

# Design an Interchangeable Bed Coffin for Covid-19 Patients to Reduce the Use of Wood as a Raw Material for Coffins

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**Abstract - Covid - 19 is a virus that is becoming epidemic in the world starting early 2020. This disease has claimed many deaths from all over the world, including Indonesia. Handling of the bodies of victims of Covid - 19 cannot be arbitrary. Because the bodies of sufferers of Covid - 19 can still infect people who have contact with the bodies. Therefore, the procedure for handling covid-19 bodies has a special standard set by the World Health Organization (WHO), namely the use of coffins. The problem faced in Indonesia is that this country is predominantly Muslim where people who die are not buried using coffins so that the possibility of Indonesia experiencing a shortage of coffins is very high. On the other hand, if we pay attention to environmental factors which also need to be worried because the more use of coffins, the more the need for raw material for the coffins, namely wood. Then more wood will be cut. This will have long effects in the future. This research activity develops a multi-use product. It is a product that can be used as a mattress for the patient as well as a casket when the worst happens to the patient. The products used use a knockdown system so there is no need for physical contact from health workers to patients when they need to turn them into coffins.**

**Keywords:** Covid 19, Coffin, Bed.

## I. INTRODUCTION

Recently, we were shocked by news in the form of a video showing the bodies of Covid-19 victims left scattered on the roadside in Italy. According to the latest Covid-19 situation report in Indonesia from the website of the Indonesian Ministry of Health, as of February 23, 2021, there were 1,298,608 confirmed positive Covid-19 cases, with 35,014 deaths. These numbers are very high and are likely to increase further, given that the number of new cases has not shown any tendency to decrease. Therefore, we need the availability of a significant number of coffins, considering that health protocols for the burial of Covid-19 victims require the use of coffins. Therefore, more wood is needed as a raw material for making coffins, which will inevitably increase the

logging of trees both in forests and community gardens. This poses a danger to the safety and balance of the ecosystem, as trees function as absorbers of rainwater—which has been quite high lately—and also as processors of harmful gases into oxygen, which is essential for humans, animals, and the plants themselves. Thus, it is crucial to limit the excessive use of wood for making coffins for Covid-19 victims. One way to achieve this is by creating Interchangeable Bed Coffins for Covid-19 patients. This paper discusses the design process of the Interchangeable Bed Coffin for Covid-19 patients, which has various advantages to address the aforementioned issues. This product offers an affordable and economical solution. Additionally, it is multifunctional, as it can serve as both a bed and a coffin. Another advantage is that it is easy to carry because it is lightweight and does not take up much space, as it is just a stack of cardboard when not assembled. These factors are the background for the design of this product. This device is expected to reduce physical contact between medical personnel and the bodies of Covid-19 victims if a patient being treated in this bed passes away. This product is much cheaper than conventional coffins because it is made of cardboard, is easy to transport and store since it can be folded when not in use, and is environmentally friendly due to its cardboard material. This product is expected to assist the government in managing the increasing number of Covid-19 patients day by day, ensuring that during the burial process, there is minimal contact between the burial personnel and the deceased patient. Thus, the availability of this product is expected to help reduce or curb the transmission rate of Covid-19 in Indonesia. The steps to design and determine the specifications of the Bed Coffin are stated in (Narayana K L, 2006).

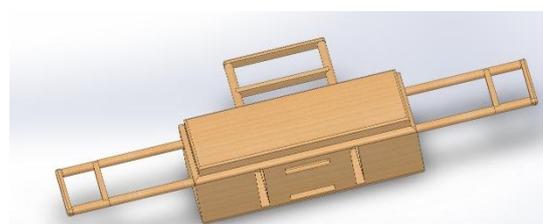


Figure 1: Bed Coffin

## II. RESEARCH METHODOLOGY

### 2.1 Product Design Process

In the design process of the Bed Coffin, the flowchart, which outlines the research procedure, refers to the book "Introduction to Engineering Design" written by Darmawan, 2004. To achieve optimal product outcomes during production, a thorough product design process is necessary. Refining the concept we desire is also crucial to producing the best possible product. A product concept encompasses all activities and processes that facilitate the transition from the idea of launching new product information to enabling production, ensuring its use, and maintenance (Ghimisi & Dana, 2017). The following is the product design flowchart for the Bed Coffin.

