Summary

Introduction

The product concept discussed in this article is designed for the aforementioned age group to aid them in the cooking process while reducing exhaustion. The aim of this product is that help the elderly make dumpling skin by hand. To reach a broader customer base, the product will be modular in design to achieve different functions, such as making dumpling skins of different thicknesses.

The design processes

2.1. Design reasons taken into consideration

Design reasons taken into consideration. Since the hand function decreases with aging body, specifically after the age of 65, this age related age-related degenerative changes happen due to anatomical and physiological changes. Due to this, there a change in hand grip and reflex times, so the product have to design such a way to accommodate for this problem.

2.1.1. General Market research and survey results

The result from market research shows that cooking is one of the main life problems for elderlies, and dumpling is the one of the main food in Asian as more than 60 percent of them dedicate more than half of their time to rolling dumpling skins during the dumpling-making process.

2.1.2. Product Oriented market research

However, according to the survey data, making dumpling skin is still a challenge for most people. However, shortening the time to roll out a dumpling skin can speed up dumpling making by at least a third.

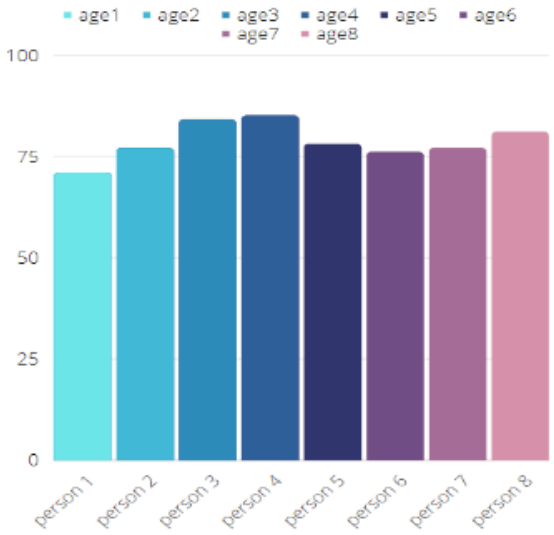


Figure: Age distribution of the respondents

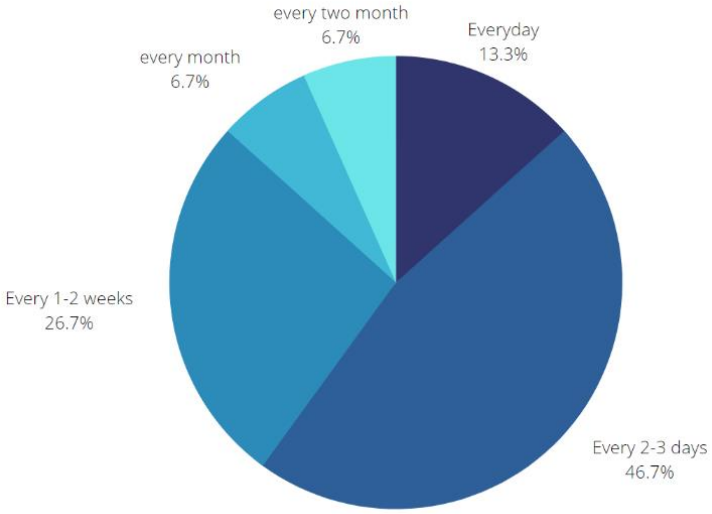


Figure: Frequency of people eat dumpling

2.2. About existing products in current market

Figure: The pasta machine from Lackland (Product number: 72388)

