

The Design of Instant Desk Cleaner for Public Facilities during Pandemic Era

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Abstract

Nowadays, health has become one of the most prioritized aspects of human life. This problem is caused by the outbreak of covid-19 the world currently experiencing that can lead to the death of a person's life. As dangerous as covid-19 symptoms are, it can be prevented by keeping our hygiene clean. However, public facilities' sanitation is not well maintained as fewer staff are working on it due to the pandemic, such as the table around the area. Because of this, we create a product called "Instant Desk Cleaner," which is an automated product that at the same time can clean and disinfect a table to prevent the virus from staying on the table and preserving the hygiene of people who are going to use it. We created this product from the survey to find the customer's concern and needs during this pandemic era. Moreover, we created four product concepts and narrow them down to the final concept by concept selection. Then, we created the 3D image of the product by using Autodesk Fusion 360 to make a suitable dimension of the product that can fit easily and operates effectively on the table.

Keywords

Wiper, Sprayer, Instant Desk Cleaner, Joint, Steel Rail

1. Introduction

Covid-19 pandemic is one of the disasters that the world is currently experiencing. Covid-19 or commonly referred to as the coronavirus, is a virus that attacks the human respiratory tract, which causes a person to have symptoms such as high fever, cough, flu, shortness of breath, and sore throat. In Indonesia, there is currently an outbreak of Covid-19 caused by a coronavirus, resulting in the death of a person's life [11]. This condition shows that the essential thing in people's lives right now is their health. Due to the rapid spread of the coronavirus, many aspects of life have changed, such as forming a lifestyle and work stay at home, virtual optimization in various fields, and the emergence of togetherness and a sense of the same fate [10]. But not everyone agrees, and some of them still go outside the house to earn income to support their economy. Because of this, the government applies a new regulation called the new normal. The government made the new normal regulation to accelerate the handling of covid-19 in the health and socio-economic aspects, employing people adapting to daily life in this pandemic situation [12].

In applying the new normal regulation, many aspects need to be considered. One of them is the cleanliness in public facilities. Cleanliness in public facilities is paramount to people due to the virus spread by touching contaminated objects and surfaces [14]. If public facilities are not kept clean, people will be exposed to the virus. For instance, in general, a table is used by someone to complete a task they are doing or eat and drink. The coronavirus can survive on a table's surface within a week, depending on the material used. If it is not cleaned, those who use the table will get the coronavirus.

To preserve the table's cleanliness in public facilities, a tool that can both disinfect and clean the table at the same time is needed and this product is safe to be operated on the table. Therefore, we designed a table cleaning tool that is user-friendly to operate. With this table cleaning tool, users do not need to be concerned as this product is guaranteed can effectively and efficiently clean the table. This product will be automated as technology keeps growing and product these days use automation technology, which gives many benefits such as an increase in productivity and no human error occur during operating [13].

1.1 Objectives

The objectives of designing a table cleaner are as follows:

- a) To create a tool for cleaning and disinfecting tables.
- b) To create a tool that can minimize the workforce than cleans table manually.
- c) To Create an automation tool that can clean the table automatically in an instant.
- d) Creating automation tools that can clean the table effectively and efficiently without leaving dirt on the table

2. Literature Review

2.1 Product Planning

Product planning involves all of the internally focused decisions, steps, and tasks necessary to develop a successful product. In other words, it involves everything you'll need to do that will affect the product itself. By contrast, go to market planning involves all of the external facing steps. These are the things you'll do to introduce and market your product to the public. [1]

2.2 Product Design

Product design is the process designers use to blend user needs with business goals to help brands make consistently successful products. Product designers work to optimize the user experience in the solutions they make for their users and help their brands by making products sustainable for long term business needs [2]. Designing or planning is an attempt to arrange, obtain, and create new things beneficial to human life. In this case, designing can be wholly new or develop an existing product to increase the product's performance. Manufacturers widely use this concept to produce various product variants, which are accepted as new products in consumers' eyes. [3]

2.3 Product Development

In product design and development, the product can be divided into two major parts: goods and service products. In particular, in this discussion, the products to be described are products resulting from the manufacturing process. Manufactured products are products of a process (manufacturing) sold by producers to consumers who need them. [1]

Product development is a strategy for company growth by offering new or modified products to the current market segment and developing product concepts into physical products to ensure that product ideas can be turned into realizable products. Product development can also be defined as the process of finding ideas for new goods and services and converting them into additional commercially successful product lines [4]. The purpose of the product development process is to provide maximum value to consumers, win the competition by choosing innovative products, and modify products with high value in design, color, size, packaging, brand, and other characteristics [3].

2.4 Market Research

Market Research is a systematic activity and has objectives in identifying problems and opportunities, collecting data, processing and analyzing data, disseminating useful information to assist management in identifying decisions and efficient solutions incorporate marketing [5]. This systematic activity includes various activities for market research activities, starting from problem formulation, data collection, data analysis, and hypothesis testing. Market research aims to obtain accurate information to explain the existing facts objectively and is free from the influence of personal desires (political biases). [6].

2.5 Likert Scale

The Likert scale is a scale used to measure the perceptions, attitudes, or opinions of a person or group regarding an event or social phenomenon, based on the researcher's operational definition. This scale is a psychometric scale usually applied in questionnaires and is most often used for research in surveys, including in descriptive survey research [7].

2.6 Validation

Validity comes from the word valid, which means the extent to which a measuring instrument's accuracy and accuracy are used to perform its measure function (Azwar 1986). Besides, validity is a measure that indicates that the measured variable is the variable that the researcher wants to study (Cooper and Schindler, in Zulganef, 2006). It is essential to get the test this validity; the SPSS program is used. Researchers often use the testing technique to test the validity to

use the Bivariate Pearson correlation (Pearson Moment Product). This analysis is done by correlating the score of each item with the total score.

