



Enhancing Ergonomics and Efficiency: An Adjustable Keyboard Wrist Rest with Desk Organizer

Romeo P. Montecillo¹

¹ Associate Professor 4, Mechatronics and Graphics Design Department,
Cebu Technological University-Main Campus.

Abstract: This study is to develop and assess the design and efficacy of the multipurpose workstation accessory of Adjustable Keyboard Wrist Rest with Desk Organizer. It was developed to comprise the functions that aid the application of ergonomic and organization principles for computer-related work. Its notable function is the keyboard wrist rest's adjustability function for better keyboard compatibility. It was made to aid keyboard users (such as students, teachers, and office workers) in alleviating and/or preventing the risk of wrist injury while typing, and determining its acceptability as a product is essential for its application for usage by the mentioned users. To assess the product's acceptability, a descriptive method was utilized. Results from the analyzed data show that the acceptability level of each product's qualities as per its Aesthetics, Features, Performance, Serviceability, and Safety are Highly Acceptable. Thus, with an overall weighted mean of 4.53 as to its overall acceptability, the product is Highly Acceptable. It is concluded that the Adjustable Keyboard Wrist Rest with Desk Organizer is a product with high acceptability, supporting its viability and efficacy in applying ergonomic and organization principles when utilized properly.

Keywords: Adjustable Keyboard, wrist rest, desk organizer, carpal tunnel syndrome, musculoskeletal disorder, multipurpose, ergonomic.

Introduction

Nowadays, working with personal computers is an integral part of most human activities. Computer use, whether desktop or laptop, is common in many workplaces, and some companies may find functioning without them unbelievable (Joseph, 2019). A desktop computer typically stays at work or at home, where the computer terminal must be linked to an external monitor, keyboard, and mouse; in contrast, a laptop has all of these components built in and can be transported as a single, fully functional unit that can be used in most setting (Douglas, 2019). All in all, having either has become a necessity due to their convenience, especially within professional and academic settings (Magher, 2021).

With the COVID-19 pandemic profoundly altering the way of life, with one influence having to bring work and education to the safety of people's homes, working with personal computers has never been more imperative. Furthermore, an increase in digitalization is leading firms and educational institutions to shift to a work-from-home (WFH) system (De' et al., 2020). With that, technology bridged the gap that the pandemic has created between people and their work and responsibilities. Thus, with the prominence of computer workstations, workplace safety, and work efficiency are more significant than ever. While being the "safer" alternative, the work-from-home circumstance has brought an often-overlooked danger with inconspicuous effects. The "danger" is the disregard for ergonomic principles within (personal) work environments and the products used. As working in make-shift offices become more common, the risk of discomfort and potentially serious musculoskeletal disorders may result from poor static postures (Gerding et al., 2021). In addition to this, without the physical supervision of a manager and/or teacher, employees, and students become negligent about desk organization. Business consultant (Larry Alton, 2017) states that "It [desk organization negligence] will have a

negative toll for the workers and students. If not dealt with in a prompt manner, it can actually have a harmful impact on productivity and output”.

Acquiring a keyboard for its aesthetic appeal but disregarding the technical features that might cause the risk of discomfort for long hours of repetitive typing is a mistake often made by consumers. This can lead to repetitive strain injuries, namely Carpal tunnel syndrome and finger strains which can be attained through poor posture and incorrect typing ergonomics. In fact, Carpal tunnel syndrome accounts for 15% of all workplace injuries (Weaver, 2015). According to Cornwell University, “the ideal typing posture is such that the keyboard is below your elbow height when seated, with your wrists straight and not placed on the surface of the desk.” (Muller, 2019). If the keyboard is too low, one will have to compensate by bending their wrists upward; and if the keyboard is too high, one compensates by raising their shoulders to elevate their arms” (Middlesworth, 2022). Therefore, keyboard design, size, and tilt should be considered when selecting a keyboard. Otherwise, a keyboard wrist rest: an ergonomic accessory, can aid with these issues. A wrist rest attachment is incredibly practical as it lets the user keep their wrist in a neutral position and gives support for the forearm, meaning less stabilizing work is required of those muscles (McGee, 2020). With the precedence of computer workstations, workspace organization, and cleanliness have become significant policies encouraged by schools and companies. Mainly because a clean desk increases productivity and persistence by 84%, by employing desk organizers, one can turn a cluttered workspace into an organized environment. Every component having its intended place can save time and allow the user to switch between tasks more effortlessly. This leads to increased productivity while also improving creativity and critical thinking (Ledger, 2022). Generally, the advantages of having a desk organizer within a workstation include stress reduction, saving time, and an increase in work productivity (Louise, 2019).

