

Coconut Candy Cutter Machine for Small Medium Enterprise (SMEs) Businesses

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Abstract: The coconut candy cutting machine is a product developed to simplify the cutting process and improve the hygienic quality of coconut candy. This research used the design model of Design Thinking, which consists of the phases of empathy, definition, ideas, prototype, and testing. The objective of this study was to design, develop and test the functionality of a coconut candy cutting machine operated by the Blynk application. The project used components such as linear drive motors, relays and the NodeMCU ESP8266 microprocessor. Based on evaluation from experts, found that they agree with The Prototype of Coconut Candy Cutter Machine for Small Medium Enterprise (SMEs) Industry in terms of design, function, and suitability. Besides, the coconut candy cutting machine makes coconut cut with the correct size before being distributed to consumers.

Keywords: Coconut Candy Cutter Machine, Blynk Application, Design Thinking

1. Introduction

Coconut or *Cocos Nucifera* is a tree that is cultivated for its multiple utilities, mainly for its nutritional and medicinal values (Deb Mandal & Mandal, 2011). The coconut tree is a single species classified in the genus *Cocos* and is a large palm tree. The tree can reach a height of 6 to 30 meters, and it depends on the variation. It is readily available in all tropical regions. Fruit leaves and stems derived from coconut trees can be utilized for various uses and products based on coconut (Zulkifli, 2012). Among the popular products is coconut candy. Coconut candy is a type of food that has a unique and creamy texture making it quite popular with the public, especially among children. The specialty of coconut candy is the sweet taste and dense coconut texture. Coconut candy is perfect as a side dish for birthday parties or during the festive season. This coconut candy can be cooked yourself or purchased with ready-made coconut candy products. Most small and medium enterprises (SMEs) produce coconut candy.

Throughout observations during a visit to the coconut candy manufacturing industry, researchers found that the work of cutting coconut candy manually on a large scale led to long-term consumption and high energy consumption. The time taken to cut the coconut candy for skilled workers is 5 to 10 minutes for a tray of coconut candy (Mrs Salimah, personal communication, 27 February 2020). The coconut candy will be compressed into the existing tray and then measured according to the appropriate size to cut. Coconut candy was splitter using a knife and ruler. According to Mohd Yusof (2008), the use of limited time requires the use of modern technology that enables people to carry out their activities more efficiently, systematically, and effectively. The traditional use of cutting methods causes entrepreneurs to take a long and uncertain time to produce quality products. The cutting process takes a long time, which prevents the operator from producing as many coconut sweets as possible.

The process of cutting coconut candy manually is also not guaranteed cleanliness. According to Singh (2000), most fast-food products are naturally destroyed and require prevention from damage during storage and marketing processes to achieve the desired life span. The process of cutting coconut sweets is done conventionally, in other words, cutting products cut by hand and cutting tools such as knives. We do it while leaving it uncovered. Thus, it will increase the chances of contamination. Contamination is pollution or poisoning (Fourth Edition Board Dictionary). Moreover, openly cutting food will expose food to parasites like flies, cockroaches, and others. It will make the food unsafe to eat. Authenticity includes the quality of a product (Robert, 2017). It is recognized that the authenticity of a particular type of food is important to human satisfaction. Studies show that the factor of perfection (High-Quality Conscious) is a major factor that influences consumer decisions when buying an item (Yusuff, 2017). Therefore, human beings value quality when choosing food or drink. If the coconut candy produced does not meet the hygiene aspect, this will cause bacterial reproduction and result in the coconut candy cannot last long. So, the cleanliness of coconut candy is one of the important factors in the coconut candy company.

