Design and Development of Bread Making Machine for Indian Homes

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Abstract
India is a country which has wide variety of grains and their extracts. India is the 2nd highest wheat producing in the world. As the production of wheat is high, the development of sub products from wheat is also high. In the current market, various machines have emerged in the market with newer technologies and materials for the better extraction of bread from wheat for commercial purpose both in large and small scale industries. Not enough machines are available for personal use in Indian homes for making bread and the cost of existing ones are such that it is unaffordable for the general public. Wheat bread is widely consumed by the people but one cannot know whether private and public manufactures have taken necessary steps to maintain the hygiene while preparing. Hence, the present work is to come up with the new Bread making machine for Indian homes, focusing on hygiene and to cater to the needs of Indian homes considering Ergonomics, functionality, Usability, Safety and Aesthetics.

Key Words: Domestic Household Products, Bread Making Machine, Automatic

1. INTRODUCTION

India is a country of wide variety of grains and their extracts. Wheat is the leading source of vegetable protein in human food, having a higher protein content than other major cereals such as maize (corn). Bread deserves an important place in the diet because it is inexpensive, fast and convenient, low in fat and provides a range of nutrients.[1] Bread is one of the oldest processed foods - and various types include different grains, including wheat,spelt, rye, oats and barley. Bread is a ready-to-eat product which is becoming increasingly popular in hotels, restaurants, canteens and in households. There are many varieties e.g. whole flour bread, brown bread, milk breads which is baked by the local bakers.

1.1 Introduction to bread maker
1. Bread maker is home appliance helps to bake a bread by adding different incidents to baking pan.
2. The leading parts of the bread maker are manufactured with plastics and stainless steel.
3. Currently the type of bread maker machine available in the market is a semi-automatic baking machine.
4. The bread maker is commonly used in the household, restaurants, and hostels.

1.2 Literature Survey

India is the 2nd biggest grower of wheat next only to china. In India, the cultivation of wheat is most common in Rajasthan, Uttar Pradesh, Bihar & Madhya Pradesh. It is also cultivated in a smaller extent in West Bengal, Uttarakhand, Gujarat and Punjab. India’s wheat production has increased in last 10 years at CAGR (compound annual growth rate) of 2.89 percent.

Area under wheat cultivation has also increased in last 10 years at CAGR of 1.60 percent [2] as shown in Fig 1.

The patent [3] gives the information of the current bread making machine which is capable of kneading, rounding the dough, and baking it as shown in Fig 2.

1.3 Product Study

Since there are no best products available in market for the design of Bread making machine for Indian homes. Product study has been carried out on similar bakeries and its related existing products. Therefore product study research for focus in types of bread makers, materials types and specification are listed under the product study [4] as shown in Fig. 3.

1.4 Summary of Market Study

From the market survey, the following points have come into light
• Currently which are available in market those are big in size and heavy in weight.
• There is no compact design available in the market for bread maker.
• Machine functionality to be improved to reduce kneading noise.
• Since India is importing all machines, there is a huge potential for entrepreneurship.

3.1 Quality Function Deployment (QFD)

QFD is a systematic methodology based on a close awareness of customer desires, coupled with the combination of corporate functional groups. It consists in converting buyer necessities into design features for each step of the development of the product. The Quality Function Deployment chart is given in Fig. 4 which can then be used to design and making the product.

2. PROBLEM DEFINITION

From the literature survey and ethnography research following problems are identified and the problem statement is generated. The problems identified are:
• Ergonomic aspects are not considered properly.
• Huge machines available in market but it cannot be used in domestic households.
• High cost of the existing bread makers.
• Lack of safety in existing machines.
• Not suitable to bake multi-flavour breads.
• Materials used are not healthy in the long run.
• Users are not satisfied with existing machine due to limited features.

3. METHODOLOGY

The methodology involved in solving the problem involved are:
• To create QFD (Quality function deployment) and arrive at PDS (Product design specification) based on Genba study.
• To create concepts for the design of bread maker.
• To create a detailed design and geometrical model of the selected conceptual bread making machine unit
• To optimize the concept
• To build the final working model
• To validate the design with the end user

1.5 Summary of Literature survey

The summary of ethnography and literature survey are as follows:
• In recent years there is a huge potential market rapidly growing in India.
• Cost of the present machine is too high and doesn’t have enough safety features.
• New machine need to be implemented with reasonable cost.
• Majority of Indian citizens (23%) consumers consume bread on a daily basis.
• The recent study by the Centre for Science and Environment (CSE) says that Potassium bromate is used to strengthen dough, improve the shelf life of bread, causes cancer and also could trigger thyroid disorders.
• Bakery made breads aren’t very nutritious.
• There is a growing segment of people ready to pay the extra buck for a healthier bread product.

