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Minimalist Wardrobe for Elderly Inspired by Dupli Casa, Germany

Syazwani Azmi[1], Mohamad Ali Selimin[1]* & Mohd Hasni Chumiran[1]

[1]Department of Production and Operations Management, Faculty of Technology Management and Business,
Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, Johor, 86400, MALAYSIA

*Corresponding Author Designation

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Abstract: Malaysia's senior population increased during the third and fourth quarters of 2018. The growing old population is regarded as an ageing problem that is not limited to Malaysia but is a worldwide issue. Existing furniture nowadays may have a detrimental influence on elderly health since they have movement limitations owing to their body flexibility. For instance, almost 89.6% of the older populations were dissatisfied with the current wardrobe design. Therefore, the purpose of this study is to design and develop a prototype of a minimalist wardrobe for the elderly inspired by Dupli Casa, Germany. A Google Form survey was distributed to persons who live with older people or who may have an opinion regarding geriatric-friendly design. The survey data was used in the design and prototyping processes. In this study, two visuals research, two thumbnails, four ideations, seven idea developments, and a final design were generated based on the obtained design criteria. According to the results of the survey, the wardrobe design should include a hanging area, stacking space, and drawers. The majority of respondents also requested to have a sensor light in the wardrobe as an added feature. This wardrobe's prototype is built of plywood and laminated plywood. In addition, the wardrobe's door is made of a hinged door, which allows the elderly to have a better view of the inside. The newly designed wardrobe in this study is intended to ensure that senior individuals, even if they live alone, have no difficulty utilising and organising their wardrobes.

Keywords: Minimalist Design, Wardrobe, Elderly, Geriatric-Friendly Furniture

1. Introduction

Malaysia's senior population increased from 2.12 million to 2.21 million in a year, from the third quarter of 2018 to the third quarter of 2019. Furthermore, the senior population is predicted to more than double from 7.5% to 15% in 2040 (Safian et al., 2021). According to the World Health Organization (2011), people's life expectancy is growing because they live in a better environment, eat

*Corresponding author: aliselimin@uthm.edu.my

better, and medical technology is improving. According to the Mahidin (2020), male life expectancy is predicted to climb from 72 years in 2010 to 78 years by 2040, while female life expectancy is expected to rise from 77 years to 83 years during the same period. The shifting population is caused by increased life expectancy and decreased fertility.

Today's furniture may have a harmful impact on geriatric people's health. This is due to the fact that the height and weight of senior persons approaching the age of 65 are gradually dropping. People utilise a variety of furnishings in their everyday lives at home to make living simpler. A wardrobe is a piece of furniture that is typically seen in any home (Goh et al., 2011). Wardrobes are mostly used to store and hang clothes. Recently, a study on the ergonomics of clothing for elderly individuals was released. It was mentioned that the current clothing needed to be changed because the design is not totally acceptable for elderly individuals owing to their movement limitations. As the number of elderly people in Malaysia grows, it is necessary to develop a wardrobe that is appropriate for their abilities. Furthermore, the bone, muscle, and tendons begin to shrink, affecting the flexibility and activity of their leg. Based on this, Gu & Zeng (2019) discovered that over 89.6% of the elderly were dissatisfied with the current wardrobe design. The most prevalent reasons for discontent are cumbersome wardrobe usage, limited storage space, tall and inappropriate space division (Gu & Zeng, 2019). The mismatched wardrobe design causes senior people to face a number of issues, such as difficulty taking and storing items from top storage owing to their flexibility and movement limitations. The simplicity and ease of use of furniture for elderly persons, particularly geriatric people, should be considered while developing new furniture for this specific category of consumers.

Minimalism was the first style found in painting and sculpture because it highlighted the extremely simple handling method in developing a rich artistic language in the art (Hornstein et al., 2005). As time passed, the minimalist style was embraced by the majority of people. Then, when the interior designer has been influenced by the minimalist style, this style changed the way of life. As a result, it evolved into a distinctly modern style with a minimalist design. The material selection, simple and clean design, as well as colour tones, are factors that will complement the minimalist design. Therefore, the objective of this study is to provide a solution to the aforementioned problem by designing and developing a prototype of a modern minimalist wardrobe that have a better partition for the clothing and stuff organisation for elderly people.

2. Literature Review

2.1 Wardrobe

A wardrobe is a tall closet in which clothing is hung and stored. Almost every bedroom in a house has this type of furniture. A wardrobe can be characterised as a significant storage facility. A wardrobe's dimensions must be adequate for the user's size in order for them to feel comfortable when using the furniture.