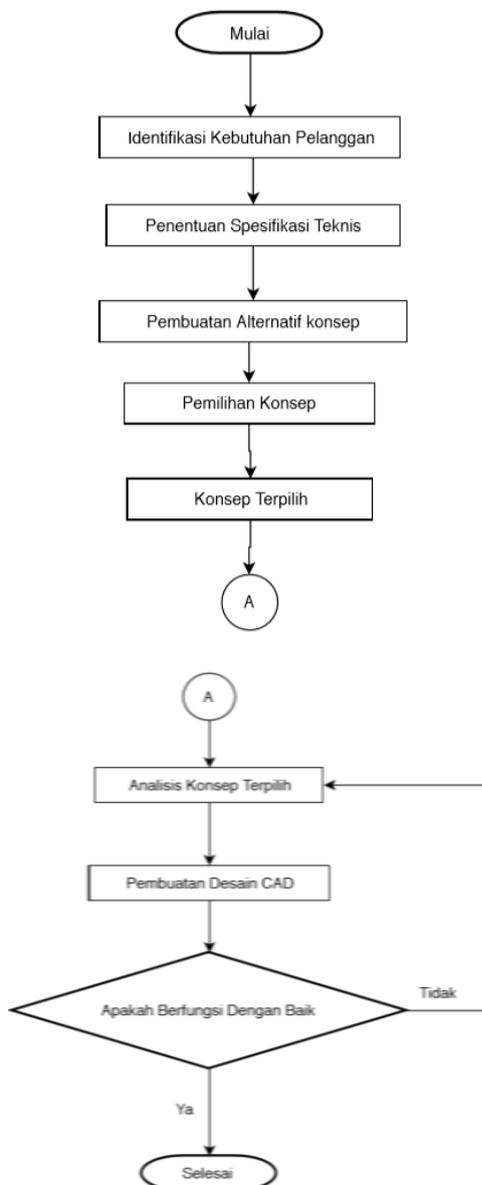


Figure 2: Prototype Creation Flow Chart

The planning process begins with identifying product development opportunities (Golder & Mitra, 2018). The sequence of product design steps mentioned above must be followed systematically and orderly to achieve the best possible product for marketing. Therefore, it is not recommended to perform the steps randomly.

### 2.2 Customer Needs Identification

This task involves the design of an interchangeable bed coffin. The criteria considered in this process are taken from the book "Introduction to Product Design" (Darmawan, 2004). Some criteria aimed to be achieved in designing this structural design are as follows:

1. Part Price
2. Ease of Use (ergonomics)
3. Durability
4. Part Design Form
5. Part Weight
6. Material
7. Dimensions
8. Safety for Users
9. Product Maintenance
10. Environmental Friendliness
11. Production Speed
12. Practicality in Storage
13. Load Resistance

### 2.3 Steps of the Interchangeable Bed Coffin Manufacturing Process

Here are the steps involved in the manufacturing process of the interchangeable bed coffin:

#### 1. CAD Product Design

This stage involves creating CAD (Computer-Aided Design) designs of the selected concept, along with providing real dimensions using Solidworks 2016 software. CAD design provides the most realistic depiction of the shape, specifications, and design of the product to be manufactured and sold to the public (Kang & Dharchoudhury, 2009). The output of this stage is technical drawings that will be used as a guide in determining the design of the interchangeable bed coffin. A good design is one that has a high level of accuracy in each part that will be assembled, allowing readers to easily understand and visualize the design they are purchasing (Eger & Drukker, 2012). Based on this statement, the researcher designed each part of the bed coffin with as much detail as possible.