With the points presented, it can be noted that the prominence of computer workstations elevates the significance of the application of ergonomic and organizational principles in increasing productivity and in preventing negative health effects. Mainly with the help of desk organizers and ergonomic tools such as keyboard wrist rests.

Thus, the goal of the study is to develop and assess the design and efficacy of the multipurpose workstation item Adjustable Keyboard Wrist Rest with Desk Organizer. Aiming to help in resolving the issues highlighted, it is a product that incorporates the functions of an ergonomic keyboard wrist rest and the practicality and aesthetic of a flat rectangular desk organizer into one compact and portable product, all while addressing an ergonomic design flaw by incorporating an adjustability function in the keyboard wrist rest for better keyboard height compatibility.

Methods and Materials

To test the acceptability and efficacy of the developed Adjustable Keyboard Wrist Rest with Desk Organizer. Establishing the needed materials and equipment and creating the initial product design with the consideration of implementing the following dimensions of quality: Performance, Features, Serviceability, Safety, and Aesthetics.

The study utilizes a descriptive approach to conduct and assess the study; that is, to progress and evaluate the effective product design of the item and to perform a survey to identify and measure the product’s quality in accordance to specific Garvin’s dimensions of quality. The identified respondents are thirty (30) students of Bachelor of Science in Graphics and Design (BSGD), ten (10) selected technology faculty members, and ten (10) selected office workers of Cebu Technological University.

Procedure for Data Gathering

Gathering data was conducted by providing questionnaires to the identified respondents. The study's target participants included a total of fifty (50) respondents: thirty (30) students, ten

(10) faculty members, and ten (10) office workers who were selected to answer a scaling questionnaire. The authority to conduct the study is sought from the office of the Campus Director. Before the questionnaire was given to the respondents, instructions for answering said questionnaire were provided by the researcher(s). The researcher then explains the purpose of the study with a demonstration to show how the product is utilized. After the duration of the test, the researchers collect and consolidate the data for quantification and analysis.

Results and Discussion

This part of the study determines the acceptability and efficacy of the developed Adjustable Keyboard Wrist Rest with Desk Organizer. The development of the product was divided into phases. For the first phase, the base concept of an Adjustable Keyboard Wrist Rest with Desk Organizer prompted a “concept and research phase” focusing on the analysis of existing models for both components. The information gathered contributes to the “designing phase,” which involves sketching out initial designs, applying functional dimensions, revisions, and creating a physical 3D model. A detailed orthographic and isometric layout document, and a 3D model video demonstration, are then made to be given to the researcher-selected woodworking expert(s) for a commission on its construction.