2.7 Ergonomics

Ergonomics is the study of human behavior related to their work. Ergonomics research targets are humans when working in the environment [15]. In short, it can be said that ergonomics is the adjustment of work tasks to the condition of the human body to reduce the stress that will be faced. The efforts include adjusting the workplace's size with the body's dimensions so that it is not tiring, setting the temperature, light, and humidity, which aims to suit the human body's needs [9].

3. Methods

3.1 Phase-1: Market Research

In this phase, a survey questionnaire was used for this research. The questionnaire was distributed by google form to random respondents. Target respondents for this study were 120 respondents. These questionnaires' main objectives were to know more about the automatic desk cleaning machine's public responses. The questionnaire consisted of four parts, including; a) personal details, b) customer needs, c) features suitable for "Instant Desk Cleaner," d) most suitable concept design to proceed.

3.2 Phase-2: Validation Test

In this phase, the results of the survey are tested to see the validity of usage. Only valid results can be used for this study. To test the validity of this study, we use the SPSS program. Researchers often use the testing technique to test the validity to use the Bivariate Pearson correlation (Pearson Moment Product).

3.3 Phase-3: "Instant Desk Cleaner" Design

In this phase, based on the second phase results, valid results were analyzed for the product's design ideas. Four alternative concepts were designed from the survey results and processed to get the final concept of "Instant Desk Cleaner." Software Fusion 360 is used for designing those concepts. Designing of "Instant Desk Cleaner" is based on ergonomic principles and anthropometric data.

4. Data Collection

4.1 Customer Needs

The Likert scale calculated the results of customer need from the questionnaire. Based on the result taken from 120 respondents, the customer needs for "Instant Desk Cleaner" can be seen in table 1.

Table 1. Customer Needs

Variable	Score	Categories
Functional	96,33	Very Important
Automatic	92,67	Very Important
Easy to use and practical	93,33	Very Important
Fast	95,83	Very Important
Ergonomic	93,33	Very Important
Aesthetics	87,5	Very Important
Light	86,17	Very Important
Durable	96	Very Important
Safe	96,33	Very Important

4.2 Morphology Concept

Based on the survey result, we obtain several alternatives for the material, features, shape, and components for designing "Instant Desk Cleaner." From these results, we put those aspects in a morphology table to design 4 different variants for the concept of our product, "Instant Desk Cleaner." The morphology table can be seen in table 2. Concept design for each variant can be seen in figure 1.

Table 2. Morphology Table

	Component	Aspect	Alternative 1	Alternative 2
A	Shape	Structure	Square	Round
B	Shape	Structure Frame	 Cylinder Pipe	 Horizontal Bar
C	Material	Structure	 Stainless	 Iron
D	Material	Table Clamp	Grip	Suction cup
E	Position	Operation button	Middle	Above
F	Position	Instant desk cleaner	On the side of the table	In the middle of the table
G	Electricity	Automation	Rectifier	Battery

Variant 2
 Variant 3
 Variant 1
 Variant 4

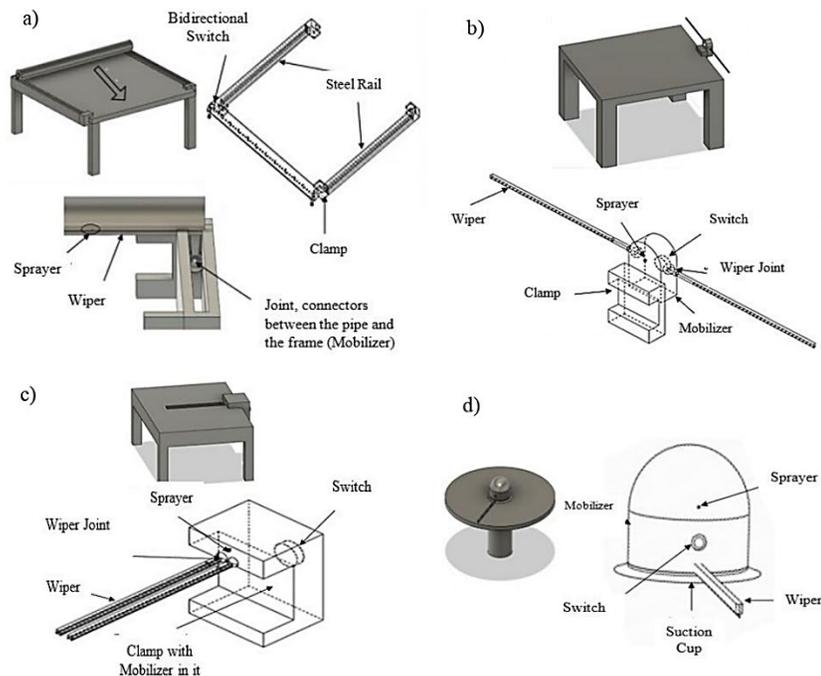


Figure 1. a) Variant 1, b) Variant 2, c) Variant 3, d) Variant 4

4.3 Concept Selection

Four concept designs were surveyed to 120 respondents to determine the best concept design for Instant Desk Cleaner's final concept based on the public's perspectives. Respondents' answers will be analyzed and considered carefully for the concept selection process. The result of the concept selection survey can be seen in table 2.

Table 3. Concept Design Survey

Variable	Number of Respondents	Percentage of Respondents (%)
Which of these concepts is the most effective and efficient design for cleaning a table?		
1. Variant 1	80	66.7
2. Variant 2	14	11.7
3. Variant 3	5	4.2
4. Variant 4	21	17.5

Based on the survey result and further consideration, the final concept for "Instant Desk Cleaner" is variant number one. Variant 1 is the most suitable concept for "Instant Desk Cleaner" because it fulfills all customer needs and the form of its design is the most effective and efficient in cleaning a table.

