Faculty of Information Technology

Automated Papadam Maker
Final Report

Group No: 37

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1.0 INTRODUCTION

Papadam is more or less an essential in a Sri Lankan meal of rice & curry. Every household and restaurant adds this delicacy to their meals. The common and only method is purchasing pre-prepared and dried Papadam which are packed and sold at an affordable price. They mainly come as circular disks which are fragile. Therefore, could be easily broken down into smaller pieces according to preference. They are then deep fried in oil and served immediately.

There could've been two possible ways through which this project could've been feasible. We could either build a machine for industrial purposes where the end product is made from scratch. In other words, we can start from the raw ingredients, make the dough, and produce flattened, dry disks of papadam. The other option is to build a device for use in restaurants and other shops as such in the food industry. A device that fries the already dry papadam according to specifications. After much controversy and advice we received from our mentors, we decided to build a machine that is suitable for industrial purposes.

2.0 PROBLEM IN BRIEF

The process of manufacturing papadam in Sri Lanka is done as small scale businesses mostly in rural parts of the country and almost the whole procedure from mixing the dough to drying it is done manually. The lack of use of machinery and technology is very prominent in industries such as this. Another concern is the value of all the recourses such as labor that is used for the manufacture of papadam when it can be more efficient and effective if technology is used instead. Apart from that, the matter of hygiene is also something that needs to be considered.

3.0 AIM AND OBJECTIVES

3.1 Aim

- Our aim is to introduce a more effective, hygienic and easy way to produce Papadam, which requires minimum human intervention. We are developing a device which can be used for industrial aid when making Papadam.

3.2 Objectives

- Structure the most effective design for the product.
- Build the kneading component separately. It features a mixing bowl and a customized hook that would be used for mixing the dough evenly.
- Build a mechanism to roll out the dough into a flat spread.
- Build a mechanism to cut out circular disks form the dough.
- Build a drying mechanism in which the dough can be left to dry in near environmental conditions.

4.0 LITERATURE SURVEY

The manufacturing of papadam is usually carried out as small scale businesses in rural villages so the use of machinery is quite less but while doing some research, we did come across a machine that was built for the purpose of manufacturing papadam. It is a very bulky machine with dimensions of 6 feet in length. Though a certain amount of the process was automated, most of the procedure had to be done by human hand.

5.0 ANALYSIS AND DESIGN

As we planned initially, the device could be identified in 4 separate components which are the kneading section, the rolling part, the cutting part and the drying component. But with prolonged sessions of brainstorming, trials and tests, we decided that the rolling and cutting components can be incorporated into a separate section on its own. So we decided to restructure it, which leads it out of the original design we had speculated.

First the dry ingredients (flour, pepper, cumin and salt) are put into the kneading bowl. Along with the dry ingredients, water is added in proportionate amounts throughout the mixing procedure. Once the dough is of the required consistency, it is transferred to the next stage in which it is flattened out and shaped. Then the disks of the dough drop onto a steel mesh inside the oven. The oven is an open compartment so that there is a free air flow in and out of the compartment and a coil at the bottom of the oven heats the area so that the dough dries in an environment almost similar to natural conditions.

