one of the advantages of 3D masks so that they can prevent tightness when it used. With these considerations, the author tries to test and modify the development of the mask pattern.

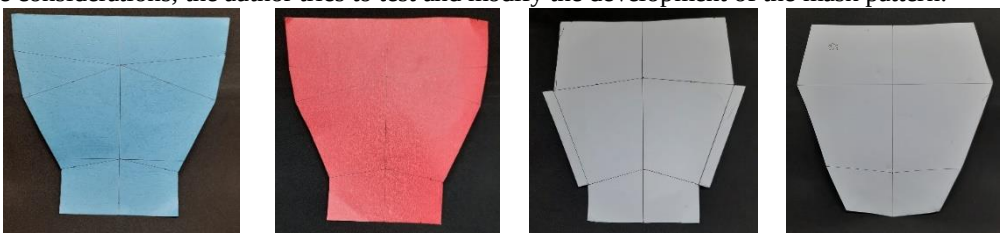


Figure 1. Trial and pattern modification

The following is a detail of the standard size of the mask according to the pattern that has been selected:

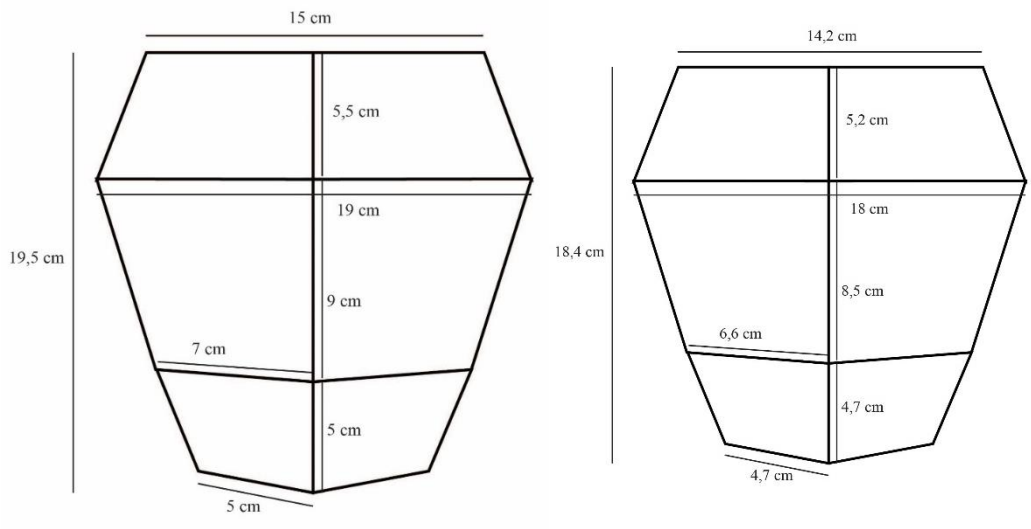


Figure 2. The size of the selected mask pattern and alternative sizes (women)

Considering the comfort aspect raised in the form of preventing the effect of dew on glasses users, the following analysis and evaluation of the previous design alternatives have tried to answer these challenges.

Table 1. Table Analysis of Alternative Design Solutions for Anti-Dew Effects on Masks

Alternative Design	Cutton Material	Anti-Dew Solution	Protection Effectiveness	Total
valve mask	3	2	0	5
3 D mask	3	3	3	9
mask with nose bridge	3	3	2	8
mask with extra space	3	3	3	9

Note : 0 : bad, 1 : quite, 2 : good, 3 : best

Based on the assessment of the design alternatives above, the highest points were obtained, namely the 3D mask design and the mask with additional space. Considering that masks with additional (extra) space require additional components that create many folds that have the potential to become a source of virus transmission, the authors prefer an alternative 3D design to prevent the effect of condensation on the glasses.

Figure 3. Prototyping The Mask Pattern

Mask Frame

The next point related to the comfort aspect of the mask is to prevent suffocation in users with respiratory problems. This means that users without respiratory problems can feel short of breath when wearing a mask, so of course users with respiratory problems will have more problems when using a mask.

After making various observations on the components that cause shortness of breath when using a mask, the authors found that this was because the distance between the inner fabric of the mask which was too close to the nostrils and mouth became an obstacle to the ventilation process (human inspiration-expiration) when breathing. Here's the illustration :

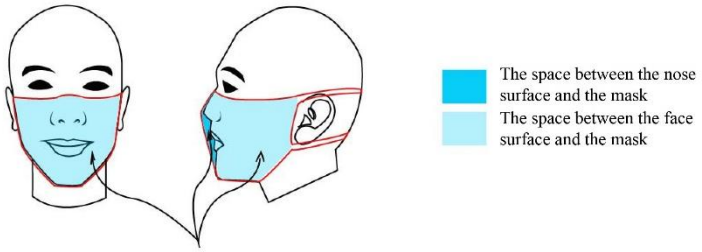


Figure 4. The area of space between the mask and the surface of the face

The dark blue area represents the space formed by the distance between the inner mask surface and the nose-mouth. The existence of this area is a solution to preventing congestion when wearing a mask. The following is an analysis of alternative design solutions that become a reference.