Table 1. Product design specifications

<table>
<thead>
<tr>
<th>Sr</th>
<th>Factors</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Product name</td>
<td>Bread Maker</td>
</tr>
<tr>
<td>02</td>
<td>Colour</td>
<td>Black</td>
</tr>
<tr>
<td>03</td>
<td>Area of use</td>
<td>Home, Hostels, Restaurants</td>
</tr>
<tr>
<td>04</td>
<td>Material</td>
<td>Stainless steel, Aluminum, Plastics</td>
</tr>
<tr>
<td>05</td>
<td>Target Customer</td>
<td>Indian bread lovers</td>
</tr>
<tr>
<td>06</td>
<td>Performance</td>
<td>Daily usage</td>
</tr>
<tr>
<td>07</td>
<td>Life Expectancy</td>
<td>5 years</td>
</tr>
<tr>
<td>08</td>
<td>Standards and Specification</td>
<td>International Standards</td>
</tr>
<tr>
<td>09</td>
<td>Environment</td>
<td>Easy Installation</td>
</tr>
<tr>
<td>10</td>
<td>Dimensions (MM)</td>
<td>Length 350 x Width 240 x Height 220</td>
</tr>
<tr>
<td>11</td>
<td>weight</td>
<td>8-9 kg</td>
</tr>
<tr>
<td>12</td>
<td>Shape</td>
<td>Rectangular</td>
</tr>
<tr>
<td>13</td>
<td>Quality &amp; manufacturing</td>
<td>Good quality material with longer life</td>
</tr>
<tr>
<td>14</td>
<td>Maintenance</td>
<td>Daily cleaning based on usage</td>
</tr>
<tr>
<td>15</td>
<td>Input/Controls</td>
<td>Manual</td>
</tr>
<tr>
<td>16</td>
<td>Special features</td>
<td>Ease of service, Compact, Hygienic</td>
</tr>
<tr>
<td>17</td>
<td>Price (INR)</td>
<td>5500</td>
</tr>
<tr>
<td>18</td>
<td>Safety</td>
<td>Free from sharp corners, User friendly</td>
</tr>
</tbody>
</table>
3.3 Concept Generation

The concepts are done as per the outcome of the QFD and PDS made. In the process of concept generation, doodling and CAD models of the 2D sketches are done. The various concepts are shown in Fig. 5. These were generated by varying the form, aesthetics and other parameters.

![Fig. 5 Concepts]

4. RESULT AND DISCUSSION

To clearly identify the positives and negatives in each concept, participatory method is an efficient method for concept selection. Shortlisted concepts are further weighed in weighted ranking method for various parameters such as ergonomics, safety, aesthetics and functionality as shown in Fig 6.

Concept 3 has been selected for further development from weighted ranking method.

![Fig. 6 Weighted ranking method]

4.1 Final concept Refinement

The final concept of the Bread making machine has been refined considering the manufacturability. Ergonomics, DFMA aspects as shown in Fig 7.

- Overall size of the product has been reduced to make it compact.
- The lid along with window openings are restricted and hence made easy
- The mechanism is changed as per available pulley with belt in the market.
- Width is reduced since display has to be kept beside the machine.

4.2 Ergonomic study

The product ergonomics is deals with interrelation between the product task, user and the environment. The posture shown in the Fig. 8, the user handle holding place. Here consideration is given for 5th percentile of female and the handle is designed for 12mm dia.

![Fig. 7 Modification in the final concept]

![Fig. 8 Ergonomic posture]

4.3 Detail design of final concept

The bread making machine has been shown from the isometric view to better understand all the features included in it, in Fig. 9.

![Fig. 9 Final model product parts]

The exploded views as shown in Fig 10 help to understand more about the individual elements. In drafting it shows the outer major dimensions to know the size.
4.6 Validation

Validation of the final concept has been done with a 1:1 working model developed to ensure the potential of the final design and was found satisfactory. The remarks of the users with respect to criteria like functionality, aesthetics, manufacturability, serviceability and usability are shown in Fig. 14.

5. CONCLUSION

The complete design process from market survey to prototype making was carried out for designing a Bread making machine for house hold Application, considering functionality, aesthetics, and safety. Since the users themselves deal with the product directly, the fears of hygiene of the food is allayed. The form and general aesthetics considered are of simple and attractive in nature thereby catering to all kinds of mind-sets. Thus the product is successful in achieving its set goals and can be introduced in the market. Following points can be considered for future work:

- Selection of material for mass production
- Variaty of colour for mass production
- Auto dispensing for bread ingredients
- Interior light for detail visibility of process
- Baking duration to be reduced

REFERENCES