5. Result and Discussion

5.1 Numerical Results

The "Instant Desk Cleaner" machine is an innovation in automatic desk cleaning. Only by pressing the button once the cleaning machine will move to the end of the table and clean the table from dirt, viruses, and bacteria. The "Instant Desk Cleaner" machine has two essential parts. The first part is the outer tube of the engine "Instant Desk Cleaner," which has a role as a functional aspect of this machine for cleaning tables. This part holds the mobilizer, sprayer, and wiper; the second part is the steel rail. This table supports the motion path. This product function is to connect the machine to the table, and the cleaning tool and the mobilizer on the joint can move from one end of the table to the other. This machine is also designed with the ergonomic aspect of "Instant Desk Cleaner." The ergonomic table of the "Instant Desk Cleaner" switch dimension can be seen in table 4.

Table 4. Ergonomic Aspect

No.	Component	Reference	Percentile	Dimension (mm)	Tolerance (%)	Final Dimension (mm)
1	Width of the switch	Index Finger Width of Men	95%	22	9.09	24

Table dimension for "Instant Desk Cleaner" Component can be seen in table 5.

Table 5. Dimension for "Instant Desk Cleaner" Component

No.	Component	Dimension (mm)
The exterior of the "Instant Desk Cleaner" Engine Tube		
1.	USB Port	12 ± 1.2 x 50 ± 0,5
2.	Switch	24 ± 2.4 x 10 ± 1
3.	Joint Radius	5
4.	Joint Length	50
5.	Joint Width	6
6.	Pipe Radius	25
7.	Pipe Length	700 ± 70
8.	Wiper Width	15

9.	Wiper Length	650 ± 65
10.	Sprayer Radius	0.5 ± 0.05
Steel Rail		
11.	Steel Rail Length	1000 ± 100
12.	Steel Rail Width	25
13.	Steel Rail Cavity Length	980 ± 98
14.	Steel Rail Cavity Width	15
15.	Height for the Upper Part Cavity	30
16.	Width Bellow the Cavity	5
17.	Height for the Bottom Part Cavity	15
18.	Width for Table Clamp	20
19.	Length for Table Clamp	45
20.	Height for Table Clamp	20
21.	Width for Desk Support Cavity	15
22.	The thickness for the Upper Part of Table Clamp	10
23.	The thickness for the Bottom Part of Table Clamp	15
24.	Bolt Hole Radius	5
25.	Bolt Height	18
26.	Upper Part of the Structure's Fillet	2
28	Bottom Part of the Structure's Fillet	5

5.2 Graphical Results

Based on the concept selection process results for consumer needs, concept one is determined as the final concept for Instant Desk Cleaner. The final concept of our product, Instant Desk Cleaner, can be seen in Figure 2.

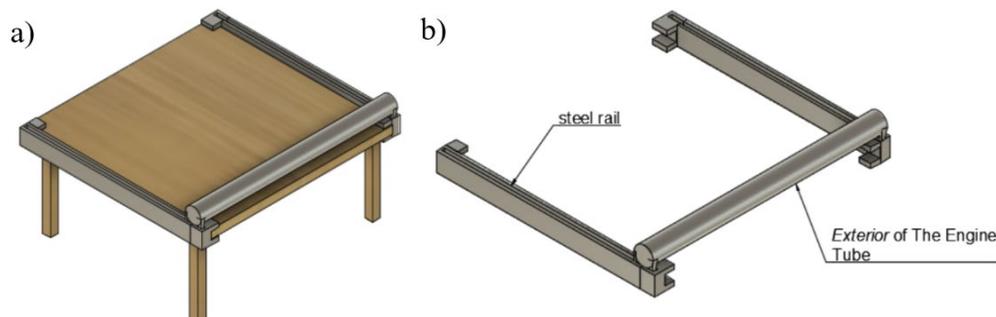


Figure 2. a) "Instant Desk Cleaner" Implemented on a desk, b) Parts of "Instant Desk Cleaner."

Our product's final concept is an automatic table cleaner shaped like a long cylinder with a combined feature of a sprayer and a wiper. It can be seen in the picture above, along the pipe, there are small holes for spraying cleaning chemicals such as disinfectants and soap. Beside the sprayer, there is a long shaped wiper that cleans the table after the sprayer eject droplets of cleaning chemicals at the table surface. The motion of this tool is from left to right or right to left. This movement is supported by a framework that has been implemented on the front and back of the table. Dirt, trash, bacteria, and viruses will be cleaned to the end side of the table; buyers can provide a place on the end side of the table so that all dirt can be cleaned into that place.

The movement to the right and the left can be done by a motor moving the pipe joint through the steel rail's cavity frame. For spray technology, we use an automatic perfume spray machine. Those machines will be connected with a circuit so that when the switch is pressed, the two machines can move simultaneously. The mechanism of the "Instant Desk Cleaner" tool is a table cleaner that moves from to the end side of the table using a motor as the mobilizer. While the machine is moving, the cleaning agent will be removed from the spray and cleaned immediately using a cloth behind the spray hole.