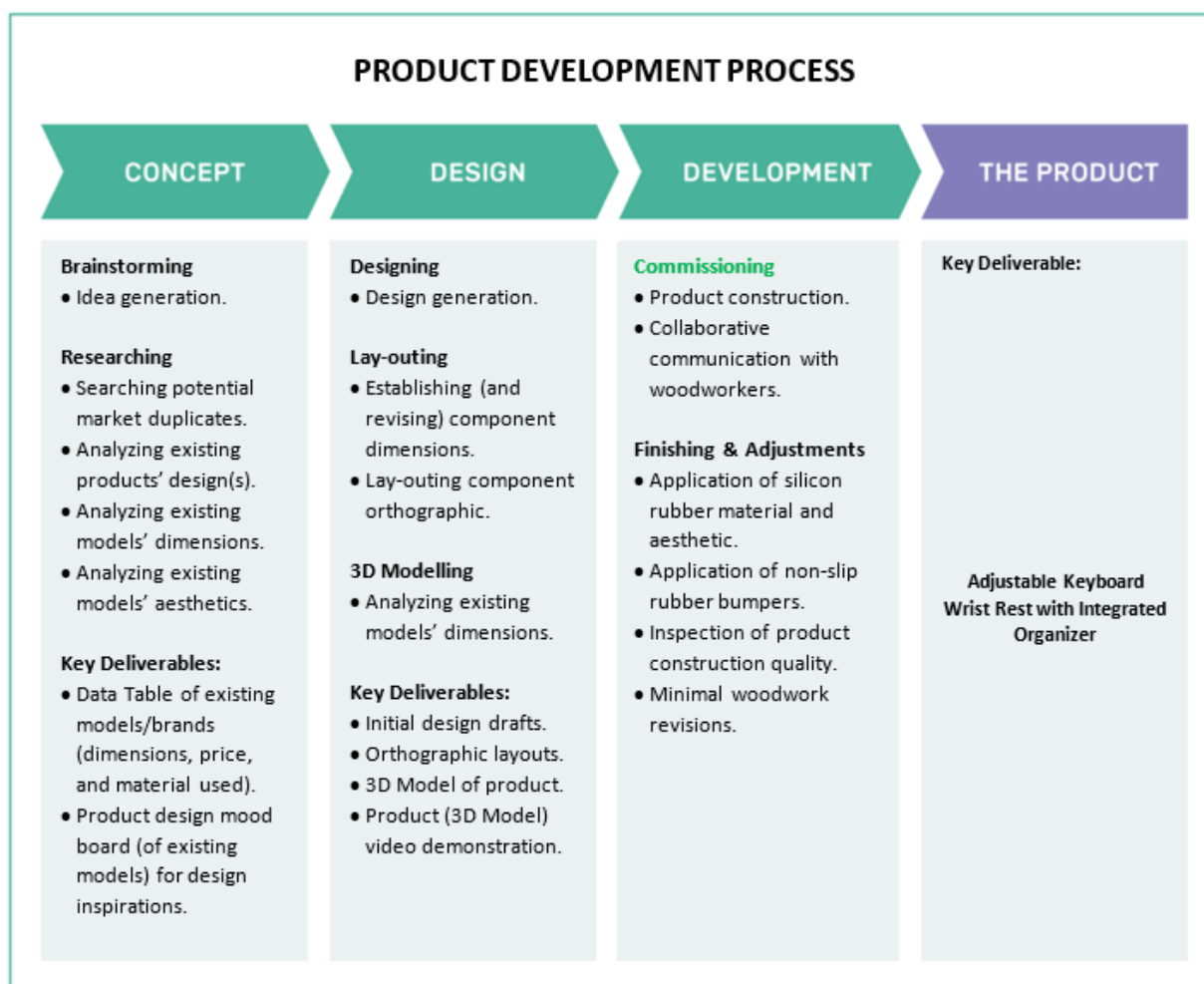


Figure 1. Product Development Process

Shown in Figure 1 is a simplified chart of the project development process. The flow and process of the product's development can serve as a guide on the order of procedures taken for product conceptualization and development, as well as a way to monitor the flow and progress of the project.

Product Layout and Model

The product layout and model refer to the orthographic views of the product's wooden components. This is a necessary requirement for the 3D modeling process and the commission for its physical construction.

The established dimensions for the adjustable keyboard wrist rest component include a height of 1.5cm, length of 40cm, and width of 8cm, with a surface incline radius of 17cm. The dimensions are based on existing standard wrist rest models. To elaborate, the researchers determined the mode (most occurring value in the dataset) of the allocated measurements of 20 known brands of keyboard wrist rests.

Table 1. Allocated data on dimensions of wrist rest models for full-sized keyboards

	BRAND / MODEL NAME	HEIGHT (cm)	WIDTH (cm)	LENGTH (cm)
1	Redragon	2	7.5	43.5
2	MageGee	1.8	8	43.18
3	Ajazz	1.6	8.5	42.8
4	BusyHands	1.8	8.5	44
5	szxfile3	2	8	33
6	Fantech	1.8	9.5	44.6
7	XYV Unlimited	2	8	44
8	Handcraft	1.8	8.5	44
9	S.Y. Cat	2.54	8.5	46
10	Hyper X	2.28	8.9	45.7
11	Gimars	2.54	8.64	42.18
12	Razer	2.64	9.02	44.48
13	JEDIA	2.54	8.26	43.79
14	Grifiti	0.64	10.16	43.18
15	Meatanty	1.8	8	44
16	KBD FANS	1.8	8	44
17	Luwei	1.8	8	44
18	Keychron	1.5	8	44.7
19	Aidata	2.6	7.62	45.72
20	ELZO	2.48	8	43
	MODE	1.8cm	8cm	44cm

