Advances in Social Science, Education and Humanities Research, volume 520
Proceedings of the 6th UPI International Conference on TVET 2020 (TVET 2020)

The Design of Automatic Rice Cooker 3 in 1 with Circuit Control Based on Solidworks as Three Dimensional Modelling Software

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***Abstract*—The development of technology allows all activities to be carried out automatically, including for rice cooking. The problems who still exist when we did it is about of the time-consuming process, especially for among people who have a lot of activity. The automatic rice cooker 3 in 1 with circuit control is a solution for answer that problem. This rice cooker has three functions in the same appliance, which consists of a circuit control as a control center of the tool, a rice storage tank, a rice washing pan equipped with blade and cooking rice until it is ready for consumption. This study aims to design the automatic rice cooker 3 in 1 using Solidworks as a three-dimensional modeling software and secondary data from articles and journals to analyze bottle fiiling time, water discharge and selenoid valve power consumption.**

Keywords—automatic rice cooker, Solidworks, Secondary data

I. INTRODUCTION

Breakfast is an important thing to do before starting an activities in the morning. Breakfast with rice consume will increase an energy in the body so that we are better prepared for daily activities. The calories contained in 100 grams of rice is 1300 kcal. The rice cooking process until now still using the traditional method with several different tools, is considered a quite difficult activity, especially for among people who have a lot of activity. Workers need an energy to carry out activities and around 60% of them employees are not used to having breakfast [1]. This indicates that a series of rice cooking processes using different tools and separate processes is time consuming so that people who have busy routines tend to experience difficulties with this. Through heavy duty gas steamer research, to cook 300 grams of rice it takes 45 minutes until it is ready to consumption [2]. The same thing felt by the food industry which has higher cost to pay their employees or just for bought a series of tools for the rice cooking process such as rice boxes, rice washing machines and rice cooker. The number of workers in the food industry sector in 2012 reached 14 million employees, including micro, small and medium industries and it will always increasingly in every year [3]. So the aim to create a design concept for the automatic rice cooker 3 in 1 is none other than to provide an overview and information to others about the concept, mechanism and use of the tool, by using the Solidworks as three-dimensional modeling software will make the design look more real and by using secondary data obtained through journals or articles in the internet that have been published before, the author hopes to improve the results of previous research by linking some of the data obtained, beside that with secondary data the author hopes to correct mistakes from previous research or giving the solution for the problems that have never been solved before. By using this methods the design will have a great potential to be realized as a product in the future with some improvements on the next research.

II. METHODS

This research using D & D (Design and Development) as a method and secondary data obtained from various sources such as books, news and journals that have been published previously. Secondary data analysis is a research strategy that aims to generate qualitative and quantitative data to find new problems and to confirm the results of previous research [4]. This study aims to analyze problems that have been carried out by previous researchers which will then be used as a reference so that the design of the tool that is made will have the potential to be used as a real product, as well as to correct mistakes that have been made by previous research. The time needed in making this tool design is around two weeks. The flowchart explains the process of making tools starting from priminary studies to be used as secondary data, the process of draft design making, final design, decision to get the result that design proof to revisied or not, until we got the final design of the automatic rice cooker 3 in 1 it is all obtained as follows:

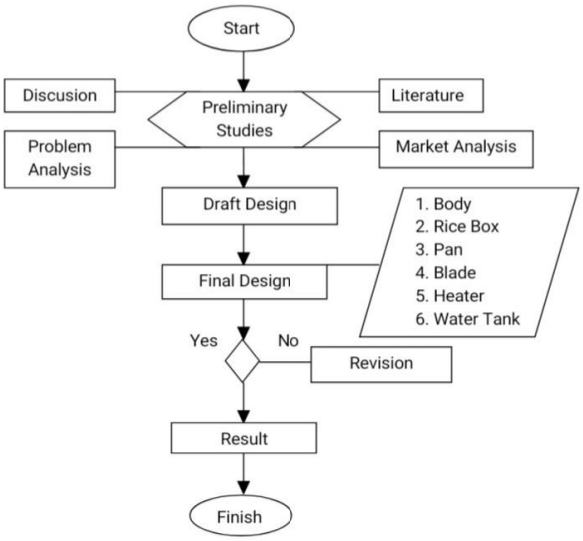

Fig. 1. Flowchart.

- Preliminary studies include: the initial stages carried out by the team such as literature studies, problem analysis, market analysis, and discussions with the supervisor, these will be used as the basis for drafting designs and obtaining secondary data from various media such as news, articles and journals that have been previously published.
- Draft design: is an initial design made, which aims to evaluate so that the design obtained will be better. The draft design on the automatic 3 in 1 rice cooker device. The draft design at this stage contains a simple picture of the parts of the appliance in general, such as a rice tank, a washing place to a rice cooker where rice cooking takes place.
- Final design: is the final design of a tool. The results of the evaluation of the draft design, however, the final design is still not perfect so it needs to be re-evaluated.