2.3. Concepts and final concept selection

2.3.1. The first concept

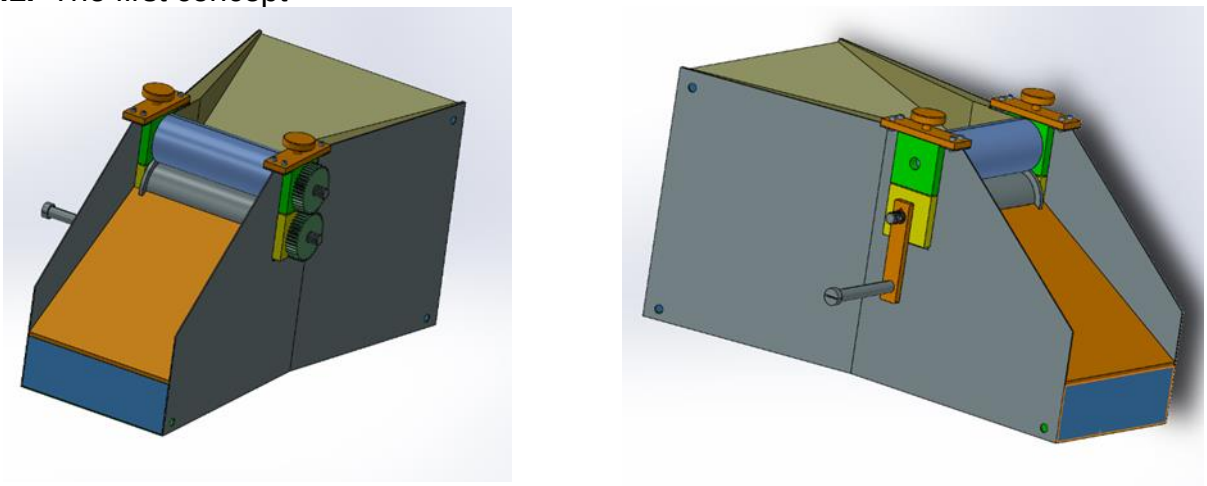


Figure: First concept CAD model-1 (taken from ProEngineer)

2.3.2. The second concept

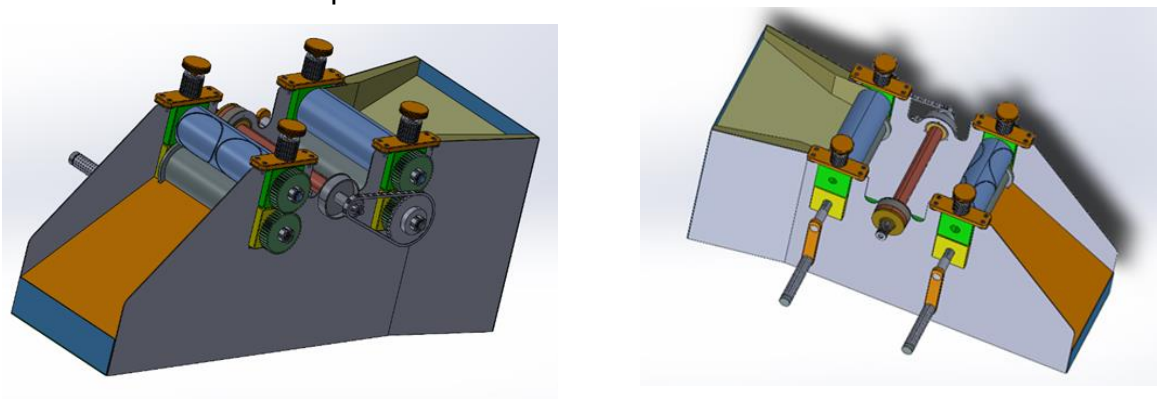


Figure: Second concept CAD model-1 (taken from ProEngineer)