According to the data gathered, the most common wrist rest length (for full-size keyboards) is 44cm, while the recurrent width is 8cm. The common height of models intended for thick-capped keyboards is 2.5cm, while 1.8cm is the standard for thin-capped keyboards. While the mode of the gathered heights overall is 1.8cm, the notion of the 2 separate heights was taken into consideration for the adjustable stand components. Due to this, the adjustable keyboard wrist rest height was adjusted to 1.5cm.

The desk organizer dimensions are made to fit exactly the keyboard wrist rest with a length of 36cm, height of 1cm, and width of 8cm. The desk organizer's functions include a mug/cup compartment with a diameter of 7cm. For the remaining space, three quadrilateral compartments are allotted for stationery items and miscellaneous accessories and objects (ex., Pen, eyeglasses, paperclips, and others). As the desk organizer was made to fit exactly under the wrist rest, the overall height was limited to 1cm, making the height of the 4 compartments constrained to 0.50cm.

As established in the designing phase, the adjustable stands are modeled to adjust the wrist rest's overall height when positioned inwards or outwards. Both left and right stands are made with a height of 1.5cm, a width of 2cm, and a length of 8cm. The basis of measurements is mainly how it affects the overall height of the wrist rest: Once the stands are positioned to lift the wrist rest (standing mode), the keyboard wrist rest's overall height becomes 2.5cm.

Alternatively, if positioned to be inclined with the wrist rest (flat mode), the overall height becomes 1.5cm.