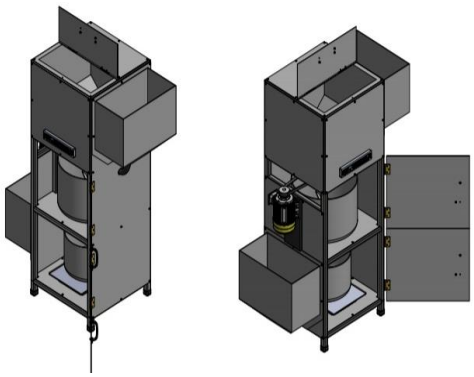

Fig. 2. Final design.

- Decision: at this stage the results are obtained whether the final design is suitable for use or not. There will be two decisions, namely if the design fee is good, the results will be obtained immediately for use and the design making is complete. However, if the final design is still not feasible, it is necessary to revise it again. Revision of the design of the tool will start from the initial process, such as a literature study on secondary data used, guidance with accompanying lecturers, to the software and tools used. because a design error is something that needs to be corrected in more detail so that the results obtained are more satisfying.

Fig. 3. Decision design.

A. Components the Automatic Rice Cooker 3 in 1

The components that are composed of the automatic rice cooker design are as follows:

TABLE I. COMPONENTS OF THE TOOL

No	Component of the Tool	
	component	***Qty***
1	Hollow frame	20 meters
2	Hinge	8 unit
3	Selenoid valve	3 pcs
4	Motor	1 pcs
5	Pulley	1 set
6	V belt	1 pcs
7	Blade	1 pcs
8	Rice cooker pan	2 pcs
9	Thermostat	1 pcs
10	Heater	1 pcs
11	Tube (Diameter10 mm)	2 meters
12	Connector 220 volt	1 pcs
13	Time Delay Relay	3 pcs
14	Pcb / Circuit control	1 pcs
15	Handle	5 pcs
16	Wheel	4 pcs
17	Water tank (10 L)	2 pcs
18	Framework Plate	6 pcs
19	Shaft	30 cm
20	Rice box	1 pcs
21	Hex Bolt nut	40 pcs
22	TCL transmision	1 pcs

B. *Process of Making Tools Design*

The process of making this design uses Solidworks as three dimensional software. The initial stage is to determine the parts that are composed of the equipment, such as the rice storage tank, water tank, rice washing pan, shaft blade, and heater. The dimensions obtained are based on secondary data on previously published news, articles and journals, so that a tool design that has the appropriate specifications can be obtained.

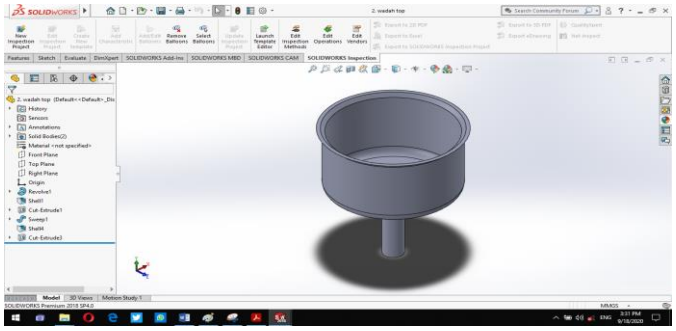

Fig. 4. Rice washing pan.

Beside control circuit as a control centre on this tool, the automatic rice cooker 3 in 1 uses an electronic motor as its main drive. The electric motor is connected to a belt on the blade and shaft blade through a transmission which aims to regulate the electric motor, so it will produces relatively small rotation.

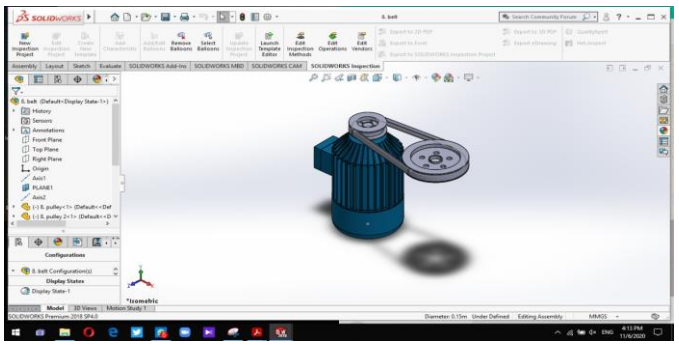

Fig. 5. Electric motor.

