

Design and Development of Foot Pedal Operated Vegetable Chopper

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Abstract: Cooking is an integral part of daily life, involving the essential task of chopping various ingredients. While manual chopping with a knife is common practice, it poses challenges in terms of time, effort, skill, and safety. The study focuses on the design and development of a foot pedal-operated vegetable chopper to address these limitations. Leveraging the efficiency of pedal mechanisms, the research creates an innovative chopping device suitable for both household and industrial use.

The study adopts the Input-Process-Output (IPO) model in developing the foot pedal-operated vegetable chopper. Inputs include insights from related studies, scope, and a draft plan. The process involves construction and testing, resulting in the output of a multi-slicer vegetable chopper.

The design phase outlines a comprehensive plan, tools, materials, and equipment, along with a cost and benefit analysis. The development phase includes a Gantt Chart, construction, and testing. Trials reveal initial flaws, leading to design adjustments and a successful final revision. The foot pedal-operated vegetable chopper proves economical and beneficial for end-users. Its cost-effectiveness and electricity-free operation enhance its appeal.

Keywords: Cooking, Food, Foot pedal-operated chopper, Pedal, Vegetable chopper

1. Introduction

In our daily lives, cooking and buying food has always been an essential part of our routine. Cooking technically involves chopping, whether it is vegetables, meat, or other condiments and spices. In the kitchen or even in food industries, manually chopping vegetables using a knife is a common practice but take a lot of time and can be more complicated. Firstly, it can be time-consuming and tiring, especially when preparing large quantities of vegetables. Secondly, it requires a certain level of skill and dexterity to achieve consistent and uniformly chopped vegetables. Thirdly, it can be hazardous, as accidental cuts can occur due to the use of a sharp knife.

Winston (2017) stated that over the years, the traditional process of slicing vegetables has always been slow, tedious, boring, time-consuming, and in some cases unhygienic. Designing and fabricating a machine capable of slicing vegetables which will mechanize the slicing process for both domestic and commercial consumption becomes a necessity. Various methods have been implemented in the process of size reduction of vegetables ranging from manual, electric, and automated. The desire to make a design that simplifies saves time, that is relatively cheaper and efficient during the process of size reduction of vegetables.

According to a study by S. Talapatra, Shakil M., Mondal P.K., and Islam M.S., on the "Implementation of Product Design Tools for the Development of an Automated Vegetable Chopper", human life nowadays has become more competitive and faster than the previous. Automation brought about by technology has saved human effort and time to a large extent. Large-scale hotels and food industries are already utilizing automatic machines. However, some automated machines require external power in order to function. To address these limitations, this research aims to design and develop a foot pedal operated vegetable chopper, offering a hands-free, efficient, and safe alternative for chopping vegetables.

Pedal mechanisms have been utilized for centuries in a wide range of applications, from propelling bicycles to powering sewing machines. Their simplicity, efficiency, and ability to provide controlled motion make them valuable tools for various mechanical tasks. Pedal mechanisms are essentially lever systems that convert the user's foot pressure into rotational or linear motion. The basic principle involves a crank mechanism, where the pedal is connected to a rotating shaft, and the shaft's rotation is then transferred to another component or mechanism. This simple yet versatile design has demonstrated its effectiveness in various applications, including transportation, manufacturing, and even medical devices.

The researchers incorporate the pedal mechanism to design and develop a product named Food Pedal Vegetable Chopper. This chopper is mainly designed to reduce human effort and make the job of chopping vegetables much easier and faster. Its main features are pedal operated, non-electric consumer and changeable stainless, and sharp blade.

2. Methodology

Descriptive research was used to identify the needs of users and to develop a vegetable chopper prototype. This involves conducting user interviews and surveys, as well as observing users in their kitchens. The findings of the descriptive research were used in designing the vegetable chopper, ensuring that it is easy to use, safe, and effective. By conducting user interviews, surveys, and observations, researchers gain insights on how people chop vegetables, the challenges they encounter, and their desired features. This information is invaluable for informing the design of the vegetable chopper, ensuring that it is user-friendly, efficient, and meets the needs of the target audience.