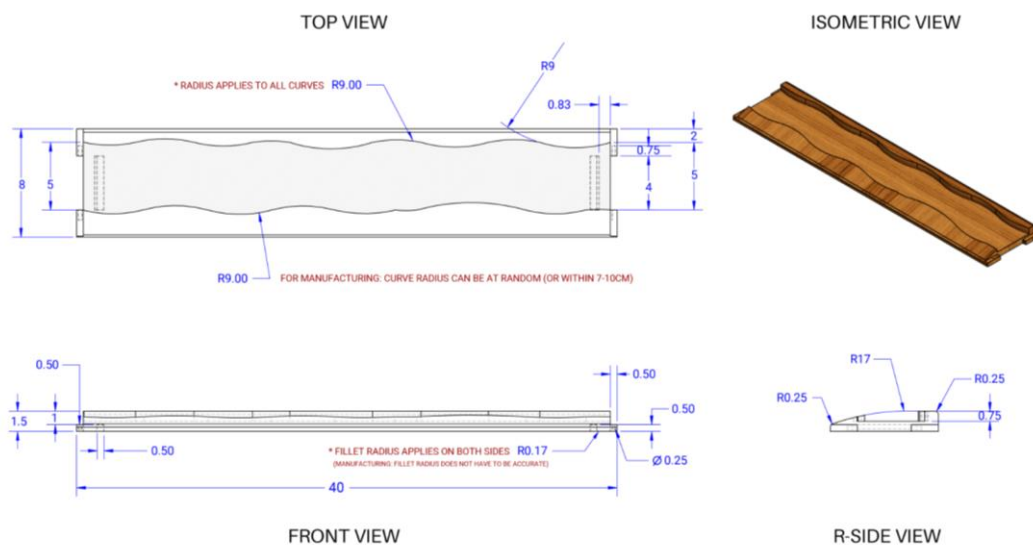


Figure 2. Keyboard Wrist Rest Orthographic Layout and Model

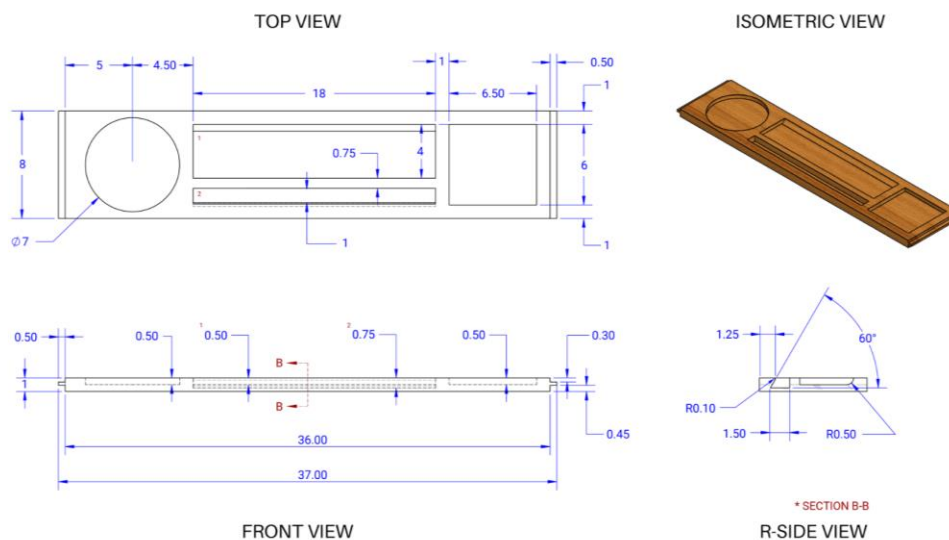


Figure 3. Desk Organizer Orthographic Layout and Model

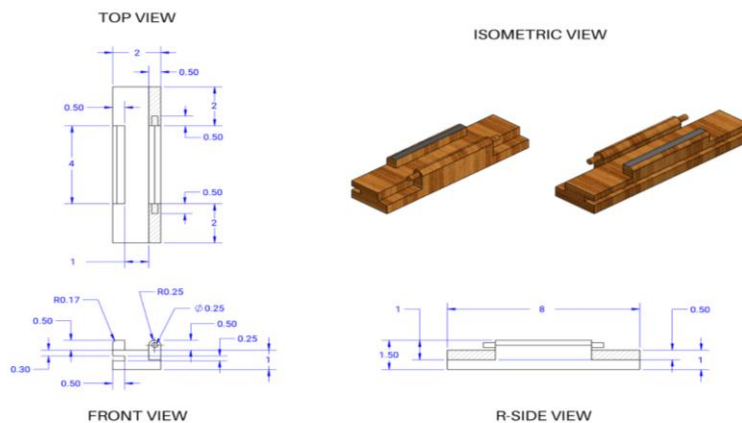


Figure 4. Adjustable Stands Orthographic Layout and Model

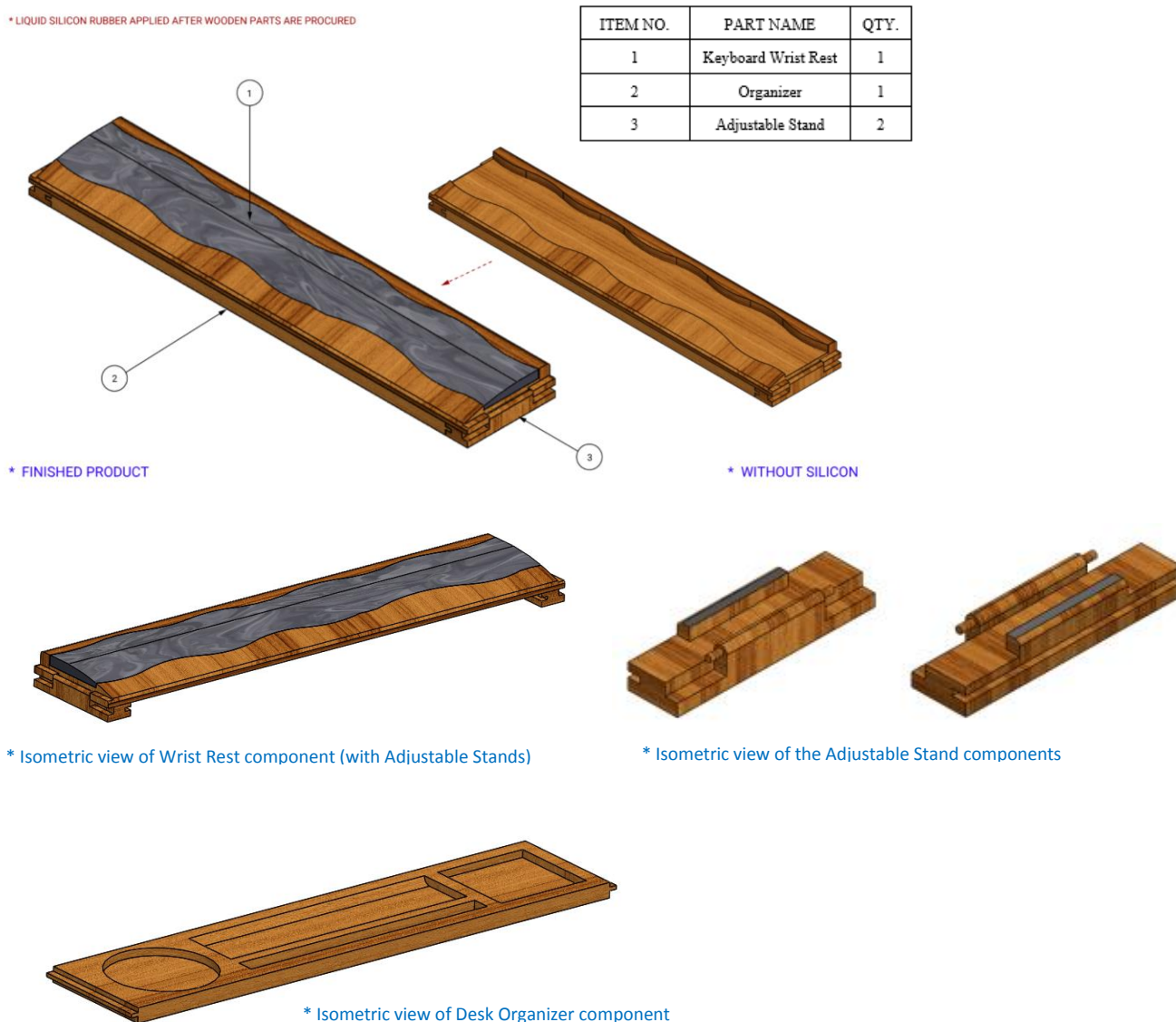


Figure 5. Finished Product

With the dimensions finalized and secured, the isometric and 3D modeling of the components followed. As shown in Figure 5, the “valley provides the space where the silicone rubber is molded and embedded in. The wavy pattern of the gap was designed to portray a “river-like” appearance as an attempt to enhance aesthetics. Its corners include insertion holes for the adjustable stands to connect to the keyboard wrist rest’s assembly, as shown in Figure 5.

The adjustable stands, as discussed, are modeled to adjust the wrist rest’s height when positioned in or out. Using the selected design draft portrayed in Figure 5, the model was created to allow the stands to rotate inwards and outwards. The hinge motion was modeled by connecting the protruding 0.50cm rods of the adjustable stands with the keyboard wrist rest’s insertion holes. When flipped outwards, a 0.50cm extrusion was added to allow the stand to stay flat (as shown in Figure 5, shaded in gray). Additionally, a 0.50cm deep and 0.25cm high gap was subtracted on each stand’s side to serve as an insertion space for the desk organizer when kept under the wrist rest.

When the mention of the insertion space in the adjustable stands model, the desk organizer’s model (specifically its sides) was cut to match and fit perfectly with the 0.50cm deep and 0.25cm high gap of the adjustable stands. The compartments accurately follow the provided orthographic. The model is shown under the Isometric view of the Desk Organizer component.

The finished product shows the 3D model of the product in its fully assembled state, with the desk organizer inserted between the adjustable stands and under the wrist rest.