On the market, there are several types of wardrobes. The different designs will provide that specific area with different functionality and aesthetics. One of the most frequent and popular types of wardrobes on the market is the hinged door wardrobe as shown in Figure 1(a). A hinged door wardrobe is so named because the door is linked to the body using sturdy hinges. The free-standing wardrobe is ideal for people who often rearrange their living space or who are often away from home on a regular basis. This sort of wardrobe's storage capacity is not only inside the wardrobe but it can also be utilised to keep objects at the top of the wardrobe. It's ideal for tight spaces that can't fit a large wardrobe. Finally, the free-standing wardrobe gives you a lot of options when it comes to choosing colours, finishes, and door types. Figure 1(b) is an example of a free-standing wardrobe.

Figure 1: (a) Hinged door wardrobe and (b) free-standing wardrobe

On the other hand, a sliding door wardrobe is a modern wardrobe that is meant to give people such a modern and sophisticated option as presented in Figure 2(a). It is, in reality, a modern take on the conventional hinge wardrobe. Sliding doors have the advantage of saving a lot of room since they glide horizontally and do not take up any space in front of the closet. Following that, a walk-in wardrobe is a luxury wardrobe since it necessitates a place specifically created to store stuff. Everything is kept in here, from shoes to jewellery and accessories. Furthermore, the typical walk-in wardrobe offers hanging and storage space on almost all sides of the room as depicted in Figure 2(b).

Figure 2: (a) Sliding door wardrobe and (b) walk-in wardrobe

Next, an L-shaped closet is sometimes known as a corner wardrobe as shown in Figure 3(a). This style of wardrobe's design might be considered as a solution for making better use of a room's wasted corner. It has the ability to produce a one-of-a-kind beauty, and this style might be a popular choice for a wardrobe. Finally, there's the slanted wardrobe. This design is almost identical to the L-shaped wardrobe, which is intended to reduce wasted space in a room. As a consequence, this design is appropriate for a slanted ceiling room, attic bedrooms, or under stairs storage (Figure 3(b)).

The elderly would have problems if their wardrobe is too small. The size of the human body and the size of the item storage typically define the overall size of the wardrobe. As a result, the size of an aged person's clothing will change from that of a normal person's wardrobe since their sizes are no longer the same and in more serious cases involving people with “old folks” posture and geriatric. The comparison of various sizes of the wardrobe, including height, depth, breadth and its arrangement is presented in Figure 4.

In the most popular wardrobe design, the top closet partition serves as a storage area for the quilt or other goods for the bed. This storage arrangement is not suitable for the elderly, as most of them suffer from osteoporosis and backbend. This will make storing and retrieving items from the upper

closet incredibly difficult. The simplest way to minimise falls or accidents is to design a new wardrobe partitioning that is tailored to the elder's body composition or to install any supported device that can help them. Then, in the wardrobe division, a superfluous stacking area should be turned into a hanging area. By providing more hanging space, the user will be able to view the precise positioning of their belongings. It can also assist with the problem of misplacing garments owing to poor recall. Furthermore, a hanging area may be able to keep more garments than a stacking area, increasing storage space. Another advantage of employing hanging storage is that it allows you to maintain your wardrobe clean and neat when removing garments or other items. Finally, the stacking area or drawer might still be included in the wardrobe because it is needed for storing little items such as socks, undergarments, or other items that cannot be hung. The stacking area and drawer should be located on the bottom part of the wardrobe.

Figure 3: (a) L-shaped wardrobe and (b) Sloped wardrobe

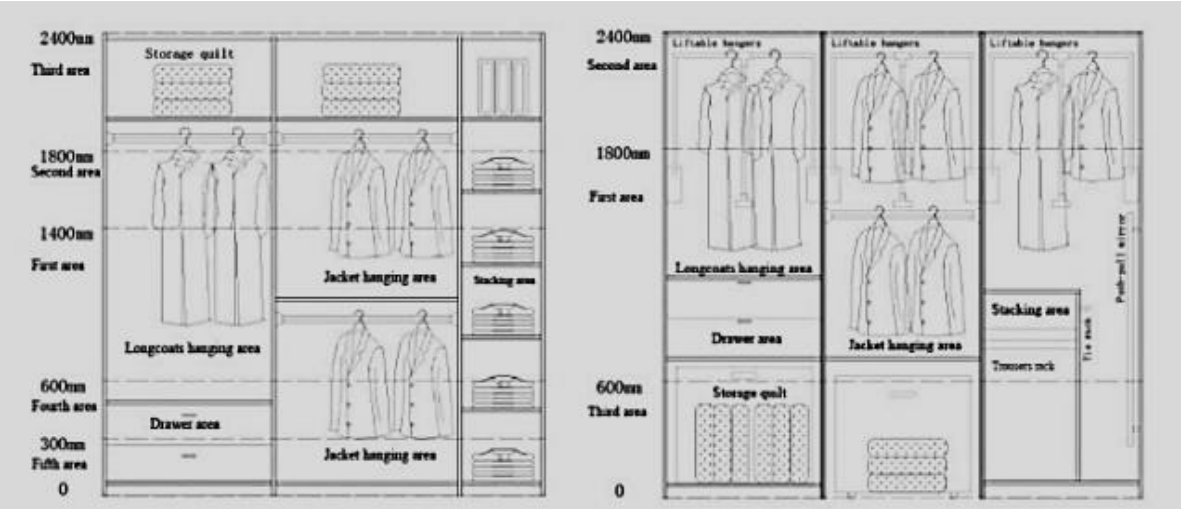

Figure 4: Difference sizes of wardrobe (Gu & Zeng, 2019)