Experimental method was also used to test the functionality and performance of the vegetable chopper. This involves chopping a variety of vegetables using the chopper and measuring the time it takes, the quality of the chop, and the amount of waste. The findings of the experimental methods were used to refine the design of the vegetable chopper. By conducting rigorous tests, researchers measure factors such as chopping speed, chop quality, waste generation, and ease of use. These data provide concrete evidence of the chopper's capabilities and identify areas for improvement.

The study was conducted at the College of Industrial Technology of Nueva Ecija University of Science and Technology, General Tinio St. Cabanatuan City.

3. Results and Discussion

3.1 *The Design Foot Pedal-Operated Vegetable Chopper*

The design phase of the study was composed of these stages: Draft Plan, Tools, Materials, and Equipment, and Cost and Benefit Analysis.

3.1.1 Draft Plan

This is the process that covers the plans and designs that were used to construct and visualize the logical designs and development of the Foot Pedal Operated Vegetable Chopper.

There are a number of manual and electric vegetable choppers available on the market, but they often have limitations. Manual choppers can be difficult to use and require a lot of hand strength. Electric choppers can be expensive and bulky. Additionally, many existing choppers are not designed for people with disabilities.

This study proposes the development of a foot-pedal operated vegetable chopper that is easy to use, efficient, and affordable. The chopper was designed to be safe and user-friendly for people of all abilities.

Design Requirements:

- a. The chopper should be easy to use with a foot pedal for operation.
- b. The blades should be sharp and durable to efficiently chop a variety of vegetables.
- c. The chopping chamber should be large enough to accommodate a variety of vegetables and fruits.
- d. The chopper should be easy to clean and maintain.
- e. The materials used should be food-safe and durable.

Preliminary Design

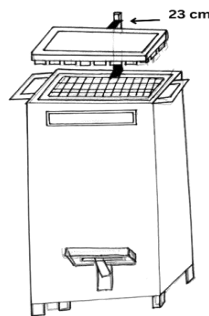


Figure 1. The Design of Foot Pedal Operated Vegetable Chopper

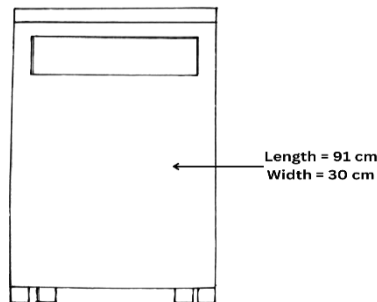


Figure 2. The Design of Foot Pedal Operated Vegetable Chopper Frame

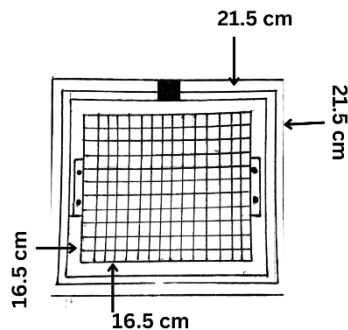


Figure 3. The Design of Foot Pedal Operated Vegetable Chopper Blade

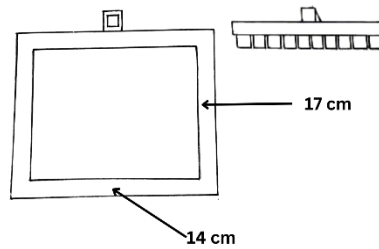


Figure 4. The Design of Foot Pedal Operated Vegetable Chopper Pusher

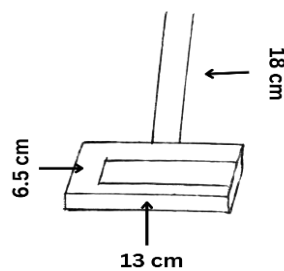


Figure 5. The Design of Foot Pedal Operated Vegetable Chopper Pedal

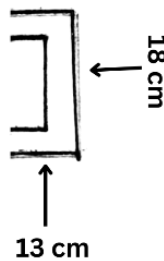


Figure 6. The Design of Foot Pedal Operated Vegetable Chopper Handle

3.1.2 Tools, Material, and Equipment

This part presents the tools, materials, and equipment utilized in the development of the Foot Pedal Operated Vegetable Chopper. The table shows a detailed list of tools, materials, and equipment with quantity and uses.