2.3.3. The final concept

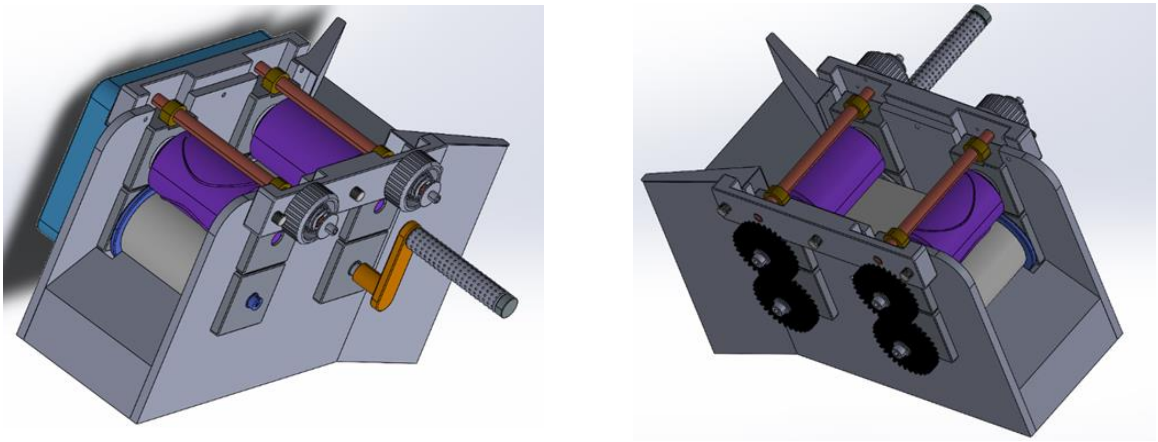
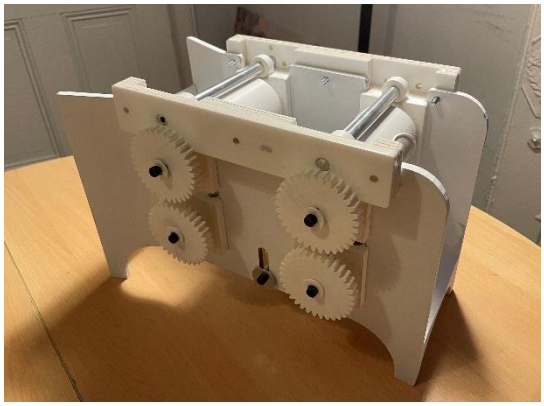


Figure: Final concept CAD model-1 (taken from ProEngineer)

2.4. Physical model

2.4.1. The prototype



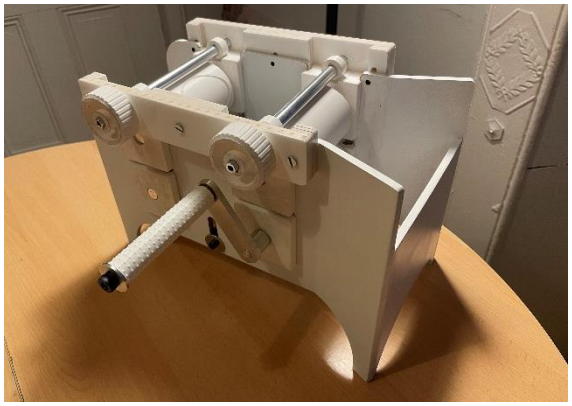
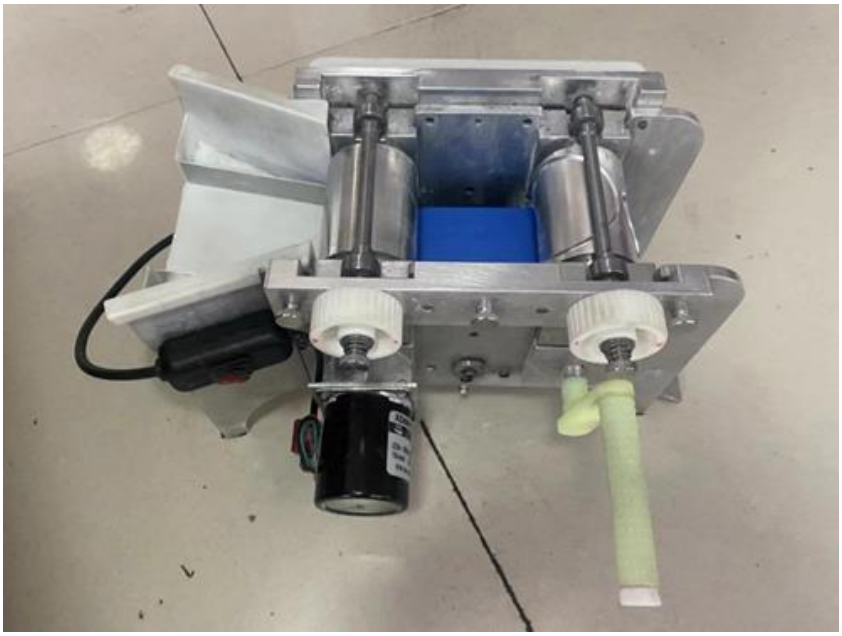