However, there are problems identified in the production of coconut candy, especially during the cutting process and the cleanliness of the product during cutting. In the coconut candy industry, the product needs to be cut to the right size before being marketed to consumers. In this cutting process, the researcher touches on aspects of cutting time as well as the cleanliness of coconut candy. Based on the background of the problem, the researcher can identify the problem faced by the coconut candy operator that is the time taken to cut the coconut candy to the appropriate size takes a long time. This problem can affect the quantity of coconut candy production by an industry. In addition, coconut candy cut using conventional methods will cause the product to be prone to contamination and affect the hygiene quality of coconut candy. In this regard, researchers have taken the initiative to create a prototype of a coconut candy cutter machine that has more systematic control and benefits the operators of the coconut candy industry. The project that the researchers are trying to develop also helps the coconut sweets industry to produce cleaner and quality products. This is a machine where coconut candy will be cut using a cutting blade according to the appropriate size driven by a motor that uses electric power. The container for cutting coconut candy is made closed, and the coconut candy will stay clean after the cutting process. This coconut candy cutting prototype has an automated handling system. Therefore, there are three objectives of this project are:

- i. To design a coconut candy cutting machine controlled using the Blynk application.
- ii. To develop a coconut candy cutting machine controlled using the Blynk application.
- iii. To test the functionality of a coconut candy cutting machine controlled using the Blynk application.

2. Methodology

Design Thinking is a product development model that provides a solution-based approach to problem-solving. According to Bastian & Arnaud (2017), it is very useful in dealing with complex problems that cannot be determined or unknown by understanding the human needs involved or by solving problems in a human-centred way, by creating many ideas in brainstorming sessions and by

using approaches directly in prototypes and tests. This model has 5 phases of product development namely: (i) Empathy, (ii) Definition, (iii) Idea, (iv) Prototype, and (v) Testing Phase.

2.1. Empathy

According to Umar & Ali (1992), empathy is a tendency felt by one to feel something done by another. In this phase, an observation is achieved to identify and understand the problems faced by a particular group. The researcher visited Seri Mas Coconut Candy producer located at Ayer Hitam in Batu Pahat, Johor. Researchers had the opportunity to see the process of producing and cutting coconut candy conducted by employees and conducted interviews with the owners of the company. From these observations, an analysis was made related to the process of cutting coconut candy performed by small and medium industrial operators. From the observations made, small and medium industrial operators related to coconut candy are still doing conventional cutting using a knife.

2.2. Definition

At this phase, the problems identified are classified first. The researcher will focus on one problem faced by the user. Researchers have collected preliminary information on the problems that occur during interviews with employers and employees at Perusahaan Seri Mas. The information collected is related to the process of cutting coconut candy. Among the information obtained is that employees need a long time to complete the process of cutting candy as the cutting process is produced conventionally. The cleanliness of the candy is also not guaranteed because the cutting process is performed in open areas, and the equipment used is not stored in enclosed spaces. In addition, the researcher also stated the point of view by combining the three elements, namely users, needs and objectives. This phase will help the researcher to gather great ideas to create features, functions and other elements that allow solving the problem.

2.3. Idea


This design development phase is a combination of understanding of problem space and ideas in producing solutions for users. For the initial start of product design, several solutions are provided so that the selection to get the best solution. In this phase, brainstorming ideas, and the creation of new solutions to develop products are used to solve consumer problems systematically and effectively. Therefore, to illustrate the idea, a final sketch is provided to explain the product developed by the researcher. The dimensions of the product sketch are also was described. Through this sketch, the researcher can understand the concept of this product properly.

2.4. Prototype

The coconut candy cutting machine has been developed based on the prototype design as stated in the methodology chapter. The analysis is prepared to obtain a design that meets the characteristics and specifications relevant to the product development. Aspects of product analysis and the suitability of the materials used need to be identified. The materials used are iron so that the products produced can last longer and are durable.

The initial process of designing this coconut candy cutting machine is to make a basic sketch to make sure the product has the specifications outlined earlier. Table 1 shows the product design that has been developed. This design is based on the needs of consumers to use and transfer this product easily while ensuring the cleanliness of coconut candy. Table 1 shows the product design that has been developed. This design is based on the needs of consumers to use and transfer this product easily while ensuring the cleanliness of coconut candy.

Table 1: Product Design

Design	Characteristic
	<ol style="list-style-type: none"> 1. The small size of the coconut candy cutter box allows the user to move the product efficiently. 2. The cutting process achieved finished in a closed box will ensure the cleanliness of the coconut candy.