Table 1. List of Materials used in the Development of Foot Pedal Operated Vegetable Chopper

Materials	Quantity	Uses
Galvanized Stainless	1 piece	Used to cover the body of the device.
Stainless Tubular	3 pieces	It is used for constructing the frame, pedal, and handle of the device

Welding Rod	22 pieces	Used to weld the sheet metals, blade, and frame.
Blind Rivet	26 grams	Used to join the stainless to the body frame.
Grinding Disc	1 piece	To grind rough edges.
Spring	1 piece	Used as a help in the pedal lever.

Table 2. List of Equipment Used in the Development of Foot Pedal Operated Vegetable Chopper

Equipment	Quantity	Uses
Welding Grinder	1 piece	It is used to remove excess material, smoothen the surfaces of the device
Drill	1 piece	Used to make holes in tubular.
Reviter	1 piece	Used to fasten two materials together.
Welding Machine	1 piece	Used to melt metal parts to assemble or connect them.

Table 3. Cost of Materials used in the Development of Foot Pedal Operated Vegetable Chopper.

Materials	Quantity	Unit Price	TOTAL
202 Smooth 0.5 galvanized stainless	1piece	575	575
Tubular	3 pieces	277	831
Welding rod stainless	22 pieces	15	330
Spring	1 piece	30	30
Blind rivet	26 grams	135	135
Grinding rim	2 pieces	45	90
Overall Total			P1,991

Table 4. Price of Vegetable Cutters existing in the Philippines

Chopper	Price
High-power Vegetables Slicer	12,999
French Fries Cutter/Potato Cutter	3,700
Vegetable Cutter Commercial Grade	12,900
Commercial Vegetable Fruit Dicer	5,241
Commercial Vegetable Shredder	19,875

The table above shows the different models and prices of commercial vegetable cutter existing in the Philippines.

3.1.3 Cost and Benefit Analysis

The total cost of production of the Foot Pedal Operated Vegetable Chopper is ₱1,991.00. This amount covers all the materials and consumables that were used in the development of the device like metal sheet stainless, Tubular, Welding rod stainless, Spring, Blind rivet, and Grinding rim.

The researchers analyzed the device if it is economical or not. The materials that were used in the construction of foot pedal-operated vegetable chopper are said to be cheaper than the commercially available choppers in the market that cost about ₱3,700 - ₱19,875 (source: <https://shopee.ph/>) and above depending on the size and brand of the chopper. The total cost of the foot pedal-operated vegetable chopper which is ₱1,991.00 and the commercially available choppers in the market that are more expensive, indicates that the foot pedal-operated vegetable chopper is very economical. It also noted that the device is beneficial to the end-user because it can be used even without electricity.

3.2 The Development of Foot Pedal Operated Vegetable Chopper with Multi Slicer

The development stage of the study was composed of these stages: Gantt Chart, Construction, and Testing.

3.2.1 Gantt Chart

Table 5. Gantt Chart of Development of the Foot Pedal Operated Vegetable Chopper Pedal

Activities	Sep 2023	Oct 2023	Nov 2023	Dec 2023
Title Proposal	[Bar]			
Planning		[Bar]		
Drafting		[Bar]		
Construction of foot pedal operated vegetable chopper		[Bar]		
Manuscript			[Bar]	
Testing of foot pedal operated vegetable chopper			[Bar]	

3.2.2 Construction

During this stage, tools and materials were prepared and assembled in accordance with the device desired design.