Figure: The whole body of the prototype（assembly uncompleted）

2.4.2. The Engineering prototype



Most of the parts of Engineering prototype are made from metal, while a few accessories such as nuts, gears, and handles are 3D printed. Metal is used as the primary material since it is more precise, stable, and robust. However, some metal parts will be replaced by plastic for lighter weight and lower cost without affecting product performance in the final material chosen.

Figure: The Engineering prototype (Xiaobo Zhou, The engineering pattermaker. Shanghai China)

2.5. How the final concept works?

The product has two operating stages, first allows the user to get the desire thickness by adjusting the nuts on the side, and second proceeds to cut the needed dough into even circular shapes. [Video link: https://youtu.be/_ng4A5q650E (Jiani Zhou: Writer-director and editor, Xiaobo Zhou: Photography)]

1.Making dough and press dough into a flat shape

Figure: Step 1 for using final product

2.Turn the machine on and select the appropriate thickness by

Figure: Step 2 for using final product

3.Put the dough inside machine

Figure: Step 3 for using final product

4.Fold the dough in half and stuff it into machine again and dust the dough with flour


Figure: Step 4 for using final product

5.Switch shaft to second gear

Figure: Step 5 for using final product

6.Put dough into machine which is the third time (It is okay to let the dough fall free, but holding the dough allows the dough to be rolled more evenly)


Figure: Step 6 for using final product

7.Shaft to the third gear for cutting the dumpling skin and put the dough into machine. (The dough can be driven automatically by the conveyor belt)

