

# Design Analysis and Performance evaluation of Automated Omlette making machine

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## ABSTRACT

*Egg omlette is one of the most popular breakfast and staple item consumed all over world in morning or all over the day. The process of omlette making involves major task of egg breaking which is a tedious operation for many followed by the frying. The project work involves the automation of this activity of egg breaking combined with temperature controlled frying with minimal oil for health purpose. The machine has four basic system the egg holder mechanism- egg breaker mechanism, secondly the egg shell disposal mechanism, the egg frying mechanism and finally the omlette disposal mechanism. The paper discusses the design analysis of the egg-holder and breaker mechanism and the performance evaluation of the machine as to the cycle time for each mechanism. The parts have been designed theoretically and analysis has been done using Ansys software.*

**Keyword :** - Egg, Omlette, Egg breaker, Egg holder, Disposal mechanism, Shell collector

## 1. Introduction

Food Automation is one among the fast growing technology. Today's food making machines are most popular and most of need (e.g. portable ice-cream machine with different flavors, coffee machine and many more). One of the regular breakfasts is omelets hence the Egg baking machine can be made to prepare omelet and is intended to prepare the omelets automatically with requirement of user automatically within few minutes. This project explains about a simple low cost circuit and mechanical design which can be mainly used as to prepare consumer food product. This created machine is egg baking machine prepares the omelets and serves in the pan automatically. This machine completely works on electricity. This machine reduces human effort and time in preparing food. It completely works on electricity and is simple to clean.

The project follows with breaking of egg in the first step then it is poured in to the pan which is placed on heater then it is baked completely and ready to serve the tasty and healthy omelets. The project uses high gear motors for mechanical works egg breaking, egg holding, disposal of omlette to serving plate. This project is integration of the process. This project can be concluded with good accurate and proper output and one can expect a healthy and tasty omelets from this machine and hence from our project. This project is named as automatic omelet making machine so with help of this omelet can be prepared easily and automatically without any manual efforts hence human efforts are reduced modern way of cooking omelet is implanted in better way. In the field of the food automation we see less invention so we thought to make some social friendly food making device with complete automation that's why we choose this area of working and finally we got an idea to make automatic omelet making machine.

## 2. Literature review :

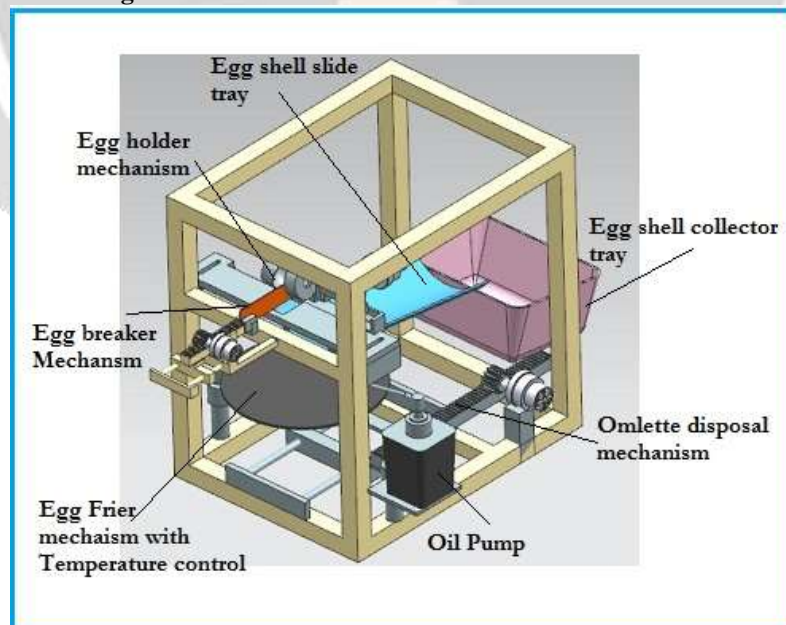
**MARKET INVESTIGATION** There is a saying that breakfast is the most important meal of the day [Eatright.org., 2008]. Eggs are widely enjoyed as breakfast entree in many countries all around the world. There are many choices of how one would like to have his or her eggs prepared for breakfast. Eggs can be served fully cooked or half-boiled. Some people like them hot and scrambled with vegetable, meat, seafood or in various other combinations. Some even like them sunny side up with a dash of pepper and salt. Being the most eaten food for breakfast, most people do not like or simply do not have the time to prepare the eggs themselves. Even if they cook the eggs themselves, they would not get the consistency in texture, taste, etc. Therefore, there is a need to provide a means to automate the process of preparing the egg(s) for breakfast, perfectly cooked every