### III. RESULTS AND DISCUSSIONS

#### 3.1 Interchangeable Bed Coffin Body Part Design

In the design of the interchangeable bed coffin, there is a main component which is the largest component, namely the Body. The Body serves as the main support of the interchangeable bed coffin itself. Because this part is the core component of the interchangeable bed coffin, it is used as the primary scale for determining the best material to be used in making this product. Material has a significant influence on the final quality of the product (Taunton, 2000). Here is the design image of the body part of the interchangeable bed coffin along with the material selection matrix for all parts.

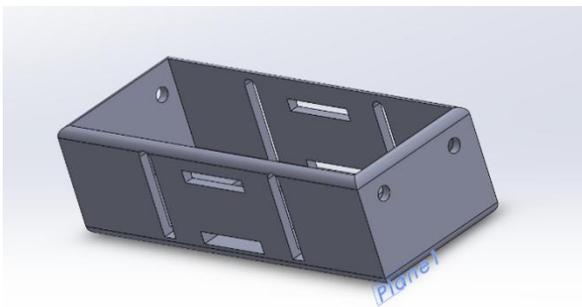


Figure 3: Interchangeable Bed Coffin Body with Metal Material (Solidworks, 2016)

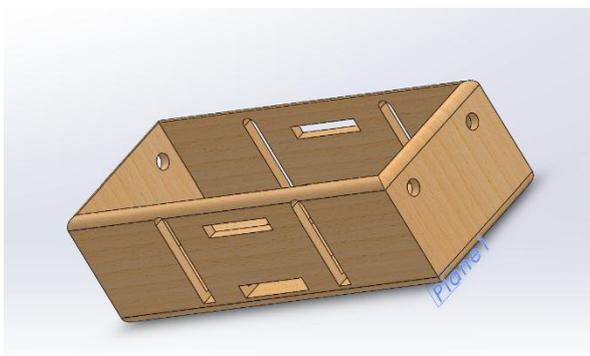


Figure 4: Interchangeable Bed Coffin Body with Cardboard Material

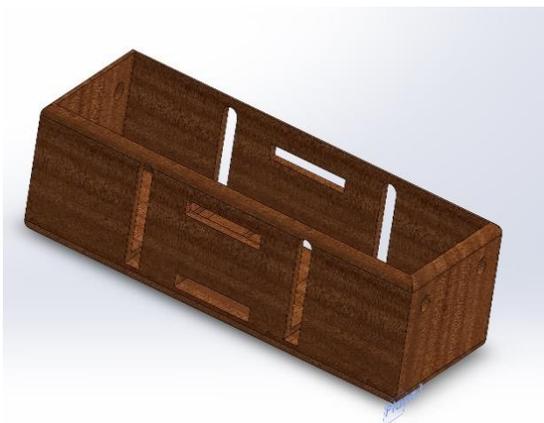


Figure 5: Interchangeable Bed Coffin Body with Wood Material

Table 1: Decision-Making Matrix for Selecting the Body of Interchangeable Bed Coffin

Number	Selection Criteria	Point	Point		
			Design 1	Design 2	Design 3
1.	Part Price	9	-	+	S
2.	Ease of Use (ergonomics)	9	+	S	S
3.	Durability	8	-	+	S
4.	Part Design Form	8	+	+	+
5.	Part Weight	8	-	+	-
6.	Material	12	+	+	+
7.	Dimensions	8	+	+	+
8.	Safety for Users	10	+	+	+
9.	Product Maintenance	1	+	-	S
10.	Environmental Friendliness	1	-	+	-
11.	Production Speed	7	S	+	+
12.	Practicality in Storage	6	-	+	+
13.	Load Resistance	10	+	S	+
TOTAL (S)			1	2	4
TOTAL (+)			4	10	7
TOTAL (-)			8	1	1
TOTAL POINT			26	76	52

With a total highest point of 76, it can be concluded that the material used in the second design is the best material for the bed coffin, which is cardboard.