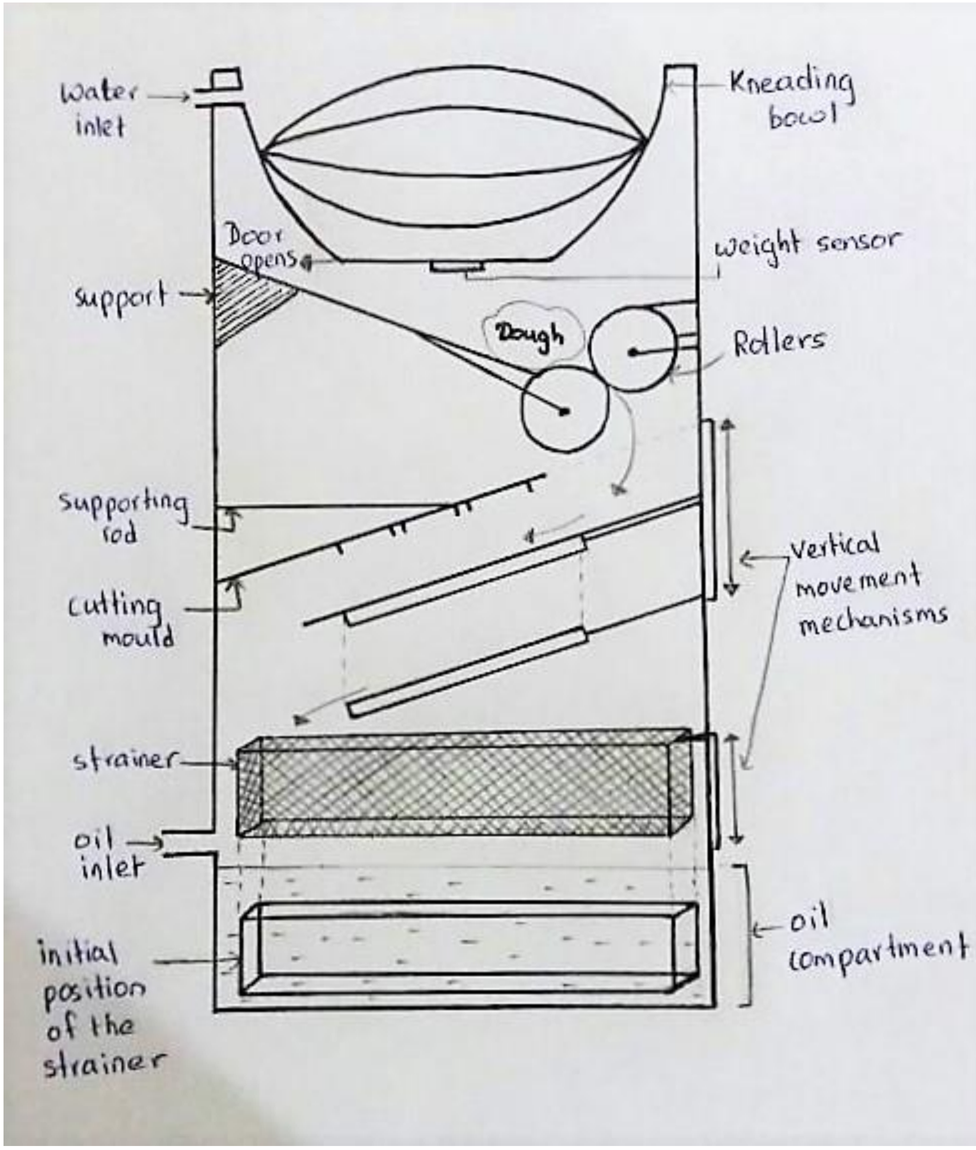


Figure 5.1 : Initial design of the product

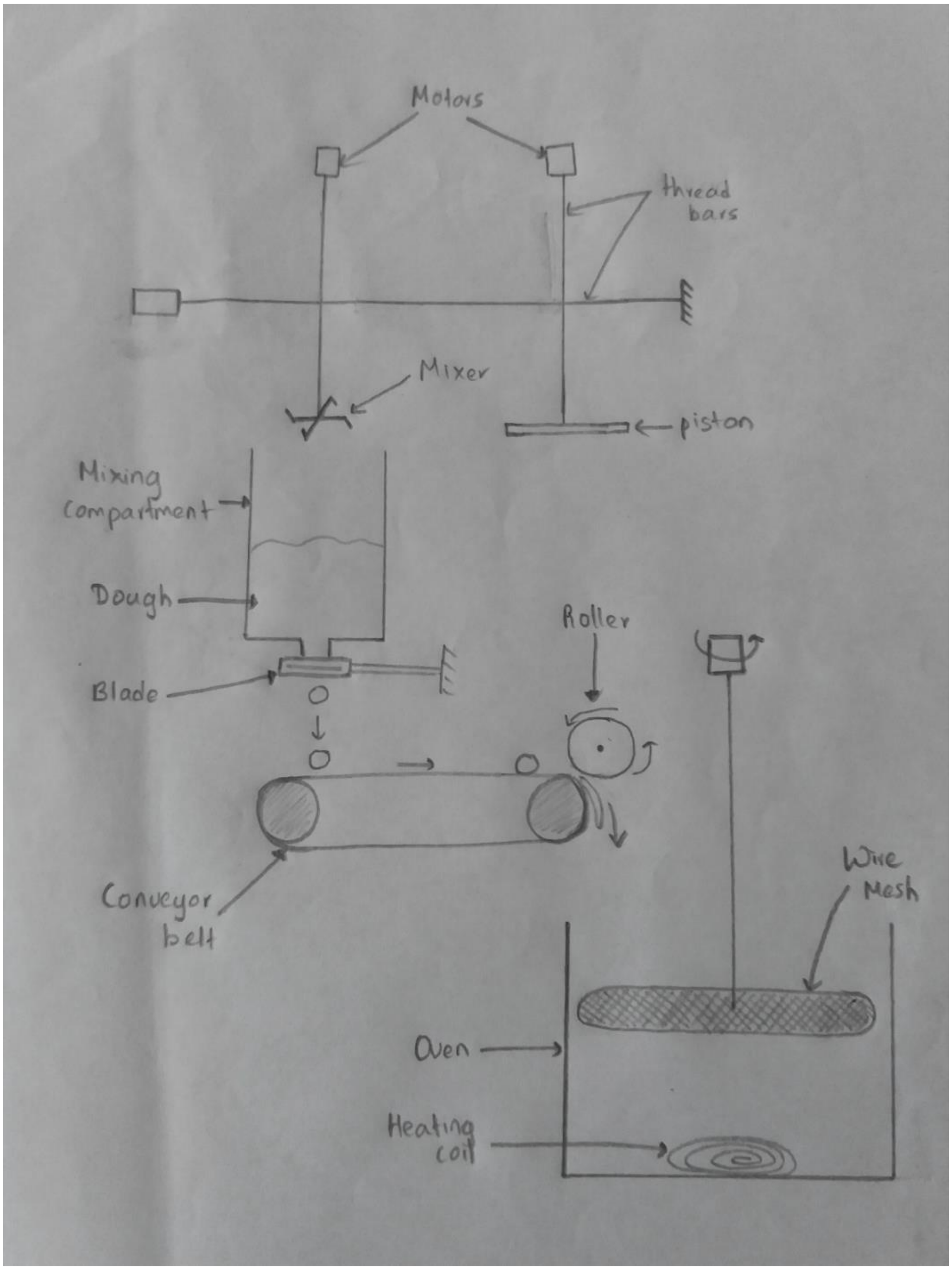


Figure 5.2 : Improved design of the product

6.0 TESTING AND IMPLEMENTATION

The kneading component

In contrast to the initial conceptual design of the device, we decided to leave the kneading component as a separate unit due to its bulkiness. As we resolved in the early stages, we stuck to the idea of using a circular bowl and a metal hook as a mixer. Upon some analysis, we decided that a mixer in the shape of a hook would be more convenient to mix dough in a round bowl since its curved feature at the bottom of the hook makes sure that when rotated, the hook approximately covers the whole area within the bowl, thus making sure the dough is evenly tended to. The smooth surface of the metal hook also provides us with an added advantage, because the dough is quite unlikely to stick to it.