time. A market survey was done to investigate the existence of such egg-cooking machines. The investigation revealed that some of the machines for egg preparation are already available in the market. These machines can be divided into two categories; egg cookers and egg processors. Egg Cookers Egg cookers or egg cooking machines refer to the machines that prepare or cook the eggs for eating. In other words, after the eggs have gone through the cooking process, they are ready to be eaten. Through the survey, most egg cookers were meant for preparing the eggs as boiled and poached. One of the machines surveyed was also capable of preparing the eggs sunny side-up and in the form of omelette. 68 The capabilities of another machine studied were such that it could boil or poach up to seven eggs perfectly hard, medium, or soft with boil and keep-warm functions. It also had dualpurpose lid that could also be used as a drip tray or serving tray, removable egg holder for easy cooling under tap water and a timer that signaled when cooking was complete [Krupps Egg Cooker, 2006]. Another machine studied had a built-in timer and automatic shut-off and when the eggs were finished, an alarm sounded [West Bend Automatic Egg Cooker, 2004]. In another product that could cook up to 7 eggs in shells - hard, medium or soft - or perfectly poached up to 3 eggs at once. It determines the amount of water added, precisely control the cooking time, and equipped with indicator lights, an audible signal, and auto-shutoff to prevent overcooking [Cuisinart Egg Cooker, 2006]. The egg cooker by Oster featured [Oster 4716 Egg Cooker, 2006] steam heat to poach of up to 4 eggs at a time, cooked and cleaned easily with non-stick and non-stain surface. When the eggs were ready, the egg cooker automatically shut off and flawlessly cooked up to 8 hard, medium, or soft eggs. Egg Processors The other category of egg-related machines surveyed was egg processors. These refer to machines that prepare processed egg products for the retail and institutional market. The term "egg products" refers to eggs that are removed from their shells for processing. The process includes breaking eggs, filtering, mixing, stabilizing, blending, pasteurizing, cooling, freezing or drying, and packaging. Liquid, frozen, and dried egg products such as white or yolk powder, egg yolk granules are widely used by the food service industry. The important feature of such machines is the egg breaking mechanism. Among the egg processors currently available in the market include the machine that has the capability to crack the egg shells and separate the yolk (yellow) from the albumen (white) where the separation process works exactly like a household egg strainer. The machine can process 18,000 eggs per hour. Since available egg cooking machines surveyed were mostly for cooking hard-boiled, soft-boiled and poached eggs, it could be concluded that there is a market potential for an automatic scrambled egg cooking machine.

### 2.1 Literature Gap

Thus from the literature review it is clear that there are no specific machines for proper omlette making hence the project objectives were set to develop the automated omlette making machine

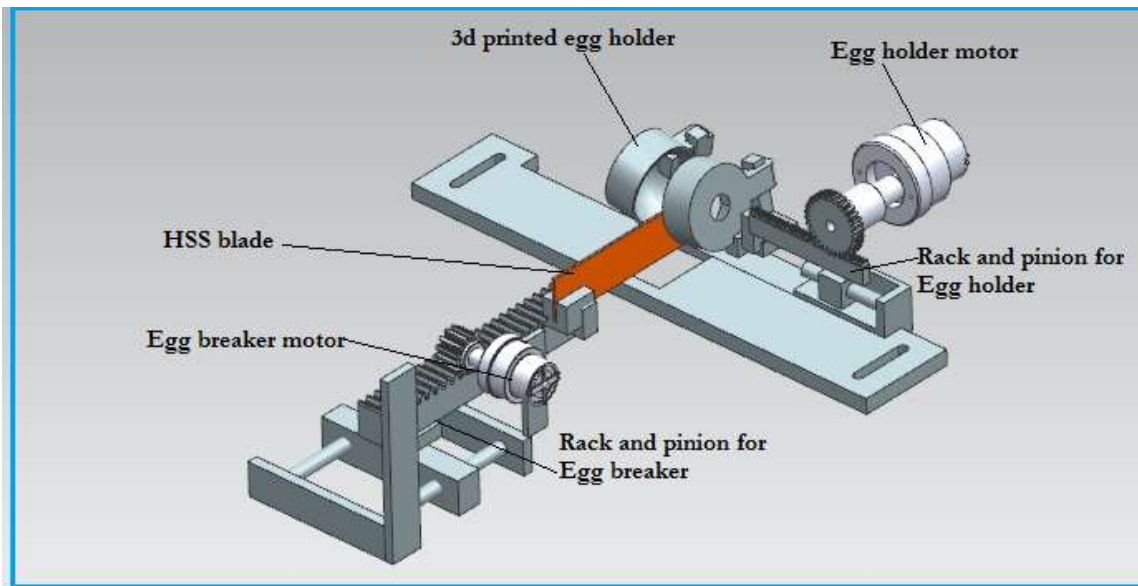
### 3. Proposal of Omlette making machine



The machine has four basic system

- The egg holder mechanism- egg breaker mechanism ,
- The egg shell disposal mechanism ,
- The egg frying mechanism and
- The omlette disposal mechanism.

### DESIGN OF THE EGG HOLDER AND BREAKER MECHANISM



#### Motor for egg holder and Egg breaker

The drive motor is 12 VDC motor coupled to an planetary gear box. Specifications of motor are as follows 60 RPM Side Shaft 37mm Diameter Compact DC Gear Motor



60 RPM Side Shaft 37mm Diameter Compact DC Gear Motor is suitable for small robots / automation systems. It has sturdy construction with gear box built to handle stall torque produced by the motor. Drive shaft is supported from both sides with metal bushes. Motor runs smoothly from 4V to 12V and gives 60 RPM at 12V. Motor has 6mm diameter, 22mm length drive shaft with D shape for excellent coupling.