Once the researcher has finished with the selection of components, then the researcher will arrange the components according to the process to be done. All components need to be connected properly and carefully. Researchers need to ensure that there is no connection between unnecessary components to ensure that the circuit can function properly. This process must be done carefully because electronic components are very sensitive and easily damaged. Each component must also be arranged to make it easier for the researcher and the user to understand the circuit process. A control circuit is a circuit that serves to control the up and down movement of a coconut candy cutter. The coconut candy cutter is powered by a linear drive motor using Blynk software as well as using NodeMCU as a microprocessor. Relays are also used in control circuits as linear motor drive switches. This relay gets a 3V power supply to operate. The supply and ground input sources on the relay are connected to the foot supply and ground input sources on the MCU Node. Next, a power supply of 12V needs to be connected to the relay as a source of power supply to move the linear actuator motor. The positive supply source is connected to the Normally Open (NO) output on the relay while the negative supply source is connected to the Normally Closed (NC) output on the relay. Common output (C) on the relay is connected to a linear drive motor.

After the component selection process, the researcher will prepare the components according to the steps performed. The components require to be connected properly and carefully. Researchers need to ensure that there is no connection between unnecessary components to ensure that the circuit can function properly. This process must be done carefully because electronic components are very sensitive and easily damaged. Each component must also be arranged to make it easier for the researcher and the user to understand the circuit process. A control circuit is a circuit that serves to control the up and down movement of a coconut candy cutter. The coconut candy cutter is powered by a linear drive motor using Blynk software as well as using NodeMCU as a microprocessor. Relays are also used in control circuits as linear motor drive switches. This relay gets a 3V power supply to operate. The supply and ground input sources on the relay are connected to the foot supply and ground input sources on the MCU Node. Next, a power supply of 12V needs to be connected to the relay as a source of power supply to move the linear actuator motor. The positive supply is connected to the Normally Open (NO) output of the relay. Besides, the negative is connected to the Normally Closed (NC) output of the relay. Common output (C) on the relay is connected to a linear drive motor.

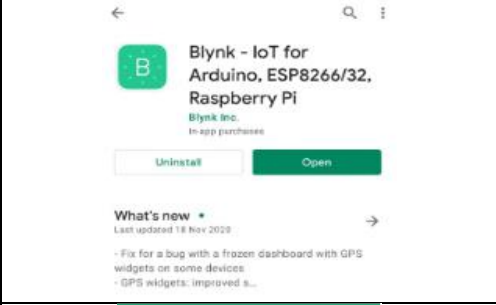
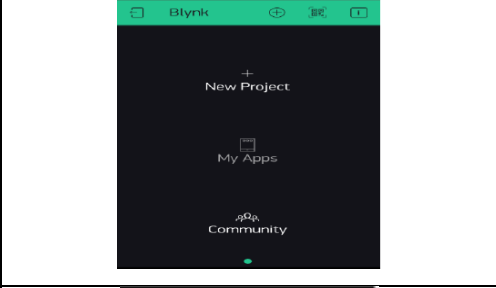
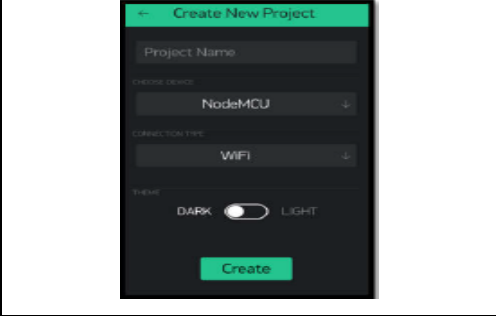
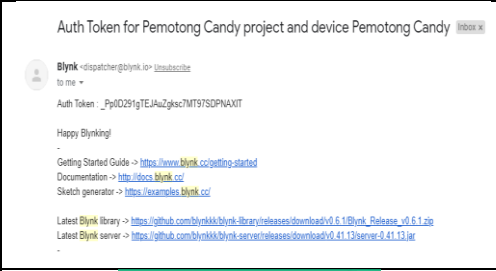
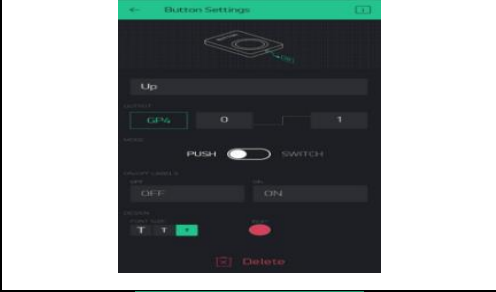
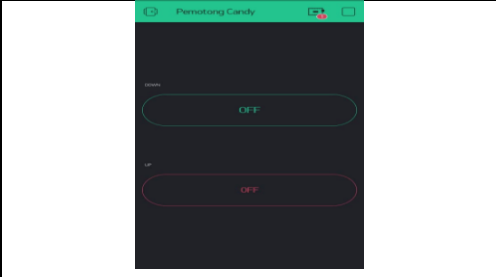
The software development process of this project involves programming using Arduino IDE software using C++ computer language. Programming begins by identifying components or modules used as inputs and outputs to the NodeMCU microprocessor. The programming developed is to connect the NodeMCU ESP8266 with the Blynk application such as internet access during the process of controlling the operation of the coconut candy cutting machine. Table 2 shows the programming for the coconut candy cutting machine.