2.2 Minimalist Concept

The notion of minimalism was developed by modernist architect Ludwig Mies Van der Rohe. The idea is based on his well-known adage, "less is more" (ArchDaily, 2021). The first minimalist paintings and sculptures were created to showcase the expression of the artwork. The intention of minimalism was to break away from the excessively beautiful and build something with an emphasis on harsh simplicity. Furthermore, the mix of shape and colour aids in the expression of the painting's aesthetic language. Typically, extraneous adornment is removed in minimalist style, leaving just the essential and fundamental parts. The design will be extremely basic and tidy, but it will also have an exquisite aspect.

There are a few design aspects that may be used while creating minimalist furniture. The first aspect is basic essentials, which means that this technique only employs fundamental elements such as light, form, and materials. Minimalism is one method for achieving maximum utility using minimal materials. The second is a clean line. When opposed to others, a clean line design focuses on functionality and practicality. Typically, this element displays a flat, smooth surface and a neat line, which creates a natural look on furniture. Finally, the high-quality materials used to make the furniture are an important aspect of minimalist design. Given the simplicity of the design for minimalist furniture, low-quality materials will make the finished product appear cheap. Furthermore, the material used for the product will have an influence on the minimalist idea.

2.3 Dupli Casa in Germany

The Dupli home, which is located in Marbach, Germany, was designed by the German architect and artist, J. Arquitectos Mayer (ArchDaily, 2009). This three-story home with a height of 12.20m was built between 2005 and 2008. The ancient structure was constructed in 1984 and has evolved into a one-of-a-kind and exceptional pattern created by the architect. Dupli Casa is a house that has undergone several additions and modifications from its original construction to its current state. The geometry of this luxurious structure is inspired by the former house on the site. The three storeys of the home provide a lovely and appealing impression from the outside.

Figure 5: Dupli Casa, Germany

The inspiration from Dupli Casa in designing the minimalist wardrobe for the elderly is focused on the look of the house, with little structure implications in the design. As depicted in Figure 5, the wall construction is made of glass and can be seen via the big aperture lens. Moreover, the black and white colour palette with smooth line design would define the areas with a minimalist appearance. Furthermore, because the Dupli Casa is a construction that plays with the angle of the structure, the wardrobe design may alter the angle.

3. Research Methodology

This study used the same procedure as other studies that have been published (Ramli et al., 2018; Selimin et al., 2019; Husuno & Selimin, 2020). This study began with a design survey, which was conducted by distributing a questionnaire to 50 respondents using Google Form. In this study, the questionnaire is divided into two sections: Section A (demographic information) and Section B (design criteria of the wardrobe). The respondents were selected mainly because they had experience and may live with an elderly or even have an opinion about the wardrobe specifications that are appropriate for senior persons. Following that, the visual research approach was employed to improve the researcher's understanding of wardrobe design. The most significant aspect of this visual research is to identify a

wardrobe design that meets the criteria for easing the elderly in managing and using the wardrobe on daily basis. It may help to discover a particular innovation that can be incorporated in the design of the wardrobe by referring to the available wardrobe photographs. It also aids in the brainstorming process for producing and developing thumbnail sketches.

Based on the questionnaire criteria, 36 thumbnails, 4 ideations, 7 idea developments, and 1 final design were generated. The improvement of an ideas from ideation to final design was done by referring the design criteria and also the most favoured design based on the final design survey. In this study, only chosen idea development sketches were utilised as candidates for the final design survey to aid in the decision-making process. A mock-up will be generated after the final design has been selected. Mock-ups was used to assess the aesthetic and structure of the chosen final design as well as identify possible changes that can be made to the design to increase the quality and values.

Subsequently, once the final design (if any) had been improved, the technical drawing was made. The wardrobe prototype was then built utilising the right materials for the design, either based on the questionnaire answers or a supplier recommendation.

4. Results and Discussion

4.1 Design Criteria Analysis

In this study, the questionnaire was completed by 60 participants. Table 1 summarises the questionnaire's significant findings. The survey results suggest the relevant criteria and information required in developing the minimalist wardrobe for the elderly. In the demographic section, 70.0 percent of the 60 respondents were female. Despite the fact that respondents aged 40 and under made up the majority (78.3%), more than half of them live with their elderly parents (53.3%). 16 respondents out of 53.3% live with an old person, followed by 15 respondents who live with two senior individuals.