The final touch for "Instant Desk Cleaner" uses a grey or monochrome design. The stainless-steel surface will be coated with grey paint to give it an elegant color and a protective coating. Besides, each end of the frame will be filled

so that it is not sharp. The final result of the "Instant Desk Cleaner" concept is an automatic table cleaner with elegant color, smooth surface, and safe use. Our product works because users only need to press one button on the left end of the pipe, then the spray and motion of the pipe to the right of the table will be moved automatically. The sizes for our products will be adjusted according to the user's table. The components used for our first product concept were:

- For the frame, steel rail and pipes use stainless steel so that it is not easy to rust.
- Output holes for the sprayer using rubber and plastic materials.
- The Movement of "Instant Desk Cleaner" uses a dynamo engine connected with a mobilizer at the joint. This movement allows the pipe or tube to move forward and backward. The mobilizer will move through the cavity in the passage path of the steel rail.
- For the wiper, the component uses a cloth that can absorb dirt and clean the table quickly.
- Spray tools using automated spray technology, which releases a chemical cleaning substance.
- For the buttons, we use a switch with 3 input system which can control the "Instant Desk Cleaner" to move forward, backward and off easily.
- Finally, we use AC and DC circuits for the automation system using a rectifier device where AC can be converted into DC with a rechargeable battery.

The following is the component design for the "Instant Desk Cleaner" product:

a) Exterior Tube "Instant Desk Cleaner" Machine

The 3D shape along with the dimensions and design details of the "Instant Desk Cleaner" for the exterior of the engine tube are as follows;

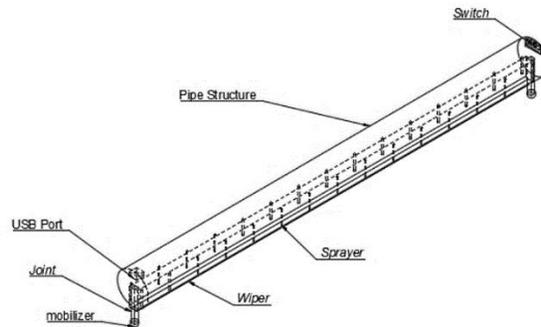


Figure 3. Isometric View of Exterior Tube "Instant Desk Cleaner" Machine

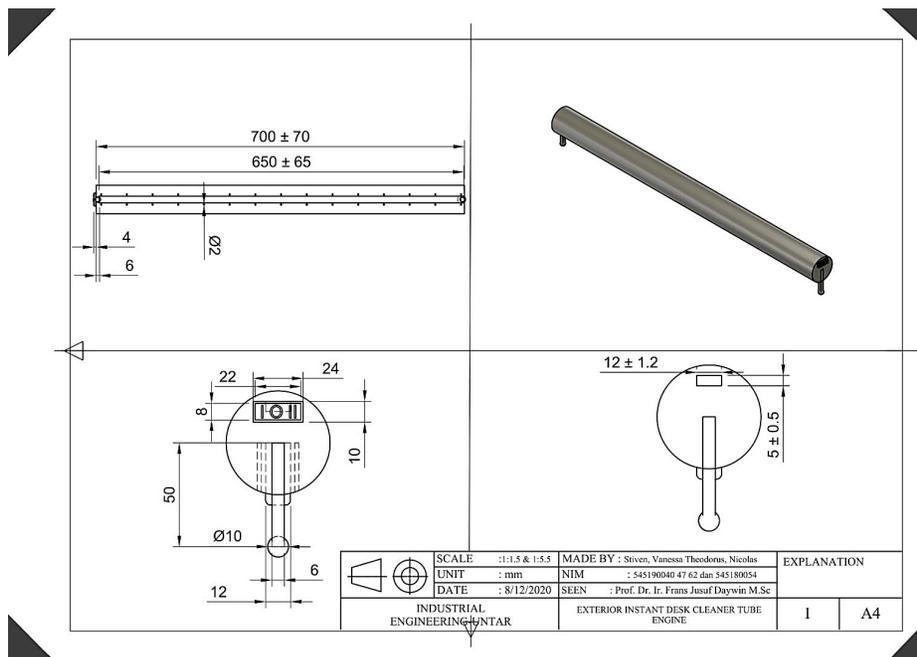


Figure 4. Drawing Design of Exterior Tube "Instant Desk Cleaner" Machine

b) Steel Rail "Instant Desk Cleaner" Machine

The 3D shape along with the dimensions and design details of the "Instant Desk Cleaner" for the steel rail are as follows;