Table 2: Programming for coconut candy cutter machine

Coding	Explanation
<pre>#define BLYNK_PRINT Serial #include <ESP8266WiFi.h> #include <BlynkSimpleEsp8266.h></pre>	<p>1. Make a declaration to the library about the Blynk application and the use of NodeMCU ESP 8266 components.</p>
<pre>char auth[] = "_Pp0D29lgTEJAUzqksc7MT97SDPNAX1T"; char ssid[] = "Mi Phone"; char pass[] = "123456789";</pre>	<p>2. Set the Wi-Fi network name and password for the network.</p>
<pre>void setup() { Serial.begin(9600); Blynk.begin(auth, ssid, pass); Blynk.syncAll(); } void loop() { Blynk.run(); }</pre>	<p>3. Create programming for operating systems for coconut candy cutter machines that will use the Blynk application.</p>

The Blynk application is an application used to control electronic devices remotely. For automatic coconut candy cutting machine development, the Blynk application is used for user-controlled operating systems. The Blynk application is connected to a pre-programmed NodeMCU microprocessor. Table 3 shows the steps of Blynk application development work.

Table 3: Steps of Blynk application development


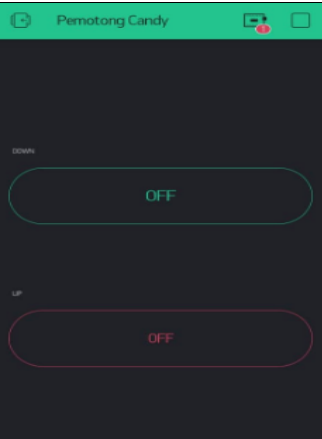
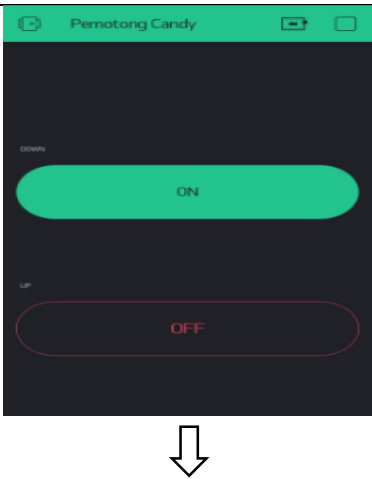
Application Development Blynk	Description
	<p>1. The diagram on the side shows a Blynk application interface view.</p> <p>2. Before using the Blynk application, users need to register an account in the Blynk application either an email account or Facebook social media.</p>
	<p>3. The diagram on the side is the first interface display displayed on the Blynk application.</p> <p>4. For the automatic coconut candy cutting machine project, the researcher opted for the New Project function.</p>
	<p>5. Set the name for the coconut candy cutting machine project, the NodeMCU microcontroller used and the Wi-Fi network to be connected.</p>
	<p>6. After the project registration is performed at the Blynk application, Auth Token sending to the registered email.</p>
	<p>7. Next, determine the relay pin connected to the NodeMCU microcontroller.</p>
	<p>8. Display on the Blynk app available on smartphones to control the movement of the coconut candy cutting machine.</p> <p>9. The switch used is an open press type switch. The switch will be OFF, and when pressed by the user the switch will be ON.</p>