#### 3.2 Interchangeable Bed Coffin Handle Part Design

The handle serves as the primary support used by the Interchangeable Bed Coffin to lift the patient when they are already on top of this product. Not only that, the handle part is also useful for changing the position of the product, which previously functioned as a bed, into a coffin. Therefore, the handle part is also designed in such a way to be strong and easy to use. Here are several designs of the handle part along with the selection matrix.

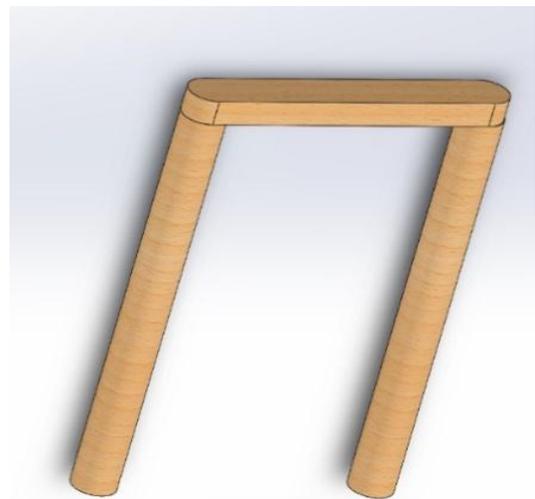


Figure 6: Design 1 Handle for the Interchangeable Bed Coffin

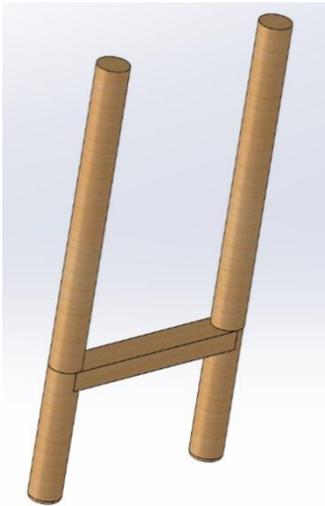


Figure 7: Design 2 Handle for the Interchangeable Bed Coffin

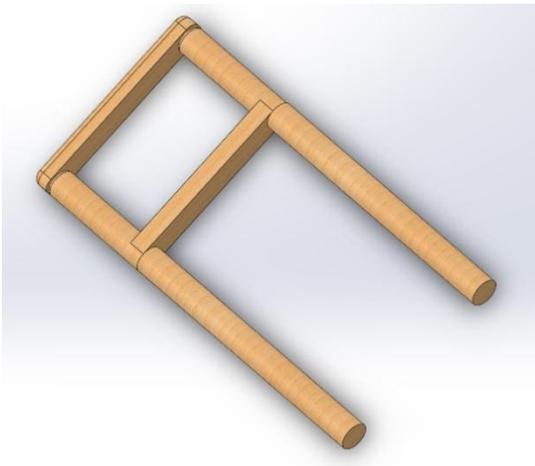


Figure 8: Design 3 Handle for the Interchangeable Bed Coffin

Table 2: Decision-Making Matrix for Selecting the Handle of Interchangeable Bed Coffin

Number	Selection Criteria	Point	Point		
			Design 1	Design 2	Design 3
1.	Part Price	9	+	+	-
2.	Ease of Use (ergonomics)	9	+	+	+
3.	Durability	8	-	+	-
4.	Part Design Form	8	-	+	-
5.	Part Weight	8	+	+	-
6.	Material	12	+	+	+
7.	Dimensions	8	+	+	-
8.	Safety for Users	10	-	+	+
9.	Product Maintenance	1	+	+	+
10.	Environmental Friendliness	1	+	S	-
11.	Production Speed	7	+	-	-
12.	Practicality in Storage	6	+	-	-
13.	Load Resistance	10	-	+	+
TOTAL (S)			0	1	0
TOTAL (+)			9	10	5
TOTAL (-)			4	2	8
TOTAL POINT			25	71	-13

With a total highest point of 71, it can be concluded that design 2 handle is the best one to be used for this product.