Design Assembly

A. Perspective Views of Adjustable Keyboard Wrist Rest with Desk Organizer (Assembled)

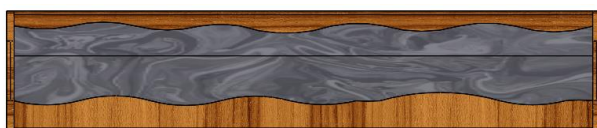
FRONT VIEW



REAR VIEW



SIDE VIEW



TOP VIEW



BOTTOM VIEW

B. Perspective Views of Adjustable Keyboard Wrist Rest (with stands: 2.50cm)

FRONT VIEW



REAR VIEW



C. Perspective Views of Adjustable Keyboard Wrist Rest (no stands: 1.50cm)

FRONT VIEW



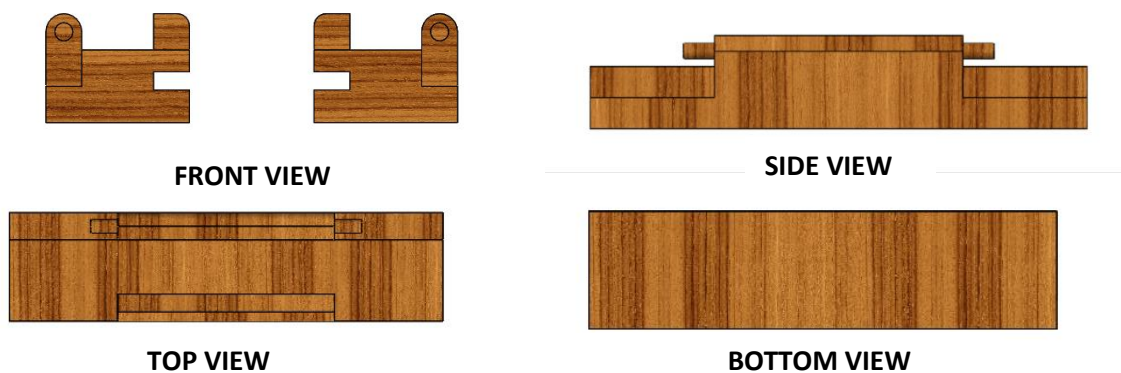
REAR VIEW



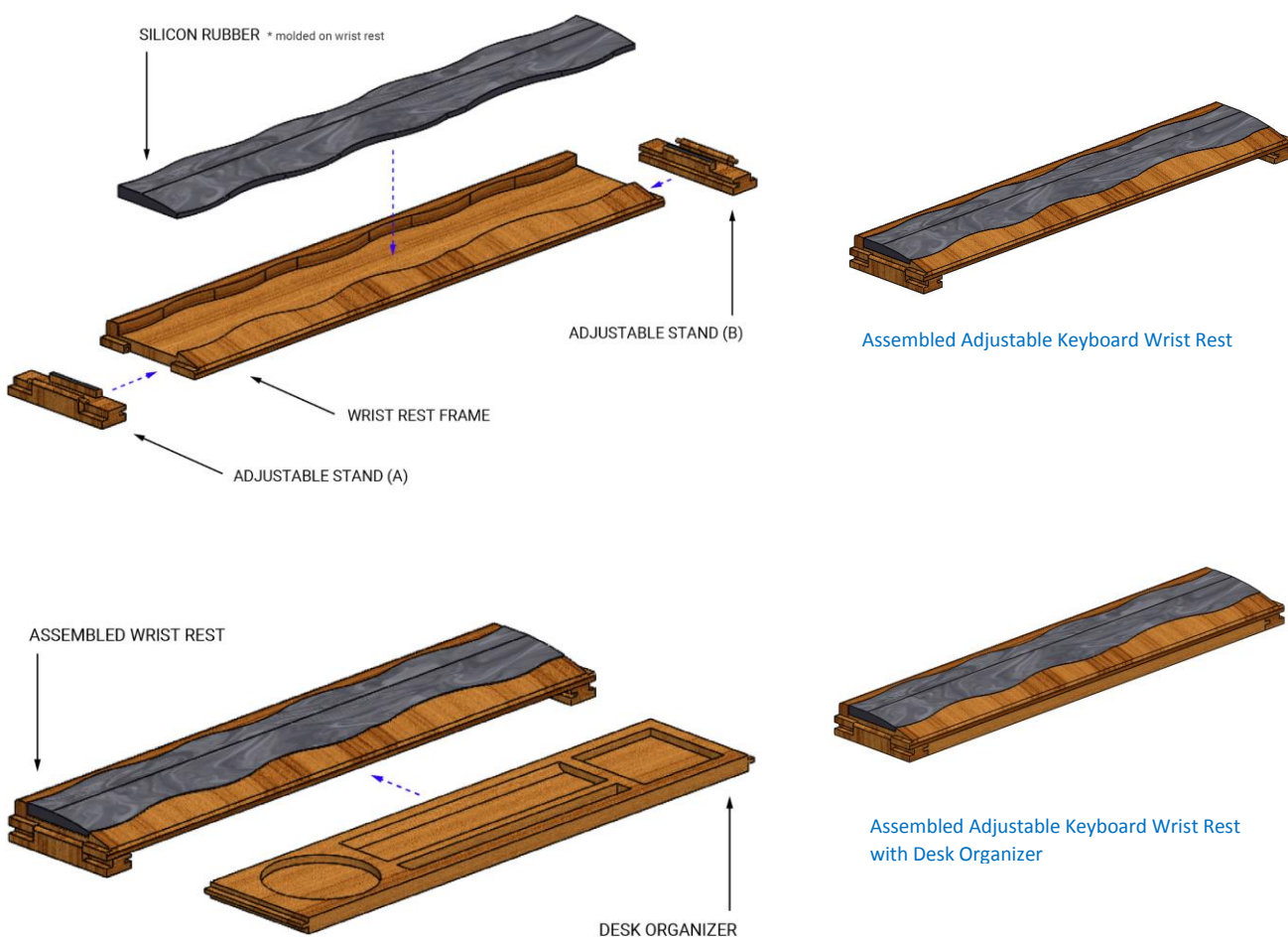
SIDE VIEW



D. Perspective Views of Adjustable Keyboard Wrist Rest with Desk Organizer - Adjustable Stand



E. Overall Assembly of Adjustable Keyboard Wrist Rest with Desk Organizer



Materials Used in Construction

The breakdown of the materials will be listed in this section. The following materials were selected based on their aesthetic potential for the prototype's final appearance while also taking comfort into account.

Table 2. List of materials for the overall product development

Parts and Materials
<p>1. Wood Keyboard Wrist Rest & Wood Desk Organizer</p> <ul style="list-style-type: none"> ● Mahogany Wood ● Boysen Wood Stain ● Boysen Gloss Lacquer
<p>2. Silicone Design of the Keyboard Wrist Rest</p> <ul style="list-style-type: none"> ● RTV Liquid silicone Rubber (A & B) ● Self-Adhesive Rubber Feet ● Pigment Dye Ink (Black) ● Metallic Pearlescent Powder (White)

Summary of Acceptability