The bowl is fixed onto a wooden base and this base along with the hook rotates in opposite directions. This motion again adds to the even and more consistent mixing of the dough. The whole structure is made using wood, hence is very bulky and heavy.

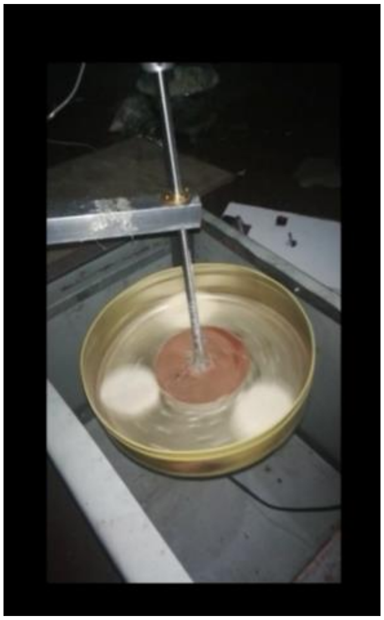
Shaping the dough

Although, at first we articulated our design such that the dough will be rolled out into a thin sheet and then cut into circles using cutting molds, we realized that there can be more efficient and less complicated methods to perform this part of the process. Our first idea was to send the dough through a roller mechanism, where two rollers rotating in opposite directions will flatten out the dough. Then it will be sent on a conveyor belt so that a mechanism with cutting molds will cut our circles from the dough and drop them off into the oven. But this seemed too complex, so we decided to use another technique instead where the dough is put into a cylindrical syringe like component and a piston driven by the aid of a thread bar is lowered into the cylinder so that the dough is pushed out in regular intervals.