### 3.3 Interchangeable Bed Coffin Bed Support Part Design

The Bed Support serves as the main support when this product is used as a bed. Therefore, the role of this part is quite important because it is related to the strength and safety of the user. Safety is one of the priorities of this research because safety means being free from unacceptable risks (Konstruksi et al., 2009). Presented are several designs of strong and safe bed support parts for use in the interchangeable bed coffin. Below are the designs of the bed support parts along with their selection matrix.

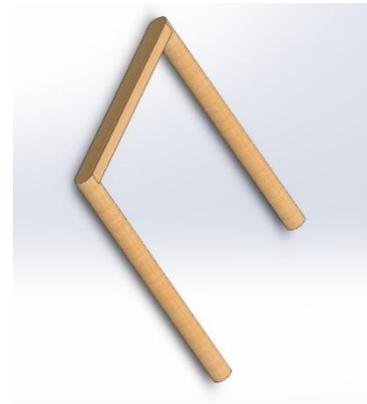


Figure 9: Design 1 Bed Support for the Interchangeable Bed Coffin

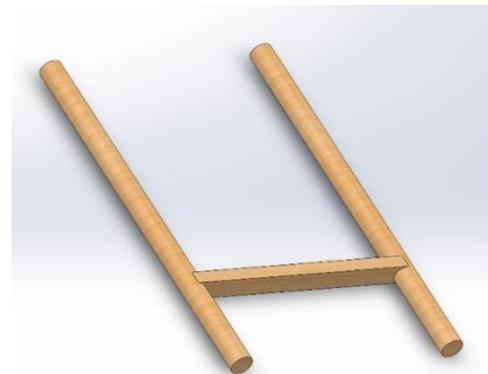


Figure 10: Design 2 Bed Support for the Interchangeable Bed Coffin

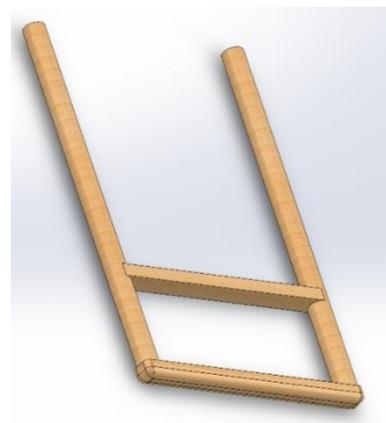


Figure 11: Design 3 Bed Support for the Interchangeable Bed Coffin

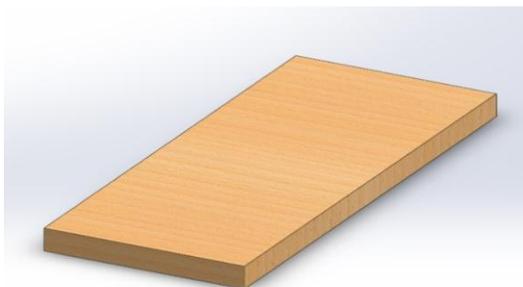
**Table 3: Decision-Making Matrix for Selecting the Bed Support of Interchangeable Bed Coffin**

Number	Selection Criteria	Point	Point		
			Design 1	Design 2	Design 3
1.	Part Price	9	+	S	-
2.	Ease of Use (ergonomics)	9	+	+	+
3.	Durability	8	-	+	+
4.	Part Design Form	8	+	-	-
5.	Part Weight	8	+	S	-
6.	Material	12	+	+	+
7.	Dimensions	8	+	+	-
8.	Safety for Users	10	+	S	+
9.	Product Maintenance	1	+	+	+
10.	Environmental Friendliness	1	+	-	-
11.	Production Speed	7	+	S	-
12.	Practicality in Storage	6	+	-	-
13.	Load Resistance	10	+	S	S
TOTAL (S)			0	5	1
TOTAL (+)			12	3	6
TOTAL (-)			1	5	6
TOTAL POINT			81	23	-7