Table below gives fairly good idea of the motor's performance in terms of RPM vs voltage at no load and that of stall torque at different voltages.

**Important Note:** This motor will be bit noisy while running. For long life, this motor is not recommended for application requiring dynamic torque of more than 3 kg-cm.

#### Specifications

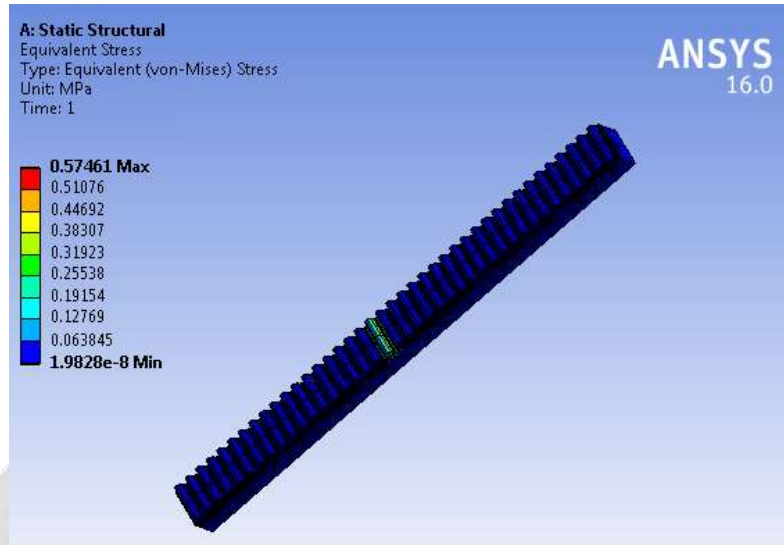
- RPM: 60 at 12V
- Voltage: 4V to 12V
- Stall torque: 18 Kg-cm at stall current of 1.3 Amp.
- Shaft diameter: 6mm

Design and analysis of Rack for Egg holder

Lewis Strength equation

WT = Sby<sub>m</sub>

The rack is of 1.0mm module, 32 teeth where as pinion is of 1 mm module and 75 mm length rack



The maximum stress induced in the part material is 0.57461 MPa which is far below the allowable stress of 100 Mpa hence the rack is safe,

#### Design of the egg holder body



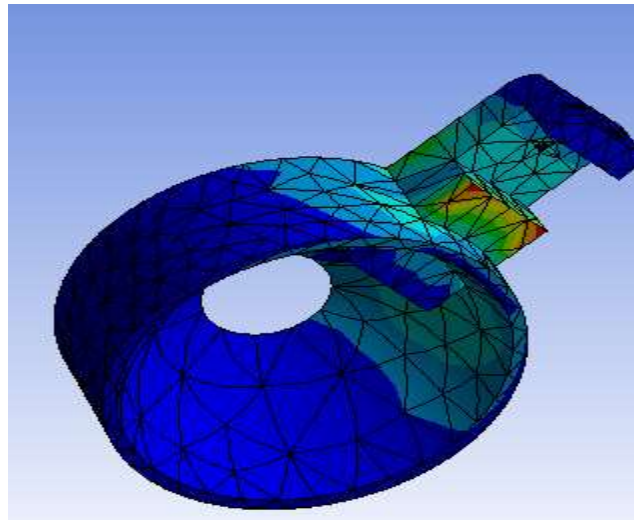
$$F_t = \text{Load} / \text{Area}$$

$$F_t = 0.66 \text{ N/mm}^2$$

$$\text{As } F_t \text{ act} < F_t \text{ all}$$

Egg breaker is safe under shear load





The maximum stress induced in the part material is 0.57461 MPa which is far below the allowable stress of 100 MPa hence the rack is safe

### **TESTING & TRIAL OMLETTE MEAKING MACHINE**

#### **OBJECTIVES OF TESTING:**

1. **Determination of cycle time of egg holder mechanism**
2. **Determination of cycle time of egg breaker mechanism**
3. **Determination of cycle time of baking mechanism**
4. **Determination of cycle time of omlette disposal mechanism**
5. **Determination of cycle time of shell disposal mechanism**
6. **Determination of total cycle time**

Sr. No	Operation	Forward (sec)	Reverse(sec)	Total(sec)
1.	Egg holding	4	4	8
2.	Egg breaking	7	7	14
3.	Egg baking	128	-	128
4.	Omlette disposal	7	7	14
5.	Shell disposal	5	5	10
6.	Total	87	23	174

Thus the total cycle time for 174 seconds ie, the time required for omlette making is close to 2 min .

#### **Conclusion :**

1. The parts of the egg breaker are designed by both theoretical and analytical method and the are safe by both methods
2. The experimental results give that the total cycle time is close to 2 min
3. A new method to reducing ghuman effort in the form of automated omlette making machine is developed

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