Table 1: Summary of questionnaire results

Section	Percentage (%)	Description
Demographic information	70.0	Female respondents
	78.3	Ages 40 and below
	53.3	Single
	53.3	Live with elderly
	47.1	Live with an elderly only
Design criteria	100.0	Own wardrobe
	41.4	Own sliding door wardrobe
	60.0	Their wardrobe is not elderly-friendly
	61.7	Have a problem with the wardrobe division
	55.6	Have limitation for elderly to reach top part of the wardrobe
	51.1	Limited view of the items store in the wardrobe
	78.3	Suggest to design elderly-friendly wardrobe
	85.0	Consider to buy an elderly-friendly wardrobe
	88.3	Recommend to re-layout the wardrobe partition
	78.3	Favour wardrobe with hanging bar feature
	68.3	Prefer wardrobe with stacking space feature
	58.3	Need drawers in wardrobe design
	58.3	Prefer sliding door wardrobe
	51.7	Suggest to add light sensor for lighting

In addition, all respondents had a wardrobe in their house, with 41.1% having a sliding door wardrobe. This demonstrates that a wardrobe is an essential piece of furniture for everyone. 36

respondents stated that their wardrobe is inappropriate for the elderly. Furthermore, seniors have difficulties reaching the top of their wardrobe (55.6%) and have restricted views of items put towards the rear of the wardrobe (51.1%). This might be due to a problem with the layout of the wardrobe's partition/division. Because the older population is growing, wardrobes designed exclusively for them are in high demand. As the older population grows, wardrobes designed exclusively for them are growing market. These problems are exacerbated for elderly citizens, notably geriatrics. Individuals who have experienced the problems that their older relatives face may be interested in obtaining this sort of wardrobe (85%).

As a result, the majority of respondents requested that a more folks-friendly wardrobe be accessible on the market to meet the demands of this population. The following criteria must be considered when designing a new elderly-friendly wardrobe: (1) reorganise the layout of the wardrobe division – 88.3%, (2) easier to access cloth hanging space – 78.3%, (3) must have drawers – 58.3%, and (4) utilise sliding door – 58.3%. Furthermore, 51.7% of respondents advised that the newly designed wardrobe have a light sensor to provide sufficient illumination to individuals while they use it.

4.2 Visual Research

A visual investigation was done to find current wardrobes on the market for use as a reference in developing a thumbnail during the design process. In order to identify the visual of the current items, the minimalist wardrobe and division arrangement was the key focus. This study's visual research is depicted in Figure 6. According to the findings of the first visual research, only minimalist wardrobes were picked as a reference. There are several wardrobe layout arrangements of minimalist wardrobes that might be used in the design process. Following that, visual research 2 depicts the interior division layout of distinct items. Again, this might be a big notion for designing appropriate interior partition for senior people.

Figure 6: Visual research of wardrobes

4.3 Design Process

There are 36 thumbnails sketched for the exterior look as well as the interior arrangement of the wardrobe. Figure 7 displays the thumbnail of this study. All thumbnails were drawn with referencing some of the criteria obtained from the questionnaire and the visual research. The red square box on the figure denotes the ideas that were chosen for further development during the ideation stage. The thumbnail 1 proposal was chosen because the design inspired by Dupli Casa, Germany has the ability to give a better function for the wardrobe than the other shape. Next, the concept from thumbnail 2 was considered because it has a decent wardrobe arrangement that will benefit the elderly because there is no stacking space at the top of the wardrobe.

Following that, Figure 8 illustrates the wardrobe ideation design. The selected thumbnails were developed further at this step by referring to the design criteria collected prior to the design process and also by integrating more than one idea from the thumbnail sketches, which is indicated by a red square (Figure 7). The appearance of the Dupli Casa architectural design in Germany served as inspiration for

improving the thumbnail ideas. There are four ideations at this stage, and because they all meet practically all of the criteria, they were all recommended for the next stage of the idea development stage.