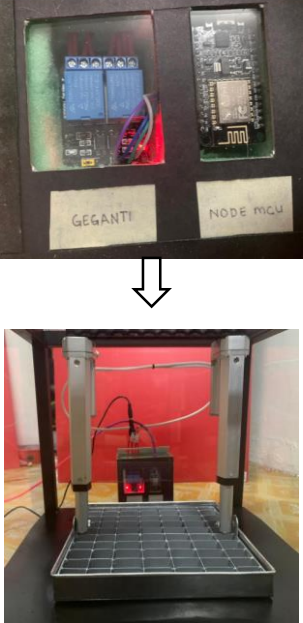
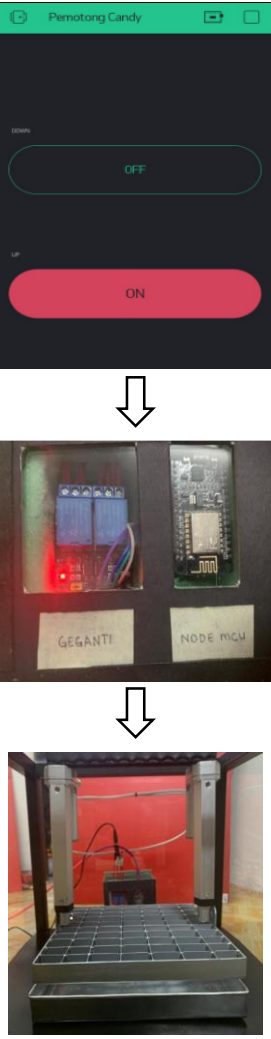
	10. There are two switches to control the coconut candy machine namely: the switch downwards to lower the cutter and the switch upwards to lift the cutter.
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2.5 Testing

The circuit prepared needs to be examined so that the circuit can function properly. The process of testing the functionality of the project is done by giving input to the relay and NodeMCU which controls the operation of the coconut candy cutting machine. The output can be seen in the operations that take place on the coconut candy cutting machine as well as the Blynk application. Table 4 below shows the functional analysis of the development of coconut candy cutting machine products.

Table 4: Functional analysis of coconut candy cutting machine products

Analysis	Description
	<p>When the 12V input supply is supplied to the relay and 5V to the NodeMCU, the LED light on the relay and NodeMCU will light up. This condition indicates that the component is in a state of readiness to operate.</p>
	<p>Testing continues with the opening of the Blynk app on smartphones. Connect Blynk to NodeMCU via Wi-Fi. The linear actuator motor is controlled using a switch on the demonstration in the Blynk application.</p>
	<ol style="list-style-type: none"> 1. When the 'open' button is pressed, the cutter will move down and cut the coconut candy batter in the container provided. 2. Operation is also seen on the relay where when the motor moves down, the first LED light on the transmission is turned off.

	<p>3. When the cutter finishes cutting the coconut candy, the motor will stop moving when the 'open' button is released.</p> <p>4. The light on the LED light on the first relay will return to the original.</p>
	<p>1. When the 'open' up button is pressed, the cutter will move up and return to its original position.</p> <p>2. Operation can also be seen on the relay where when the motor moves upwards, the LED light on the second transmission is turned off.</p> <p>3. When the cutter returns to its original position, the 'open' button is discharged, and the motor will stop moving.</p>

3. Results and Discussion

The coconut candy cutting machine has obtained expert confirmation about the product that has been developed. The evaluation of this product was carried out by three experts, namely an electrical and electronic lecturer, a general machine laboratory assistant and an entrepreneur from the coconut industry. The questionnaire used to identify the opinions of the experts had three parts, namely the design, suitability, and function aspects. The design aspect of coconut candy cutting machine development has seven items. Table 5 shows the evaluation of design aspects conducted by experts.