Table 2. Table Analysis of Alternative Design of Anti-suffocation Solutions on Masks

Alternative Design	Cutton Material	Anti-Breathless Solution	Protection Effectiveness	Total
valve mask	3	3	0	6
3 D mask	3	2	3	8
mask with nose bridge	3	3	2	8
mask with extra space	3	1	3	7

Note : 0 : bad, 1 : quite, 2 : good, 3 : best

With these considerations, the consideration of procuring an adjustable frame in the mid-mask area as an adjustable nose support is an evaluation of the design.

Mask Strap

The next thing to pay attention to is the robustness of the position of the mask to the user, given that the head consists of the face, skull, and neck area, the ideal position of the mask strap is in an area with minimal movement so as to avoid using the strap in the neck area. This strengthens the choice of strap design (the upper part) in the form of a head loop, considering the area traversed on this strap (the skull) is a static area (no joints). Another consideration is the component of the lower strap of the mask that functions as a chin support which is the most active part on the surface of the face – which when opened dynamically pulls the upper part of the mask downwards so that the mask easily sags, with these considerations the authors designed the lower strap as a support chin on the mask.

Figure 5. Trial and Analysis of Material and Shape of The Mask Strap

Mask Color

Every object or product must have a color. The application of color to this product chooses neutral colors (black) and primary colors (red, blue, yellow). The choice of black color has a consideration that the nature of this color is neutral and does not easily look dirty, this is important because the mask is located on the face so that it will affect the user's confidence. The selection of primary colors, such as red, blue, and yellow, took into account that these colors are unisex so that they do not specialize in the gender of the user considering that the target users are male and female.

Mask Material

An ideal combination of materials for non-medical masks: an inner layer made of a hydrophilic material (e.g. cotton or cotton blends), a hydrophobic middle layer made of a synthetic nonwoven material such as polypropylene, and an outer layer made of a hydrophobic material such as polyester, polypropylene or a mixture of both so as to limit contamination from outside that penetrates into the nose and mouth of the wearer. Below is an illustration of the fabric lining and the combination of materials recommended by WHO.

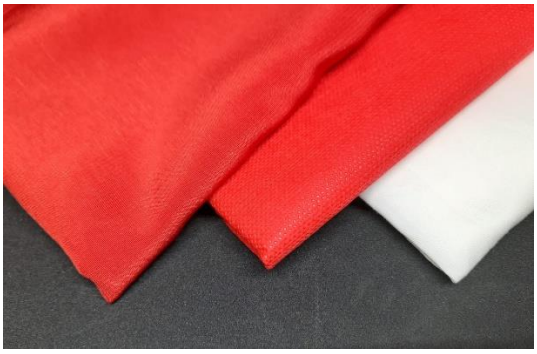


Figure 6. Mask layer: Polyester, spunbond, and Japanese cotton

Connection System

The connection system on a cloth mask that has a mask strap component is also an elastic rubber cloth is by the sewing method. Considering that the elastic structure of the rubber is not resistant to heating, this mask is not recommended for a connection system in the form of heating or a press system.

Maintenance

The cotton fiber structure of the cotton fabric makes it even stronger when wet. Other types of fabrics don't have this advantage, so we can wash cotton products without worrying about them getting damaged quickly. Cotton also has good resistance to high temperatures, so you can iron cotton products without worrying about damaging their shape and softness. The rigid, water-resistant structure of the spunbound fabric adapts to washing. Likewise, the polyester structure is easy to clean without ironing, making it easier to maintain this reusable mask.

Considering that there is a rubber component of the mask strap and buffer wire inside, it is not recommended to wash this mask using a machine because it can damage the elastic mask strap and wire structure, so hand washing is recommended in maintaining the cleanliness of this mask. This mask is recommended to be washed every day after using it for a maximum of eight hours according to WHO recommendations

3. RESULTS AND DISCUSSIONS

3.1. Concept of Shape and Size

The shape of the mask used is in the form of 3 D (three dimensions) because this shape is the most suitable form for the design problem raised, namely preventing the effect of dew and reducing the effect of tightness on the user. The size of the mask consists of the length, height and thickness of the mask body and the length of the strap. The height of the mask pattern is 19.5 cm, the width of the mask pattern is 19 cm and a minimum thickness of 0.3 cm with an estimated layer thickness of each fabric of 0.1 cm according to WHO requirements, which consists of 3 layers of fabric. The length of the upper strap is 40-45 cm which can be adjusted so that it allows the user to adjust the comfort of its use in half the circumference of the head and the length of the lower strap is 12 cm so that it can support the lower jaw (chin).

3.2. Concept of Material

The material used in this mask consists of the materials that make up the mask, namely 3 layers of cloth material on the body of the mask, elastic material on the mask strap, and buffer wire material on the inner layer. The choice of 3 layers of fabric is according to their respective properties, namely absorbing water (inner layer) and retaining water (middle and outer layers). The material for the mask strap is elastic because it makes it easier to adjust the mask strap. The buffer wire material was chosen because it functions as a buffer so that the structure of the mask can be sturdy, making it easier for users to breathe.