Figure: Step 7 for using final product

8.Separate the waste from the dumpling skin

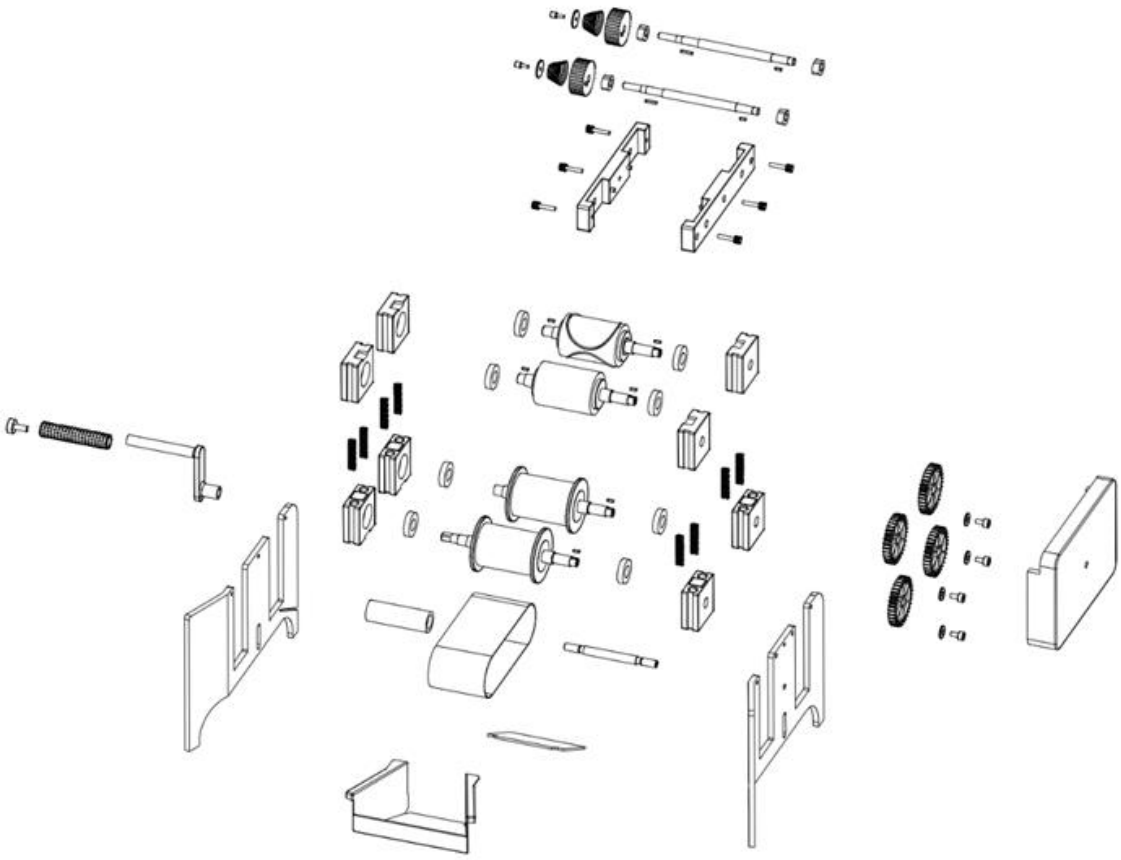
Figure: Step 8 for using final product

2.6. Theoretical support and calculation

It was found that handgrip strength was significantly lower with advancing age in men being 6.5kg to 7.6kg, and for women being 4 to 4.7kg. However, under ideal working conditions, the product structure is simplified as a torque balancing vehicle, and the product saves 77.7% of labor by calculation, and it only needs 4.48N for using this product. So, this product is very suitable for the elderly.

Manufacturing design

This product has more than 25 components including standard parts. The ABS plastic is the main material since it is cheaper and lighter, and the material of parts has strength requirement is aluminum and steel. The total weight of this product is 3.8kg and the material cost is £9.932. Assuming that the manufacturing cost is twice the material cost and the selling price is three times the total cost, then the total cost and selling price are £29.79 and £89.37, respectively.



Result

Through this product, consumers only need to spend about 5N force to make dumpling skin. Calculations under ideal conditions show that the product reduces the user's force by more than 70 percent. The calculation results fully show that the machine greatly improves the efficiency of the user to make dumplings, which achieved the purpose of the product design.

The total cost is about £29.790 in which the material cost is £9.932, and the processing cost is 19.858. This product comprised of suitable materials and simple manufacturing processes. The only complex part is the cutting shaft that requires a four-axis machine which is the most key part in product. However, parts can also be optimized through further manufacturing design, simplifying parts without sacrificing performance which make assembly steps fewer.

The price for selling in market is going to be £89.37 about based on manufacturing costs. There is only 40 x 40x 21.5 cm size and 3.82kg weight which is small and light. Families who are accustomed to eating handmade dumplings may use them 4-5 times a week.

Discussion and conclusion

Some problems were found in the process of making and testing the physical model and the Engineering prototype. Many of the parts had to be hand-polished during the initial physical model because the errors of 3D printing were not taken into account. Therefore, tolerances should be fully considered in a future design. To force the dough evenly, the conveyor belt must move slowly. If the user also needs to turn the handle slowly, it will make the user feel less comfortable. Adding motors or changing the size ratio of gears can solve this problem. Thus, this problem will be considered in future designs.

The idea behind this project is to improve the lives of older people through technology. However, the survey results show that cooking is one of the leading life problems of the elderly, and dumpling is one of the main food of the Asian people; while making dumpling skin takes up half of the time in the process of making handmade dumplings. Therefore, the dumpling skin machine is the aim of this project, which has good commercial prospects in the Asian market. Calculations show that the force required to use the product under ideal conditions is only 5N, a reduction of more than 70 percent from the initial force. It shows that the performance of the final product meets the initial requirements.