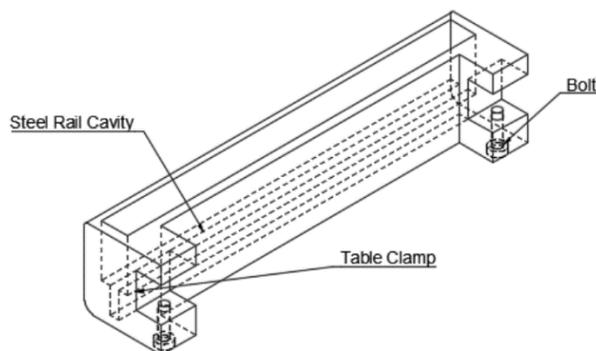


Figure 5. Isometric View Steel Rail "Instant Desk Cleaner" Machine

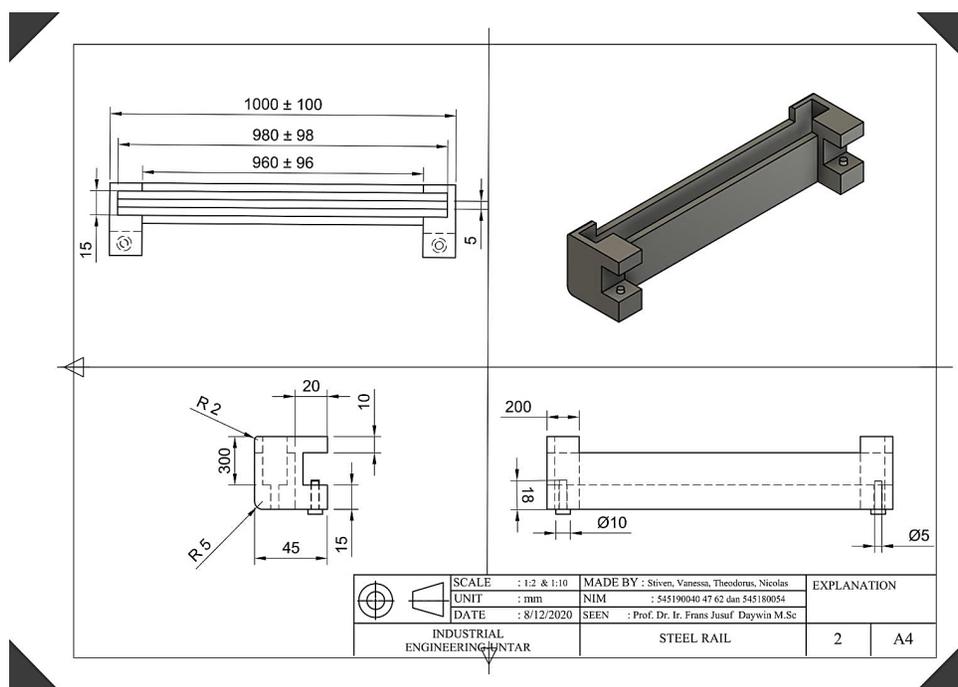


Figure 6. Drawing Design of Steel Rail "Instant Desk Cleaner" Machine

5.3 Mechanism of "Instant Desk Cleaner" Machine

The following is the working mechanism of the "Instant Desk Cleaner" machine:

1) Operating Machine "Instant Desk Cleaner"

a) Switch

In the operation of "Instant Desk Cleaner," the switch is used as a machine tool to start, stop, or change the machine's motion. The type of switch used is a reverse forward switch (bidirectional switch), where this switch can adjust the direction when cleaning the table. This switch has 3 steps consisting of 2 on switches and 1 off switch. If the switch is pressed to the left, the "Instant Desk Cleaner" will move backward and clean the table. If the switch is in the middle position, the "Instant Desk Cleaner" is either off or not moving. If the switch is pressed to the right, the "Instant Desk Cleaner" will move forward to clean the table. The switch has 3 symbols, namely, "I" which means the tool will move to the left, "O" which means the tool will be turned off, and "II" which means the tool will move to the right.

b) Motor

In the operation of "Instant Desk Cleaner," the motor will actuate when the switch is in the on position. The motor that uses dynamo will get electric power from the rectifier batteries and move the pipe connected to the wiper and sprayer. The mobilizer is at the ball joint. The ball joint will rotate and run on the driving track. The joint connected to the pipe in the motion path will move until the motion path's endpoint. Dynamo motor is used for energy cost savings, higher production performance, and extended motor life.

c) Sprayer

In the operation of "Instant Desk Cleaner," the sprayer will spray a cleaning agent as the pipe moves and will stop spraying when it reaches its final position. The sprayer will spray a cleaning agent to ensure that the table will be spotless from dirt, viruses, dust, and trashes. When the user presses the switch on, the machine will pump the cleaning agent stored in the storage and automatically eject it through the sprayer output holes. When the user turns on the "Instant Desk Cleaner" machine, the sprayer machine works in conjunction with the mobilizer.

d) Table Stand

A table stand is a tool that functions to hold an object in a fixed position so that when a shock occurs, the object does not move and is in a fixed position. In "Instant Desk Cleaner," the table stand is used to hold the tool while cleaning the table by tightening the bolts to the table surface. This design is done to maximize the "Instant Desk Cleaner" effectiveness in cleaning the table by holding the tool in a fixed position. On the table supports, there are fixing bolts so that the supports can support the tool firmly.

2) Steps to Operate "Instant Desk Cleaner"



Figure 7. The direction of Movement Mechanism "Instant Desk Cleaner" (Left)

1. The user will press the switch that has the symbol I on the side of "Instant Desk Cleaner" so that the electric current on this machine is connected and the machine can start moving to the left.
2. When the switch "on" is pressed to the right, then the motor connected to the button with the cable will turn on, and the mobilizer at the joint and the sprayer pump machine will move.
3. The joint's mobilizer will rotate and travel along the motion path; the joint connected to the pipe in the motion path will move along the path to the endpoint. The mobilizer is moved by dynamo inside the pipe.
4. The sprayer pump engine will also turn on as the motor runs. The sprayer will spray out the cleaning agent to the endpoint.
5. The pipe connected to the wiper and sprayer will clean the table by spraying the cleaning agent and wiping it.
6. After reaching the endpoint, the mobilizer and sprayer will stop automatically, and the machine will turn off. The switch will automatically change to O, which means the device is resting.
7. The next user can clean the table with the same mechanism as the one above, but the user must press the switch with the symbol II because the machine is on the left side of the table and must move to the right to clear the table.
8. The next operation will be the same as the steps above.

5.4 Proposed Improvements

Based on recent literature about "How should Restaurants Clean in Coronavirus Cases" written by Ron Ruggless in nnn.com, there are many regulations to assure that their tables are safe from the coronavirus. Workers must intensively be checked to be safe from covid-19, costumers must have minimal contact with workers and tables must be cleaned regularly and carefully with soap and disinfectant. Features implemented in our product, "Instant Desk Cleaner," overcome those intensive regulations easily. Improvements for "Instant Desk Cleaner" are extensive. There will be several improvements that are still possible to be implemented on "Instant Desk Cleaner" because we are still in the development product process. Present ideas and proposed improvements for this machine to make the pipe and the steel rail adjustable according to the table's dimension. Pipe and steel rail can elongate and contract quickly, adjusting the length of the table. Moreover, the features such as settings for the speed and the liquid's volume ejected can be added. These additional improvements can boost the market for "Instant Desk Cleaner," and its demand can undoubtedly be increased drastically.