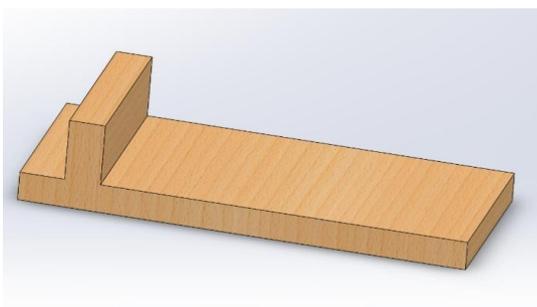
With a total highest point of 81, it can be concluded that Bed Support Design 1 is the best one to be used for this product.

### 3.4 Interchangeable Bed Coffin Base Support Part Design

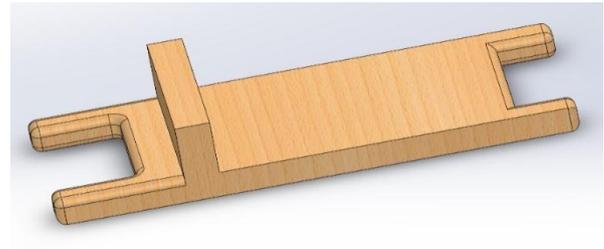
The base support of the Interchangeable Bed Coffin is where the patient lies down. Therefore, the design of this part is crucial as it is not only related to comfort but also to the safety of the product user. The base design must be sturdy and able to support the body weight of the patient using the product. Below are the design parts for the interchangeable bed coffin along with their selection matrix.



**Figure 12: Design 1 Base Support for the Interchangeable Bed Coffin**



**Figure 13: Design 2 Base Support for the Interchangeable Bed Coffin**



**Figure 14: Design 3 Base Support for the Interchangeable Bed Coffin**

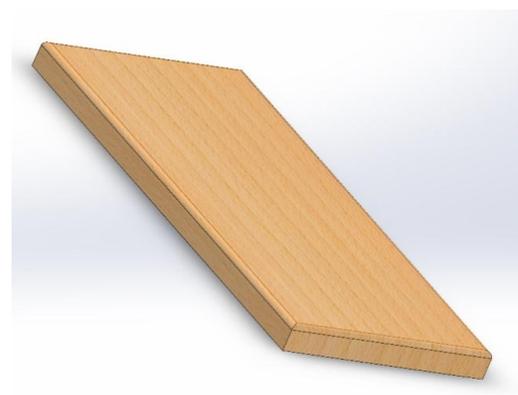
**Table 4: Decision-Making Matrix for Selecting the Base Support of Interchangeable Bed Coffin**

Number	Selection Criteria	Point	Point		
			Design 1	Design 2	Design 3
1.	Part Price	9	+	-	S
2.	Ease of Use (ergonomics)	9	-	+	S
3.	Durability	8	-	+	+
4.	Part Design Form	8	+	+	-
5.	Part Weight	8	+	+	-
6.	Material	12	+	+	+
7.	Dimensions	8	-	+	S
8.	Safety for Users	10	-	+	-
9.	Product Maintenance	1	+	+	+
10.	Environmental Friendliness	1	+	+	-
11.	Production Speed	7	+	+	-
12.	Practicality in Storage	6	+	+	+
13.	Load Resistance	10	-	+	+
TOTAL (S)			0	0	3
TOTAL (+)			8	12	6
TOTAL (-)			5	1	4
TOTAL POINT			7	79	3

With a total highest point of 79, it can be concluded that Base Support Design 2 is the best one to be used for this product.

### 3.5 Interchangeable Bed Coffin Base Part Design

The base of the Interchangeable Bed Coffin is where the patient lies down. Therefore, the design of this part is crucial as it is not only related to comfort but also to the safety of the product user. The base design must be sturdy and able to support the body weight of the patient using the product. Below are the design parts for the interchangeable bed coffin along with their selection matrix.