3.3. Concept of Connection System

The connection system used is the sewing technique because the main material of this mask is three-layer cloth and the other material that is connected is an elastic rubber material so that the sewing technique is the best choice for the connection system. This connection system avoids the use of press and heating techniques because of the elastic properties of the material which can be damaged or reduced in flexibility due to heating

3.4. Concept of Color

The colors used in this mask are the basic colors, namely red, yellow and blue, and the neutral color, namely black, because these colors minimize confusion in identifying their use. The colors used avoid flashy impressions because considering their use in areas of the face that not everyone wants to look flashy.

3.5. Concept of Structure

The structure of the mask used is in the form of a buffer that is placed on the inside of the mask so that the shape of the mask can be maintained properly attached to the face area. The structure of the mask that has this buffer is to prevent the mask from sliding down when used when the user is driving (motorcycle) or actively moving on the face area when talking which causes the mask to sag.

3.6. Concept of Maintenance

This mask is a reusable mask because the material is a three-layer cloth which allows it to be washed. Masks are not recommended to be washed by machine, considering the elastic material that loosens more easily after washing by machine, so hand washing is recommended.

3.7. Final Design

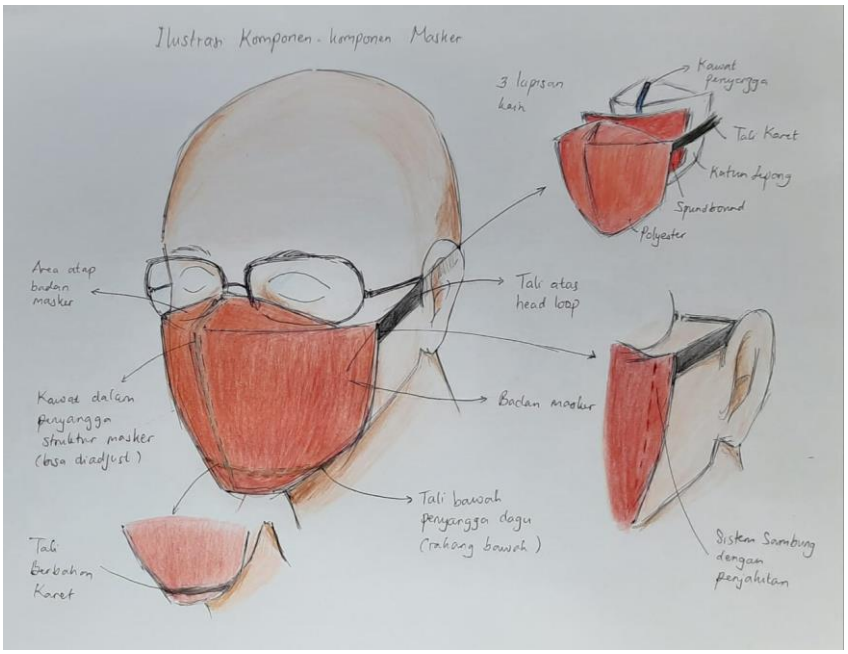


Figure 7. Component Ilustration of The Final Design

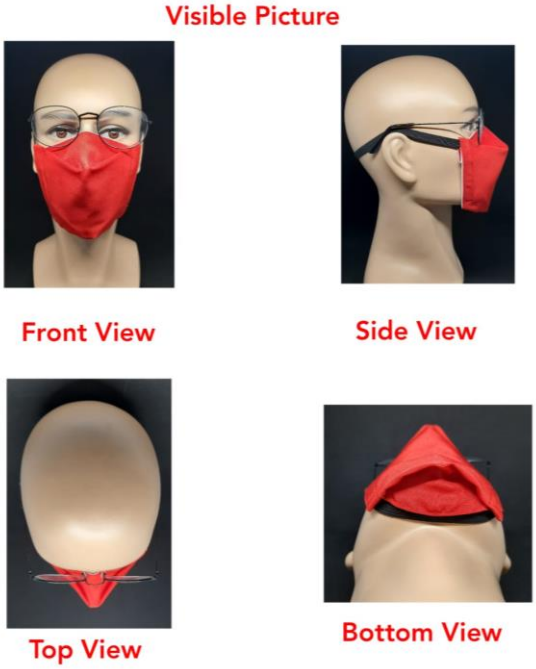


Figure 8. Display Mask

4. CONCLUSION

As the author explained on the background and problems, that this design aims to solve problems caused by a new habit that was present during the pandemic, namely the use of masks. The use of these masks has given to new habits that have an impact on the quality of life of certain populations, such as glasses users and people with respiratory problems. Their problem, namely the effect of dew on the glasses and the feeling

of shortness of breath when breathing, are the main things that the author tries to solve through this design. The solution to this problem comes through the process of collecting data in the form of references to similar masks, the results of analysis and testing of shapes and materials so as to produce design solutions that prevent the effect of dew on glasses and reduce shortness of breath in users with respiratory disorders.

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