5.5 Validation

It is essential to do the test of his data validity; this study uses the SPSS program. Researchers often use the testing technique to test the validity to use the Bivariate Pearson correlation (Pearson Moment Product). This analysis is done by correlating the score of each item with the total score. The total score is the sum of all items. Question items that significantly correlate with the total score indicate that these items can provide support in revealing what Valid wants to reveal. If $r \text{ count} \geq r \text{ table}$ (2-sided test with significant 0.05) then the instrument or question items significantly correlate to the total score (declared valid). The following is an explanation for the table of interests that will be tested for validity:

- 1: Very Not Important
- 2: Not Important
- 3: Simply Important
- 4: Important
- 5: Very Important

The process to ensure the validity of the result taken from 120 respondents using a google form questionnaire can be seen in table 6, table 7, and table 8.

Table 6. R-Value Distribution Table

N	The Level of Significance		N	The Level of Significance	
	5%	1%		5%	1%
3	0.997	0.999	70	0.235	0.306
5	0.878	0.959	75	0.227	0.296
10	0.632	0.765	80	0.220	0.286
15	0.514	0.641	85	0.213	0.278
20	0.444	0.561	90	0.207	0.270
25	0.396	0.505	95	0.202	0.263
30	0.361	0.463	100	0.197	0.256
35	0.334	0.430	105	0.192	0.250
40	0.312	0.403	110	0.187	0.245
45	0.294	0.380	115	0.183	0.239
50	0.279	0.361	120	0.179	0.234
55	0.266	0.345	125	0.176	0.230
60	0.254	0.330	130	0.172	0.225
65	0.244	0.317	135	0.169	0.221

Table 7. Validation Test Using SPSS

		Correlations									
		Functional	Automatic	Easy to use & practical	Fast	Ergonomic	Aesthetics	Light	Durable	Safe	Total
Functional	Pearson Correlation	1	.470**	.339**	.499**	.269**	.259**	.303**	.307**	.380**	.570**
	Sig. (2-tailed)		.000	.000	.000	.003	.004	.001	.001	.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Automatic	Pearson Correlation	.470**	1	.351**	.412**	.333**	.375**	.459**	.378**	.275**	.653**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.002	.000
	N	120	120	120	120	120	120	120	120	120	120
Easy to Use & Practical	Pearson Correlation	.339**	.351**	1	.550**	.527**	.459**	.449**	.436**	.473**	.724**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Fast	Pearson Correlation	.499**	.412**	.550**	1	.490**	.331**	.190*	.445**	.568**	.660**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.038	.000	.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Ergonomic	Pearson Correlation	.269**	.333**	.527**	.490**	1	.564**	.464**	.562**	.527**	.752**
	Sig. (2-tailed)	.003	.000	.000	.000		.000	.000	.000	.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Aesthetics	Pearson Correlation	.259**	.375**	.459**	.331**	.564**	1	.548**	.544**	.380**	.755**
	Sig. (2-tailed)	.004	.000	.000	.000	.000		.000	.000	.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Light	Pearson Correlation	.303**	.459**	.449**	.190*	.464**	.548**	1	.368**	.314**	.717**
	Sig. (2-tailed)	.001	.000	.000	.038	.000	.000		.000	.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Durable	Pearson Correlation	.307**	.378**	.436**	.445**	.562**	.544**	.368**	1	.691**	.730**
	Sig. (2-tailed)	.001	.000	.000	.000	.000	.000	.000		.000	.000
	N	120	120	120	120	120	120	120	120	120	120
Safe	Pearson Correlation	.380**	.275**	.473**	.568**	.527**	.380**	.314**	.691**	1	.688**
	Sig. (2-tailed)	.000	.002	.000	.000	.000	.000	.000	.000		.000
	N	120	120	120	120	120	120	120	120	120	120
Total	Pearson Correlation	.570**	.653**	.724**	.660**	.752**	.755**	.717**	.730**	.688**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	120	120	120	120	120	120	120	120	120	120

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 8. Final Results of Validity Test

Variable	R Count	R Table	Result
Functional	0.570	0.179	Valid
Automatic	0.653	0.179	Valid
Easy to use and practical	0.724	0.179	Valid
Fast	0.660	0.179	Valid
Ergonomic	0.752	0.179	Valid
Aesthetics	0.755	0.179	Valid
Light	0.717	0.179	Valid
Durable	0.730	0.179	Valid
Safe	0.688	0.179	Valid

The validity test's final results are all customer needs that were used for designing "Instant Desk Cleaner" are valid. These results show that "Instant Desk Cleaner" features and functions correspond to the needs of customer during this pandemic era.

6. Conclusion

To conclude, we have taken a series of systematic and scientifically tested steps to design an automatic table cleaning device or the so-called "Instant Desk Cleaner." We designed this "Instant Desk Cleaner" tool to maintain the table's cleanliness and hygiene, especially during the pandemic era. With this tool, labor can also be minimized so that social distancing can be maintained. In designing the "Instant Desk Cleaner," there are a series of steps that we have taken. First, we've done market research. Based on market research analysis results, concept design and product specifications are carried out by considering the ergonomic aspects of the product. In the final step, we finalize the existing concept into the final concept of the "Instant Desk Cleaner" product.

Based on the result in market research, public facilities are not well maintained before and after the covid-19 outbreak, as most of the respondents answer that they rarely see it clean. Automatic table cleaning is needed to replace the conventional manual cleaning method because it is considered less effective. Furthermore, customers need a fast, easy, and practical, ergonomic, durable, automatic, lightweight, safe, functional, and aesthetic tool.