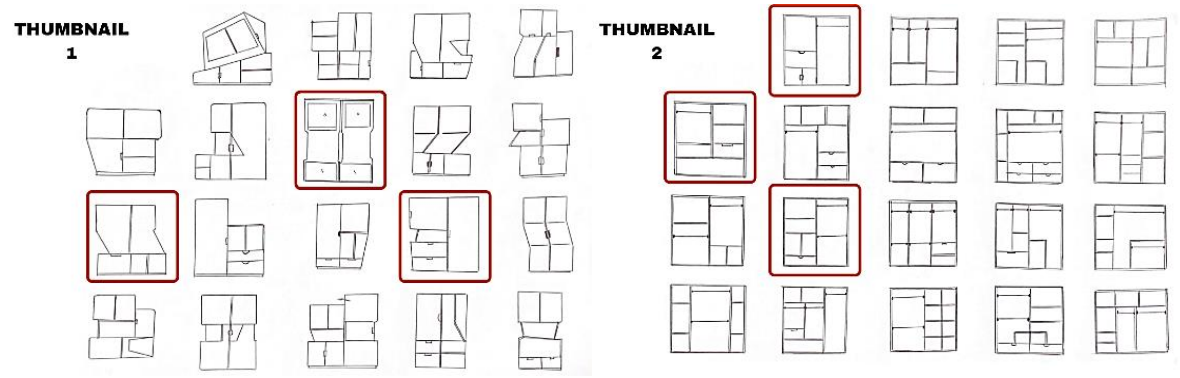

Figure 7: Thumbnail sketches of elderly-friendly wardrobe

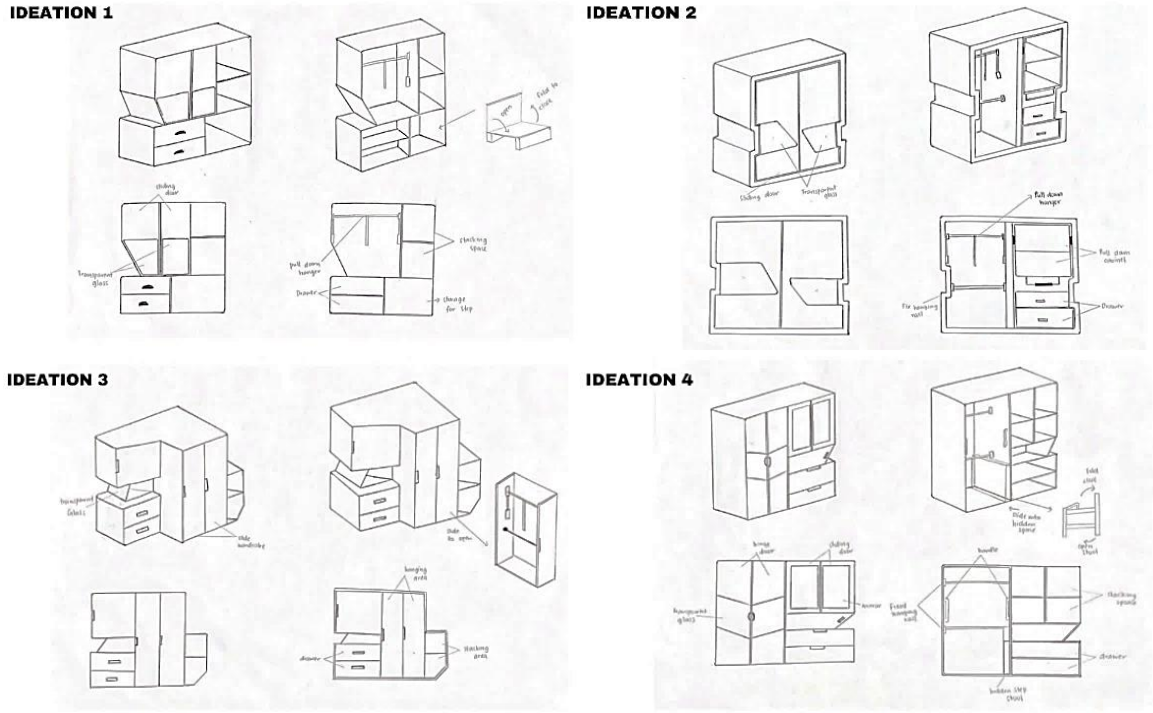

Figure 8: Ideation sketches of elderly-friendly wardrobe

Meanwhile, idea development is a developed form of ideation sketches with some added attributes that may give a remedy to the elderly's address concerns. Figure 9 illustrates a total of seven different idea developments. The ideas at this stage were primarily focused on the wardrobe configuration since it is the most crucial aspect to give the targeted consumer a practical wardrobe for seniors. The shape of the wardrobe comes in second because some shapes may interfere with its functionality. In this study, idea development 3 and idea development 7 were shortlisted as finalists for the final design survey because they met the essential needs of the targeted customer in terms of functionality and the design is simple in comparison to others (minimalist design).

A simple final design survey is carried out using Google Form to aid the decision-making process for the selection of the final design for a minimalist wardrobe inspired by Dupli Casa for the elderly. Idea development 3 and 7 were nominated as final design survey contenders. The implementation of the door mechanism is what distinguishes these two idea advancements. Idea development 3 made use

of a sliding door, which suits the user's needs. Idea development 7, on the other hand, employed a hinged door mechanism. Despite not meeting the criteria, idea development 7 was chosen as one of the final design candidates because the hinged mechanism may actually assist the elderly to have a better view of their clothes. The final design survey has 60 respondents who took the time to complete the survey. From the survey, 72% of respondents favour idea development 7. Thus, idea development 7 is selected as the final design for this study as illustrated in Figure 10.