Table 5: Evaluation of design aspect

No	Item	Yes	No
1.	This product has a user-friendly design.	3 100 %	0 0 %
2.	This product has a neat and orderly arrangement of components.	3 100 %	0 0 %
3.	Selection of materials and hardware are suitable to use on this product.	3 100 %	0 0 %
4.	This product is safe for users to use.	3 100 %	0 0 %
5.	This product is not too heavy and portable.	3 100 %	0 0 %
6.	This product is easy to operate	3 100 %	0 0 %
7.	Product design is easy to clean after use	3 100 %	0 0 %

Table 5 shows the evaluation from experts on the design aspects of the coconut candy cutting machine. As a conclusion of the checklist carried out, the three experts decided to agree on seven items. This proves that the coconut candy cutting machine has a user-friendly design and has a clear and systematic arrangement of components. Experts also agree that the project uses materials and hardware that are appropriate and safe for users to use. In addition, the coconut candy cutting machine is also portable and easy to operate by consumers. Finally, the project is easy to clean after use.

Part B of the checklist form consists of five items related to the suitability aspect of the coconut candy cutting machine. Evaluation is done based on expert feedback. Table 6 shows the assessment of suitability aspects conducted by experts.

Table 6: Evaluation of suitability aspects

No	Item	Yes	No
1.	This product meets the needs of consumers for the process of cutting coconut candy.	3 100 %	0 0 %
2.	The use of this product can facilitate the cutting of coconut candy.	3 100 %	0 0 %
3.	Simple operation of coconut candy cutting machine.	3 100 %	0 0 %
4.	The size of this product is suitable for consumer use.	2 66.7 %	1 33.3 %
5.	The size of the coconut candy produced is the same	3 100 %	0 0 %

Table 6 shows the feedback from experts on the suitability aspects of the coconut candy cutting machine. Following the checklist, all the experts agree on all the elements that were presented. But there is a fourth item, there is an individual who does not agree with the size of the product adapted to the consumer's use. The expert stated that the product is not suitable for use in the factory because the factory needs a larger machine to finish cutting a lot of coconut candy in a short time. Experts agree

that this coconut candy cutting machine meets the needs of consumers for the process of cutting coconut candy. In addition, this product can facilitate the cutting of coconut candy and the operating system available on this product is easy to operate by consumers. Finally, the size of the coconut candy produced is the same.

Part C of the functional aspect of the coconut candy cutting machine on the checklist form consists of five items. Table 7 shows the evaluation of the function aspects conducted by the experts.

Table 7: Evaluation of function aspect

No	Item	Yes		No	
1.	The OPEN and CLOSE switches work well	3	100 %	0	0 %
2.	This product can be operated using the Blynk application	3	100 %	0	0 %
3.	The motor can work well	3	100 %	0	0 %
4.	The down button on the Blynk display works just fine.	3	100 %	0	0 %
5.	The up button on the Blynk display works well.	3	100 %	0	0 %
6.	This product can make it easier for users to control the machine remotely by using the Blynk application	3	100 %	0	0 %
7.	This product can improve the cleanliness of the cut candy.	3	100%	0	0%

Based on the expert feedback in Table 7, all the experts agreed on the seven functionality items listed. The first item is an open and close switch that works well. Next, the three experts agreed the project could be handled using Blynk and the motor found on the coconut candy cutting machine works well. The up and down buttons on the Blynk app to control the movement of the motor also work well. In addition, all experts agree that this product can make it easier for consumers to control the coconut candy cutting machine remotely using the Blynk application. Finally, a coconut candy cutting machine can also improve the hygiene quality of coconut candy that has been cut.

4. Conclusion

Based on evaluation from experts, found that they agree with The Prototype of Coconut Candy Cutter Machine for Small Medium Enterprise (SMEs) Industry in terms of design, function, and suitability. Besides, the coconut candy cutting machine makes coconut cut with the correct size before being distributed to consumers. The developed coconut candy cutting machine can function well and be effectively controlled using the Blynk application on smartphones. This product can speed up the cutting process and can cut a lot of coconut candy at one time. The cleanliness candy coconut that has been cut is well taken care of because the cutting process is carried out in a closed machine.

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