Based on the concept selection analysis, the final concept chosen is concept 1, namely "Instant Desk Cleaner" in the form of a tube equipped with a wiper and sprayer with the movement of cleaning the table from the left side of the table to the right of the table or vice versa. "Instant Desk Cleaner" is designed as a table cleaning support tool, especially for the current Covid-19 pandemic. The dimensions of the "Instant Desk Cleaner" tool are ergonomic. This design is based on anthropometric data from Indonesian people, men and women. All users can use this tool comfortably and do not interfere with activities on the table. The "Instant Desk Cleaner" framework mostly uses stainless steel to make it durable, not easy to corrode, and healthy. Mechanism of action "Instant Desk Cleaner" uses a switch to control the tool's sprayer and movement to the right, left, or off. The machine used a mobilizer at the joint and a sprayer pumping machine connected to a circuit.

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Biographies

Stiven Tjen, born and raised in Jakarta, the capital city of Indonesia. he describe myself as a creative and intelligent teenager. He partake in quite a lot of different academic activities to push myself and grow to my fullest potential. In the present time, he is an ordinary second-year college student who studies at Tarumanagara University. He is currently majoring in industrial engineering. He frequently use my creativity to bring a lot of innovative ideas to life. The journal titled "The Design of Instant Desk Cleaner for Public Facilities during Pandemic Era", is his first real move and effort to push my creative ideas into reality.

Theodorus Henderson, a student from Tarumanagara University who is currently studying Industrial Engineering in Jakarta, Indonesia. he took his high school in Kairos Gracia Christian International School, where he studied Cambridge curriculum and took the O level, level, and level test.

Vanessa Angelica B, an industrial engineering student at Tarumanagara University. she was graduated from 78 high school of Jakarta where she learned about science. she had studied Korean and Chinese a little during senior high school to improve her knowledge. She also likes to play piano during her free time.

Nicolas Reynaldo, an industrial engineering student at Tarumanagara University. He graduated from Xaverius Pringsewu High School in 2018, where he studied science. During his studies from elementary school to high school, he made many achievements in the arts, especially music.

Lina Gozali is a lecturer at the Industrial Engineering Department of Universitas Tarumanagara since 2006 and a freelance lecturer at Universitas Trisakti since 1995. She graduated with her Bachelor's degree at Trisakti University, Jakarta - Indonesia, then she got her Master's Degree at STIE IBII, Jakarta – Indonesia, and she recently got her Ph.D. at Universiti Teknologi Malaysia, Kuala Lumpur – Malaysia in 2018. Her apprentice college experience was in paper industry at Kertas Bekasi Teguh, shoes industry at PT Jaya Harapan Barutama, and automotive chain drive industry at Federal Superior Chain Manufacturing. She teaches Production System and Supply Chain Management Subjects. She did a research about Indonesian Business Incubator for her Ph.D. She has written almost 70 publications since 2008 in the Industrial Engineering research sector, such as Production Scheduling, Plant Layout, Maintenance, Line Balancing, Supply Chain Management, Production Planning, and Inventory Control. She had worked at PT. Astra Otoparts Tbk before she became a lecturer.

Frans Jusuf Daywin was born in Makasar, Indonesia on 24th November 1942. is a lecturer in the Department of Agricultural Engineering at Faculty of Agricultural Technology Bogor Agricultural University since 1964 conducted teaching, research, and extension work in the field of farm power and machinery and become a professor in Internal Combustion Engine and Farm Power directing and supervising undergraduate and graduate students thesis and dissertation and retired as a professor in 2007. In 1994 up to present as a professor in Internal Combustion Engine and Farm Power at Mechanical Engineering Program Study and Industrial Engineering Program Study Universitas Tarumanagara, directing and supervising undergraduate student's theses in Agricultural Engineering and Food Engineering Desain. In 2016 up to present teaching undergraduate courses of the introduction of concept technology, research methodology, and seminar, writing a scientific paper and scientific communication, and directing and supervising undergraduate student's theses in Industrial Engineering Program Study at the Faculty of Engineering Universitas Tarumanagara. He got his Ir degree in Agricultural Engineering, Bogor Agricultural University Indonesia in 1966, and finished the Master of Science in Agricultural Engineering at the University of Philippines, Los Banos, the Philippines 1981, and got the Doctor in Agricultural Engineering, Bogor Agricultural University Indonesia in 1991. He joined 4-month farm machinery training at ISEKI CO, AOTS, Japan in 1969 and 14 days agricultural engineering training at IIRI, Los Banos the Philippines, in March 1980. He received the honors "SATYA LANCANA KARYA SATYA XXX TAHUN" from the President of the Republic of Indonesia, April 22nd, 2006, and received appreciation as Team Jury from the Government of Indonesia Minister of Industry in Industry Start-Up 2008. He did several research and survey in the field of farm machinery, farm mechanization, agricultural engineering feasibility study in-field performance and cost analysis, land clearing and soil preparation in secondary forest and alang-alang field farm 1966 up to 1998. Up till now he is still doing research in designing food processing engineering in agriculture products. Up to the present he already elaborated as a concepter of about 20 Indonesia National Standard (SNI) in the field of machinery and equipment. He joins the Professional Societies as a member: Indonesia Society of Agricultural Engineers (PERTETA); Indonesia Society of Engineers (PII); member of BKM-PII, and member of Majelis Penilai Insinyur Profesional BKM-PII.