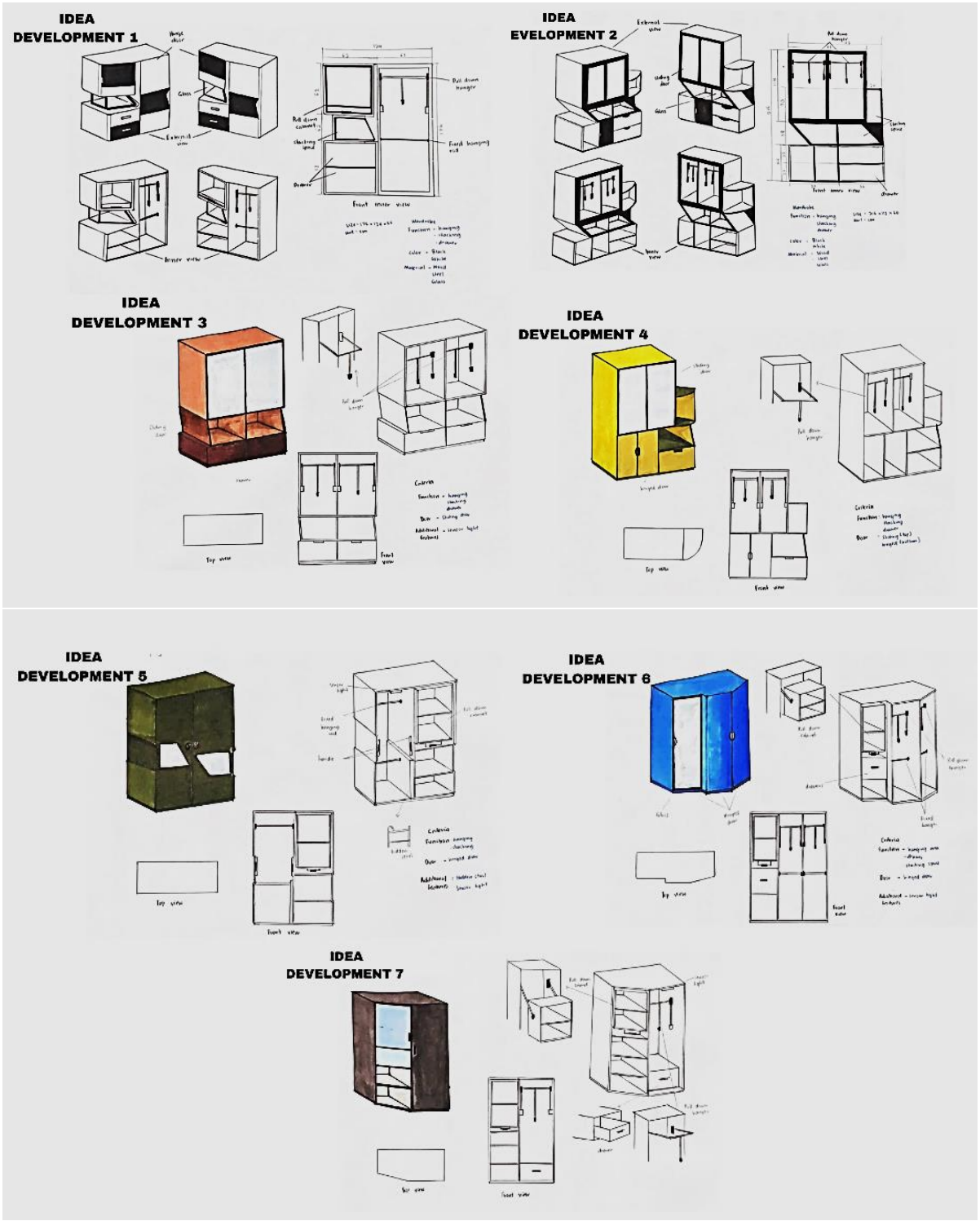

Figure 9: Idea development sketches of elderly-friendly wardrobe

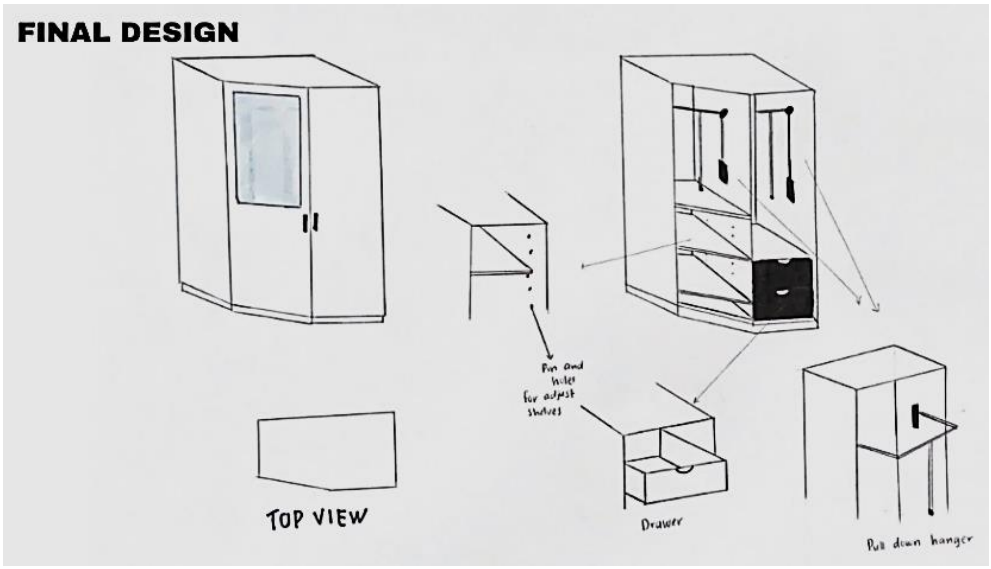

Figure 10: Idea development sketches of elderly-friendly wardrobe

4.4 Prototyping Process

The final design of the wardrobe was visualised through mock-up throughout this stage. To guarantee that the mock-up is not tiny, the scale for this mock-up is 1:8 (Figure 11). The mock-up structure of the wardrobe is built of PVC foam and bonded together with a hot glue gun. Because the foam board has a white surface finish, it does not require any additional finishing because it already reassembles the intended design's colour. In addition, to replicate the appearance of glass, a plastic sheet is utilised for the door section. Prior to the manufacturing process, the mock-up will help the researcher discover elements that may be improved, particularly the design and functionality.