**Figure 15: Design 1 Base for the Interchangeable Bed Coffin**

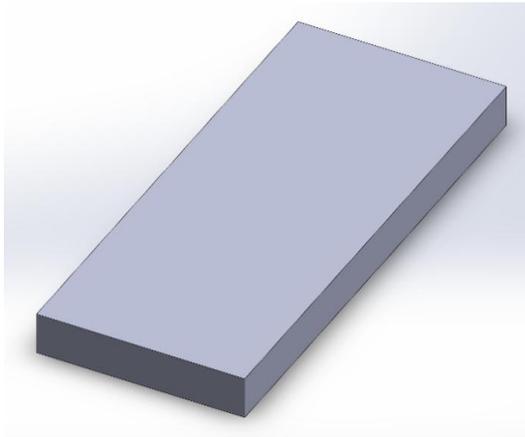


Figure 16: Design 2 Base for the Interchangeable Bed Coffin

Table 5: Decision-Making Matrix for Selecting the Base of Interchangeable Bed Coffin

Number	Selection Criteria	Point	Point	
			Design 1	Design 2
1.	Part Price	9	+	+
2.	Ease of Use (ergonomics)	9	+	+
3.	Durability	8	+	-
4.	Part Design Form	8	+	S
5.	Part Weight	8	+	+
6.	Material	12	+	+
7.	Dimensions	8	+	+
8.	Safety for Users	10	+	-
9.	Product Maintenance	1	+	+
10.	Environmental Friendliness	1	-	+
11.	Production Speed	7	-	+
12.	Practicality in Storage	6	+	+
13.	Load Resistance	10	+	+
TOTAL (S)			0	1
TOTAL (+)			11	10
TOTAL (-)			2	2
TOTAL POINT			81	53

With a total highest point of 81, it can be concluded that Base Design 1 is the best one to be used for this product.

### 3.6 Assembly of the Interchangeable Bed Coffin Product

From the five selection tables above, it can be concluded that the best parts for the Interchangeable Bed Coffin are as follows:

1. Body of the Interchangeable Bed Coffin uses Design 2
2. Bed Support of the Interchangeable Bed Coffin uses Design 1
3. Handle of the Interchangeable Bed Coffin uses Design 2
4. Base Support of the Interchangeable Bed Coffin uses Design 2
5. Base of the Interchangeable Bed Coffin uses Design 1

Below is the result of the assembly of these parts:

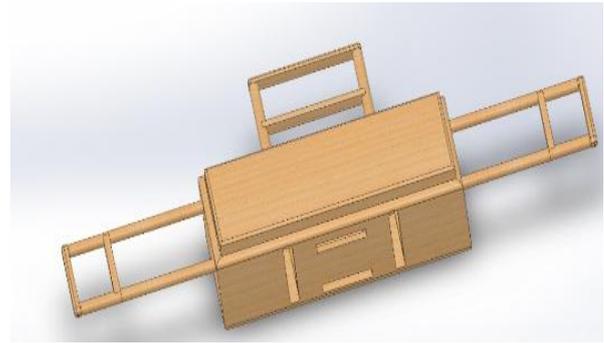


Figure 17: Assembly of the Interchangeable Bed Coffin Product

## IV. CONCLUSION

Based on the design, calculations, and creation of the Interchangeable Bed Coffin, several conclusions can be drawn. These conclusions are as follows:

1. The Interchangeable Bed Coffin design, which predominantly uses a mechanical knockdown system compared to an automatic control system, requires stronger structural strength and materials because there are additional components that increase the load-bearing capacity of the Interchangeable Bed Coffin.
2. In the design process, the most challenging part is determining the dimensions and materials of the Interchangeable Bed Coffin to ensure it is suitable and safe for use.
3. For the Interchangeable Bed Coffin with a dominant mechanical system, casting objects with specific shapes requires different components.

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