The portions of the dough that is pushed out is then cut and sent forward on a conveyor belt where a roller waits at the end. This roller rotates in the direction opposite to the movement of the conveyor belt to facilitate the fluid motion of the dough between the roller and the belt.

The oven

In the usual manufacturing procedure used in the industry, the cut outs of the papadam dough are laid under the sun outdoors to dry. Our challenge was to mimic this procedure so we decided to build an oven with certain modifications. A steel box like enclosure with the top open was built for our oven and a coil was fixed at the bottom. It is programmed so that the temperature inside the oven is maintained at a steady temperature of 80 ^{0}C with the aid of a temperature sensor. The opening at the top is so that it facilitates an air flow in and out of the oven and so that the wire mesh on which the papadam is put onto can be lowered into the oven with ease. The lowering mechanism here uses a thread bar as well. The mesh then rotates allowing the dough to be dried evenly. After testing the product, and as far as dimensions are concerned, the maximum number of potions of the dough that can be put on the mesh is 3 circles, without any complications such as the potions sticking together.



Before building the circuit on a breadboard, we used the Proteus 8 simulation software to design and finalize the circuit layout that we required. With this done, we were able to build the prototype of our circuit on a breadboard and once the circuit was agreed upon, we built it on a PCB.

We have built the main circuit for our design using the Atmega32 microprocessor along with other components such as resistors, LEDs, motor driver ICs etc…

7.0 FURTHER WORK

We have designed our product so that it minimizes human intervention to a great extent. As a further development to the product, we think that reducing the extent of human intervention more is a viable improvement. This can be achieved by building a mechanism to extend the dried up papadam out from the oven than have an individual manually remove the tray off of the oven. Another advancement is to build a mechanism to transfer the mixed dough from the kneading bowl to the syringe through which the dough is cut into portions.

8.0 REFERENCES

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9.0 APPENDIX

9.1 Appendix A - Individual contribution

1. **Student name: B.R.C Perera (174114B)**
    - Researching on the proper recipe necessary to make papadam.
    - Contributing in drawing the overall design of the product and structuring the procedures.
    - Doing background research on DC geared motors.
    - Contributing to build the kneading component.
    - Articulating the concept for the oven and contributing to building it.
    - In charge of building the conveyor belt and roller components.

2. **Student name: S.M.D.R.N.Senaratne (174152M)**
    - Writing the code for the automation of the mechanisms/programming the microcontroller.
    - Contributing to brainstorming the design of the product and structuring the procedures.
    - Contributing to building the oven's compartment.
    - In charge of building the roller and conveyor belt set.
    - Designing and building the PCB for the automation.
    - Circuit simulation.

3. **Student name: B.I.T.Keerthiratne (174074B)**
    - Contributing to building the mechanical part of the roller system.
    - Doing background research on the roller mechanism.
    - Contributing to brainstorming the design of the product.
    - Contributing to structuring the procedures.

- Contributing in building the kneading mechanism and the conveyor belt mechanism for rolling out the dough.

4. Student name: G.Kalairaj (174065A)

- Contributing to building the mechanical part of the piston-syringe component required in mid-process.
- Contributing to build the lowering mechanism for the wire mesh in the oven.
- Making the animation for the interim.
- Doing research on the types of materials used for the structure of the device.
- Contributing to build the kneading component including the mechanisms for the rotations.

5. Student name: R.Kajaroopan (174064U)

- Contributing to drawing the structure of the device.
- Making the animation for the interim.
- Contributing to building the circuit.
- Contributing to build the kneading component.
- Building the piston-syringe component required in mid-process.
- Contributing to building the oven and its lowering mechanism for the wire mesh.