Figure 11: Mock-up of minimalist wardrobe for elderly inspired by Dupli Casa

Next, a technical drawing of a minimalist wardrobe for the elderly inspired by Dupli Casa in Germany was prepared using AutoCAD software. The technical drawing will offer the exact dimensions of the final wardrobe design, which will aid in the prototype fabrication process. The technical drawing is displayed in two viewports in this study: a comprehensive view of the wardrobe in 2D view (Figure 12) and a rendered 3D view (Figure 13). The orthographic and isometric perspectives are included in the 2D view. Meanwhile, the 3D view was plotted in several viewpoints to show the rendered 3D version of the wardrobe.

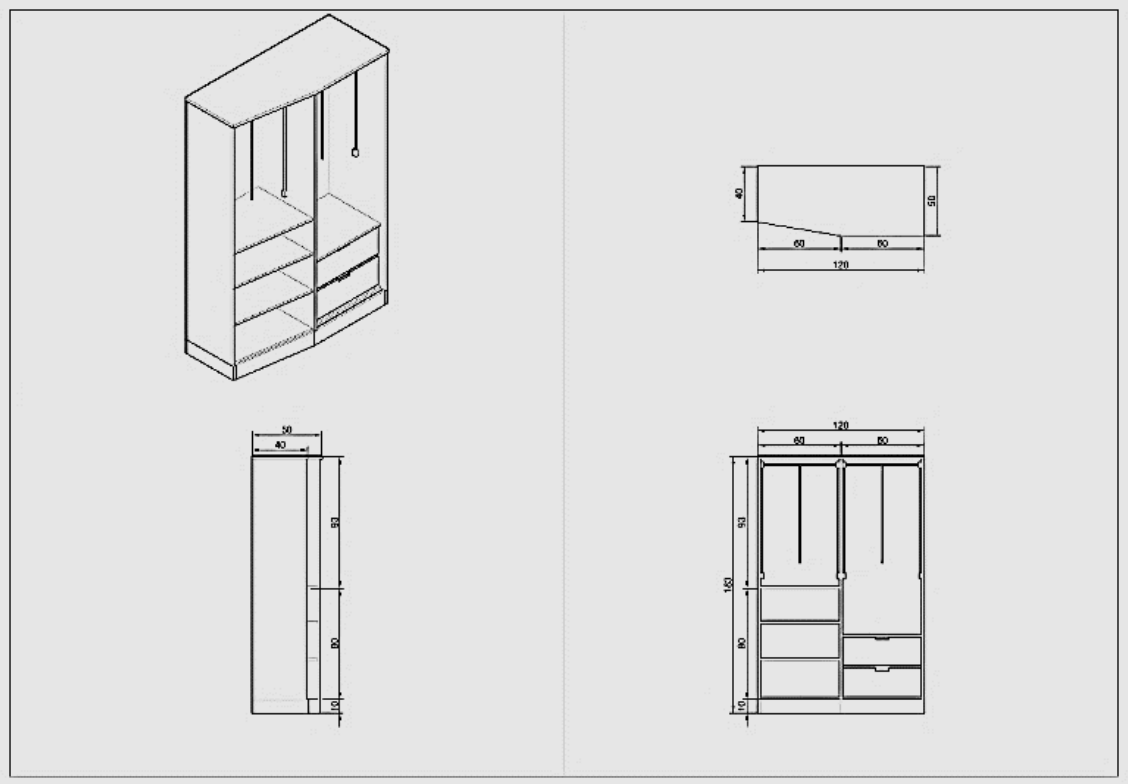

Figure 12: 2D technical drawing of minimalist wardrobe for elderly inspired by Dupli Casa