Table 3 shows the breakdown of the overall percentage rating where sixty-one percent (61%) of the respondents rated the product as Highly Acceptable, thirty-one percent (31%) rated Moderately Acceptable, 7% rated Fairly Acceptable, and the remaining 1% rated Least Acceptable. The table also shows that the overall average weighted mean of the product is 4.53, which falls under the verbal description of “Highly Acceptable.” Based on the tallied results, this implies that the product, Adjustable Keyboard Wrist Rest with Desk Organizer, is regarded by the respondents as a product that is Highly Acceptable.

Table 3. Overall Summary of Acceptability

Criteria	OVERALL WEIGHTED MEAN	REMARKS
1. AESTHETICS	4.51	HA
2. PERFORMANCE	4.49	HA
3. FEATURES	4.55	HA
4. SERVICEABILITY	4.50	HA
5. SAFETY	4.60	HA
Overall Average Weighted Mean	4.53	HA

Legend: HA = Highly Acceptable 4.21-5.00; MA = Moderately Acceptable 3.41-4.20; FA = Fairly Acceptable 2.61-3.40; LA = Least Acceptable 1.81-2.60; NA = Not Acceptable 1.00-1.80; OAWM = Overall Average Weighted Mean

Conclusion

Based on the findings, it is concluded that the Adjustable Keyboard Wrist Rest with Desk Organizer is a product with high acceptability. Confirmed as highly acceptable in its Aesthetics, Performance, Features, Serviceability, and Safety by the selected respondents; This supports the viability of its use and efficacy in the application of ergonomic and organization principles during desk and/or computer-related work. With that, the Adjustable Keyboard Wrist Rest with Desk Organizer is conventionally a functional workstation accessory that allows an increase in productivity and prevents the risk of discomfort, fatigue, and potential musculoskeletal pain among its target users.

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