The electric motor has a fungtion for the rice washing process. After pressing the ON button on the electronic controller the rice will go down with the influence of gravity and then the washing process is carried out with a blade rotation for 20 seconds per washing cycle. This cycle can be adjusted by the user via an electronic controller. The water from rice washing process will be flowed into the hose through the selenoid valve which will automatically open when the wasing process ends.

III. Results and Discussions

In the manufacturing process using SolidWorks software using several tools similar to Autocad such as:

- Skech: serves to create dimensions in the image.
- Smart dimension: to give the image size precisely.
- Circle: to create a circular image.
- Extrude: to change 2D images so that they can produce 3D images using the axis points.
- Sweep Boss: to make 2D images into 3D shapes following paths / lines.
- Extrude Cut: functions to form a 3D image on the cut.
- Hole Wizard: this tool functions to make a hole in the circle. This command can be used in the bolt design manufacturing process.
- Fillet and Chamfer: functions to cut the sides of objects.
- Shell: functions to make a circular image into an image that has volume.

A. *Selenoid Valve Power Consumtion*

To determine the power consumption produced by the the solenoid valve, the following formula can be used [5]:

$$P = U \cdot I$$
$$W = P \cdot t$$

Where :

P = Power (W)
W = Work (J)
I = Intesite (V)
t = Time (t)

Based on the formula, the power consumption of the solenoid valve is obtained as follows:

TABLE II. Selenoid Valve Power Consumption

Volume (L)	Time (S)	Voltage (V)	Current (A)	Work (W)	Energy (J)
2,5	13,53	23,95	0,768	18,39	248,865
5	10,46	23,95	0,768	18,39	192, 397
7,5	8,76	23,95	0,788	18,39	161,128
10	7,66	23,95	0,768	18,39	140,895

B. *Selenoid Valve Testing*

The data obtained is secondary data obtained through journals that have been previously published. Research conducted by Zarkasi [5] entitled: Selenoid Performance on the Valve for Automatic Drinking Water Filling Equipment, obtained the following data, this test was carried out by fulfilling water in a bottle that has a volume of 350 ml, then measuring the selenoid valve installed on gallons with a

volume of 10 L using a digital multimeter DT830B. Testing on the solenoid valve uses the following circuit:

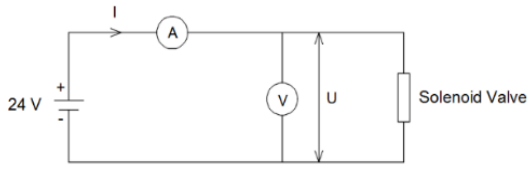

Fig. 6. Solenoid valve test circuit.

The tes doing by pouring the water into a bottle who have a volume 350 ml with different conditions of each gallon such as 2,5 L, 5 L, 7,5 L and 10 L.

TABLE III. BOTTLE FILLING TIME

NO	Bottle Filling Time (Second)			
	2.5 L	***5 L***	***7.5 L***	***10 L***
1	13,3	10,7	8,9	8,0
2	13,7	10,2	8,7	7,5
3	13,3	10,4	8,1	7,9
4	13,6	10,3	8,9	7,8
5	13,7	10,3	8,8	7,0
6	13,7	10,6	9,0	7,7
7	13,6	10,6	8,8	7,4
8	13,9	10,4	8,8	8,0
9	13,1	10,6	9,3	7,6
10	13,4	10,5	8,3	7,7
Average	13,53	13,53	10,46	7,66

C. Calculating Water Discharge

For analysis the result of water on the bottle with volumes of 359 ML as have to describe before, on this test need the data about the discharge of water on solenoid valve [5]. It can be solving with using a formula of water discharge:

$$Q = V/t$$

Where :

Q = Water discharge (mL/ second)
V = Volume (mL)
t = Time (second)

If the volume of the bottle are 350 Ml so the result of water discharge given on the data bellow.

TABLE IV. WATER DISCHARGE

Gallon (L)	Volume (mL)	Time (second)	Discharge (mL/s)
2,5	350	13,53	25,87
5	350	10,46	33,46
7,5	350	8,76	39,95
10	350	7,66	45,69

Based on the data above we can conclude about the water discharge will be the same with the volume on the gallon

IV. CONCLUSION

The making process of the design automatic rice cooker 3 in 1 uses Solidworks as a three-dimensional modeling software and has specifications for measuring, washing and cooking rice in the same tool. By using SolidWorks as a three-dimensional modeling software as well as secondary data obtained from news, journals and articles that have been published previously as a complement to previous research, the design of this tool is expected to have great potential to be realized into a product.

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