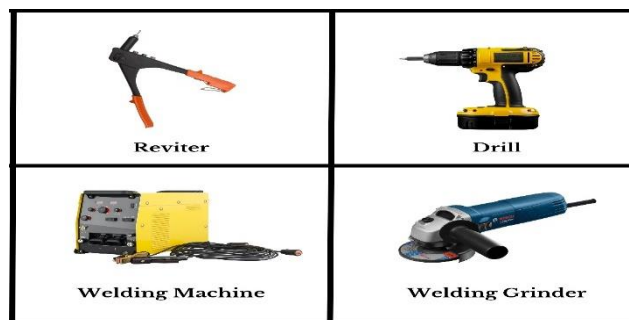


Figure 7. Equipment Used in the Development Device

Figure 7 shows the equipment used in the development Foot Pedal Operated Vegetable Chopper. Equipment includes the welding machine for stainless, grinder, hand drill, and rivet gun.



Figure 8. Materials Used in the Fabrication of the Device

Figure 8 shows the materials used in the fabrication of the device. The materials include metal sheet, tubular, blind rivet, spring, grinding disc, and welding rod.

The following pictures shows how the foot pedal operated vegetable chopper was developed by the researcher.



Figure 9. Construction of the device

3.2.3 Testing

This part presents the process of trials and its outcome and observation.

Table 6. Trial, outcome, and observation on device.

Trials	Outcome	Observation
1	The vegetable did not chop wholly.	The initial trial revealed a flaw in the chopping mechanism, as the vegetable was not chopped completely.
2	Despite changing the top to a pusher, the vegetable still did not come down.	The adjustment in the design did not solve the issue, indicating that there might be a problem with the pusher mechanism or the overall functionality of the device.
3	The final revision of the device successfully chopped a vegetable.	The device demonstrated successful vegetable chopping in the final trial, suggesting that the necessary modifications were made to address the previous issues.



Figure 10. Testing of Device

4. Conclusions

The research focused on creating a foot pedal-operated vegetable chopper with a multi-slicer, addressing design and development in distinct phases. The design phase included a Draft Plan, selection of Tools, Materials, and Equipment, and a Cost and Benefit Analysis. The development phase was structured around a Gantt Chart for scheduling, the actual onstruction of the chopper, and rigorous Testing to ensure functionality and safety. The study aimed to produce an efficient and convenient chopping device, considering the cost-effectiveness and market potential of the final product.

The study focuses on the presentation, analysis, and interpretation of data related to the design and development of a foot pedal-operated vegetable chopper. It includes: (1) Draft Plan, a foot pedal-operated vegetable chopper is proposed to address limitations in manual and electric choppers; (2) Design requirements include easy foot pedal operation, sharp and durable blades, a spacious chopping chamber, easy maintenance, and food-safe, durable

materials; (3) Preliminary Design, various design elements are presented, including the frame, blade, pusher, pedal, and handle; (4) Tools, Materials, and Equipment, The necessary tools, materials, and equipment for development are listed, such as galvanized stainless, tubular, welding rod, blind rivet, grinding disc, and various equipment like welding grinder, drill, riveter, and welding machine; and (5) Cost and Benefit Analysis, the total cost for developing the foot pedal-operated vegetable chopper is ₱1,991. A comparison with commercial vegetable cutters in the Philippines shows that the developed chopper is more economical.

The Developmental process of Foot Pedal-Operated Vegetable Chopper was composed of these stages: Gantt Chart, the development stages are outlined in a Gantt Chart, including planning, drafting, construction, manuscript, and testing; Construction, tools and materials are assembled according to the desired design during this stage. Pictures depict the equipment and materials used in the fabrication of the device; and Testing, three trials are conducted, with the initial trial revealing a flaw in the chopping mechanism. Despite design adjustments, issues persist until the final revision successfully chops a vegetable.

Based on the results of the study, the following conclusions were drawn:

1. The foot pedal-operated vegetable chopper is deemed economical compared to commercially available alternatives.
2. The device is highlighted as beneficial for end-users, as it is cost-effective and can be used without electricity.

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