Carla Olyvia Doaly is a lecturer in the Industrial Engineering Department at Universitas Tarumanagara graduated with my bachelor's degree from Institut Teknologi Nasional Malang, which study the Industrial Engineering program, then continued my Master Degree at Institut Teknologi Bandung majoring in Industrial engineering and management and a special field of Enterprise Engineering. I am very interested in studying industrial engineering by doing research related to System Design and Engineering, Supply Chain Management, Operations Research and Analysis, Information System Management, Occupational Health and Safety, Facilities Engineering, Quality and Reliability Engineering

Lamto Widodo is a lecturer at Universitas Tarumanagara since 1994, joining the Mechanical Engineering Department. Involved as a team for the opening of the Industrial Engineering Department in 2004-2005. Starting in 2005, as a lecturer in the Industrial Engineering Department. Obtained a Bachelor's degree at the Sepuluh Nopember Institute of Technology Surabaya (ITS), then completed a Master degree at the University of Indonesia (UI) and graduated with the title Dr. at the Bogor Agricultural Institute (IPB). He is engaged in research and publication in the fields of Product Design and Ergonomics, Production Systems and Engineering Economics, and teaches at various universities in Jakarta. Has published nearly 30 publications in the field of Industrial Engineering research both nationally and internationally. Active in various professional organizations, especially in the field of Ergonomics

(IEA), as well as active in the organization of the Indonesian Industrial Engineering Higher Education Cooperation Agency (BKSTI).

Adianto was born in Semarang, Indonesia on 29th April, 1955. Adianto completed his "Sarjana Fisika Degree" in 1982 from the Physics Department of the Faculty of Sciences and Mathematics, Gadjah Mada University, Yogyakarta. In 1978 when he got his Bachelor of Science in Physics (B.Sc.) he started working as a Staff of "Field of Nuclear Physics Laboratory", " Pure Materials Research Center and Instrumentation Yogyakarta", Atomic Energy Agency (BATAN). In 1986 to 1993 he received a scholarship from the Ministry of Research and Technology of the Republic of Indonesia to continue his studies in England at the Department of Electronic and Electrical Engineering, University of Salford, England. He received his M.Sc. degree in the field of Computer Instrumentation in 1988 and a Ph.D. degree in the field of Material Science in 1993. He returned back to Indonesia, then in 1994 he moved to Jakarta and appointed as a "Head of Engineering and Advanced Technology", (Echelon IIIA) at "Nuclear Science and Technology Empowerment Center", Atomic Energy Agency, BATAN, Jakarta. In 2000 he was assigned to the Ministry of Research and Technology to serve as Assistant Deputy for Science Accreditation and Development Center (Echelon IIA) and in 2005 he was assigned as Assistant Director for Academic Affairs, to Organize Graduate Research in PUSPIPTEK Serpong. In 2008, he took early retirement as a Government Official to take a full time lecturer at Universitas Tarumanagara, Jakarta. Adianto started his profession as a lecturer in the Department of Mechanical Engineering, Faculty of Engineering, Tarumanagara University and the Department of Mechanical Engineering, Faculty of Industrial Technology, Trisakti University of Indonesia from 1994 until now. He has taught mathematics, mechatronics, English and physics, but Physics is the main subject he teaches. As a full time lecturer at Universitas tarumanagara, in 2012 he was appointed as a Vice Dean for Academic and Student Affairs, Faculty of Engineering, and in 2016 up to now, he was appointed as a Director for Student Affairs, Universitas Tarumanagara. During his profession as a researcher at the Atomic Energy Agency, the Ministry of Research and Technology and as a lecturer at Tarumanagara University, Adianto as an Associate Professor has published scientific and research papers of more than 35 titles at home and abroad.

Ahmad is currently active as a lecture at Industrial Engineering Department, Universitas Tarumanagara. Mr. Ahmad graduated his bachelor's degree of Industrial Engineering at Universitas Islam Indonesia and his master's degree in University of Indonesia. He taught Operation Research and Modeling System.

Lithrone Laricha Salomon is a lecturer at Industrial Engineering Department of Universitas Tarumanagara since 2006. She graduated from Universitas Tarumanagara with a Bachelor's Degree in Mechanical Engineering. She continued her study and got her Master's Degree from Industrial Engineering Program at Universitas Indonesia. She teaches a subject related to quality management system such as Total quality management, Quality Control, Design of Experiment and Industrial Statistic. Besides teaching she also did some research and carrying out a number of community service activities in many places around Indonesia. She has written 40 publication on International and national proceeding and journal since 2007.

Agustinus Purna Irawan was born in Mataram - Musirawas, South Sumatera, August 28, 1971. Is a Lecturer at Universitas Tarumanagara and has served as Chancellor since 2016 until now. Obtained a Bachelor of Mechanical Engineering from the Faculty of Engineering, Gadjah Mada University (1995), a Masters in Mechanical Engineering from the Faculty of Engineering, University of Indonesia (2003), a Doctor of Mechanical Engineering from the Faculty of Engineering, University of Indonesia (2011), Professional Engineer (Ir) Mechanical Engineering from the Faculty of Engineering, Gadjah Mada University (2019) and Professor of Mechanical Engineering from the Ministry of Education and Culture (2014). The fields of scientific research and publication include: Product Design and Development, Strength of Materials, Natural Fiber Composites with implementation in the field of prosthesis and automotive components. Obtaining Research and Community Service Grants for Higher Education / Research and Technology BRIN / Untar / Others \geq 100 titles; Patents: 7 and still in process: 4; Copyright: 9 books; Textbooks: 6 books; Book Chapter: 2 chapters; Scientific articles \geq 100 titles. Obtained a Professional Certificate, namely the Educator Certificate, the Intermediate Professional Engineer Certificate (IPM) of the Indonesian Engineers Association (BKM PII) Vocational Engineer Association (BKM PII), and the ASEAN Engineer Certificate (ASEAN Eng.) From the ASEAN Federation Engineering Organizations (AFEO). He is active in education, various scientific activities, the world of business, professional associations, and various social activities. Received several awards: Best Graduate S2 UI GPA 4.00 cum laude (2003); First best Lecturer Kopertis Region III DKI Jakarta (2011); Best Presentation at the Seminar on Research Results of the Centralized Program, PUPT Dikti (2014); Honorary Member

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