Figure 13: Rendered 3D technical drawing of minimalist wardrobe for elderly inspired by Dupli Casa

Next, the technical drawings were converted into a full-scale prototype. Measuring, cutting, assembling, and finishing are all stages of the prototyping process. After that, each needed size section of the prototype was measured and marked on the materials, which are plywood and white Formica. Following that, the plywood was cut with a table saw. Because the size is rather large and involves firm equipment, the cutting process is managed by a competent worker to ensure safety during the process. Prior to the laminating procedure, the white Formica was cut to the size of the plywood. Then, the glue was then applied to the required surface of Formica during the laminating process.

Subsequently, the wardrobe pieces were attached with a pneumatic nail gun, and other parts, such as the drawer, were joined with screws. Filler was used to concealing the microscopic markings left by the pneumatic nail gun. In addition, the hole for the modified shelves was drilled so that the pin could be placed as a shelf support. Following that, the glass that had been trimmed to size for the door and the upper shelves was installed on the wardrobe. Finally, the drawer slider and door hinges were fixed. Figure 14 presents the final prototype for a minimalist wardrobe for the elderly inspired by Dupli Casa in Germany.

Figure 14: Prototype of minimalist wardrobe for elderly inspired by Dupli Casa

5. Conclusion

Overall, the study's research objectives were met. As an outcome of this study, a minimalist wardrobe for the elderly inspired by Dupli Casa was developed. The design of the wardrobe was based on the requirements of the potential consumers as determined by the survey. In order to collect data regarding the wardrobe design, a survey was issued to 60 respondents who may live with the elderly or have an opinion on the design of a wardrobe for the seniors based on their experience. The information gathered suggests that the user requires the following features: a hanging area, stacking space, and a drawer. These features were included in the design process, and the Dupli Casa appearance inspired the shape and colour of the wardrobe.

Four ideations were sketched and later evolved into seven concept developments based on the criteria acquired. Two idea developments were picked as finalists for the final design survey based on idea development sketches. Throughout the prototype manufacturing process, changes were made to improve the design. To make prototypes, plywood was employed as the primary material. As an additional perk, a sensor light was included in the design. This study may address the aforementioned problems about older people managing and using their wardrobes, particularly because of their restricted physical movement.

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References

ArchDaily (2009). Dupli Casa / J. Mayer H. Architects. Retrieved December 10, 2021, from https://www.archdaily.com

ArchDaily (2021). Less is more: Mies van der Rohe, a pioneer of the modern movement. Retrieved December 12, 2021, from https://www.archdaily.com

Goh, K. N., Chen, Y. Y., & Lin, E. S. (2011, January). Developing a smart wardrobe system. In 2011 IEEE Consumer communications and networking conference (CCNC) (pp. 303-307). IEEE.

Gu, C., & Zeng, J. (2019, July). Research on the Design of the Elderly Wardrobe Based on Ergonomics. In *IOP Conference Series: Materials Science and Engineering*, 573(1), pp. 012058).

Hornstein, N., Nunes, J., & Grohmann, K. K. (2005). Understanding minimalism. Cambridge University Press.

Husuno, N., & Selimin, M. A. (2020). Meja kopi moden pelbagai fungsi diinspirasikan oleh Palmanova, Itali. *Research in Management of Technology and Business*, 1(1), 326-336.

Mahidin, M. U. (2020). Household income & basic amenities survey report 2019. Retrieved on April 9, 2021 from https://www.dosm.gov.my

Ramli, N. A. M., Selimin, M. A., Ab Hamid, A. A. A., Bon, A. T., Rahim, W. N., & Halip, J. A. (2018). Conceptual design of modern minimalist dining table inspired by British military uniform. In *Proc. of the Int. Conf. on Industrial Eng. and Operations Management*, Bandung, Indonesia.

Safian, N., Shah, S. A., Mansor, J., Mohammad, Z., Nurumal, S. R., Ibadullah, W. A. H. W., Ahmad, S., & Shobugawa, Y. (2021). Factors associated with the need for assistance among the elderly in Malaysia. *International Journal of Environmental Research and Public Health*, 18(2), 730.

Selimin, M.A., Hasanuddin, S., Halip, J.A., Ab Hamid, A.A.A., & Bon, A.T. (2019). Contemporary modular study table for small minimalist residence in Malaysia. *Proc. of the Int. Conf. on Industrial Eng. and Operations Management*, Bangkok, Thailand.