Design and Analysis of Automatic Curry Maker

C. Krishnakanth[1], T. Tarun Kumar[2], Avinash Kumar Sinha[3], MadanMohan[4]

[1,2,3]UG student, [4]Assistant Professor, Department of Mechanical Engineering
[1,2,3,4]Kommuri Pratap Reddy Institute of Technology, Ghatkesar, Hyderabad, India.

ABSTRACT

Automatic cooking machine' as the name itself implies, cooking of food automatically without any human effort. Main aim is to make cooking easier, simple, and less time consuming. The machine will have pre-loaded recipes of your choice and the amount of ingredients will be specified in a C language program, so you just have to choose the recipe you want to eat and the machine will start to prepare your food and notify you when the food is ready. In present day scenario there is a rapid increase in inventions of machines which are based on automation process and they are used in every sector from home to industries. Our machine consists of induction cooker, bowls, oil and water pump, spice dispenser and some other components whose purpose is for stepwise addition of ingredients and cooking the food eventually. We have newly designed cooking pot which avoids the foods from burning. This machine can prepare food as close as food which can be prepared by a human hand.

1. INTRODUCTION

The AUTOMATIC CURRY MAKER is an electromechanical device. It helps to make the vegetable curry automatically and very quickly. It generally operated based on already programmed control device. Where the control device is integrated Circuit of open loop system. The arrangement size of the system based on employing place. For example, this System may use in home it having compact structure based on kitchen. Where employing electrical devisees such as sensors and control boards are helping to operate the mechanical devices with proper and accurate time interval during the operation. Food automation the one among the fast-growing technology, today's food making machines are most popular and most of need. The Automated food maker machine is a pioneering concept in food manufacturing since it is designed to cook more than one kind of dishes. In the modern-day situation, food maker is the eye catcher of the people who are not able to cook for themselves manually. Automation in food manufacturing has been a primary solution in improving the consistency, safety, and accessibility of food in major consumer markets. This paper explains about a simple low-cost circuit and design which can be mainly used as to prepare consumer food product. This was mainly made by considering present busy lifestyle of the people. Food maker reduces the manpower and time to certain extent. The Automated food maker is designed to deliver a whole new set of functionalities that will create a benchmark in the automated food making sector.

1.1. Parts of Ingredient Cabin

Main rods: These are solid rods used to holds the cups connected to the ring and welded to the hub

Supporting rods: These are also solid used for distributing the loads which are welded to the centre of the main rod and hub

Hub with Bearing: It is an octagon of 8 sides welded by rods holds bearing in middle

Cups: The cups used to carry the ingredients with a capacity of 500 ml are fixed to the rods

Casing: It is used to cover the mechanism and protect from environment

Stand: Is for holding the hub with the bearing

Supporting ring: To fix and support the rods

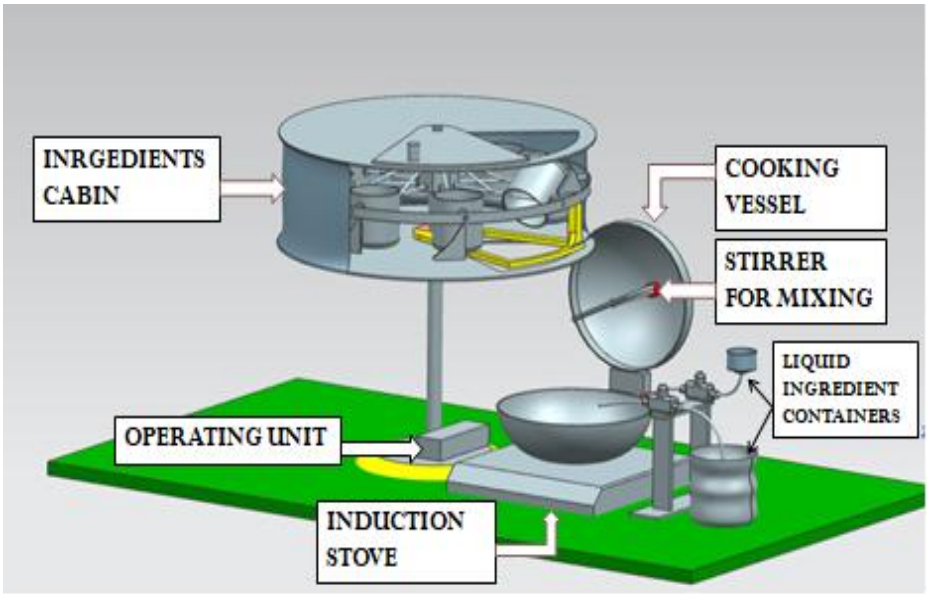


Fig. 1: Automatic Curry Maker

1.2. Working

- The microcontroller reads this input and chooses all parameters to cook
- Once the microcontroller initializes all the data according to the user's input
- It executes the programmed functions; the hardware parts of the system are initialized and they start working according to the program.
- The microcontroller program initializes the induction stove and sets the time and temperature accordingly.
- Once the induction stove initialized the cooking vessel gets heated
- After the vessel is heated up to a required temperature the oil is added in to the vessel from the container through pipe with the help of solenoid valve

2. LITERATURE REVIEW

After 2007 a good amount of research work was done regarding cooking in China. W. X. Yal et al. prepared Chinese dishes namely Jiangsu, Sichuan, and Shandong etc. The robot prepared these dishes by frying[6].To make salad first we have peel and cut the vegetable. In 2010 many experiments were done on vegetables for preparing salad by Kimitoshi YAMAZAKI et al. In these experiments' vegetables were cut by knife and peeled by using peeler [7].When we go to restaurant or hotel for eating food, we are very much attracted by food decoration. In cafeteria, chef makes design of smiley or mentions the name on the

coffee. On the same concept Jun Wei et al. make heart and smiley on the piece of the bread. This type of experiment was done in order to increase the attractiveness and to entertain kids [8]. In 2013 Yukiko Matsushima et al. proposed four Japanese dishes which can be prepared at home by taking guidance from tablet [9].In 2013 N. Yoshida et al. tried to break an egg by the edge of pan. They used robot arm to crack the egg. After cracking all the contents were collected inside the pan[10]. In 2016 Michael Sutiono et al. from Indonesia gave the concept of rice cooker. This rice cooker was called as smart rice cooker. It boiled the rice[11].Many types of function were done on making dishes like boiling, frying, cutting and pealing. Egg was also put in pan after breaking it. All the experiments were done on making Chines, Japanese and Indonesian dishes as the authors belongs to China, Japan and Indonesia. But in all these dishes no Indian dish is discussed. There are many vegetables like potato, brinjal, cauliflower, beans, bottle guard, bitter gourd, peas, mix vegetables etc. and many types of pulses which are daily prepared in an Indian kitchen, on which no cooking robot has been developed.

3. MODELLING AND ANALYSIS

Computer-aided design (CAD), also known as computer-aided design and drafting (CADD), is the use of computer technology for the process of design and design-documentation. Computer Aided Drafting describes the process of drafting with a computer. CADD software, or environments, provide the user with input-tools for the purpose of streamlining design processes, drafting, documentation, and manufacturing processes. CADD output is often in the form of electronic files for print or machining operations. The development of CADD-based software is in direct correlation with the processes it seeks to economize; industry-based software (construction, manufacturing, etc.) typically uses vector-based (linear) environments whereas graphic-based software utilizes raster-based (pixelated) environments.

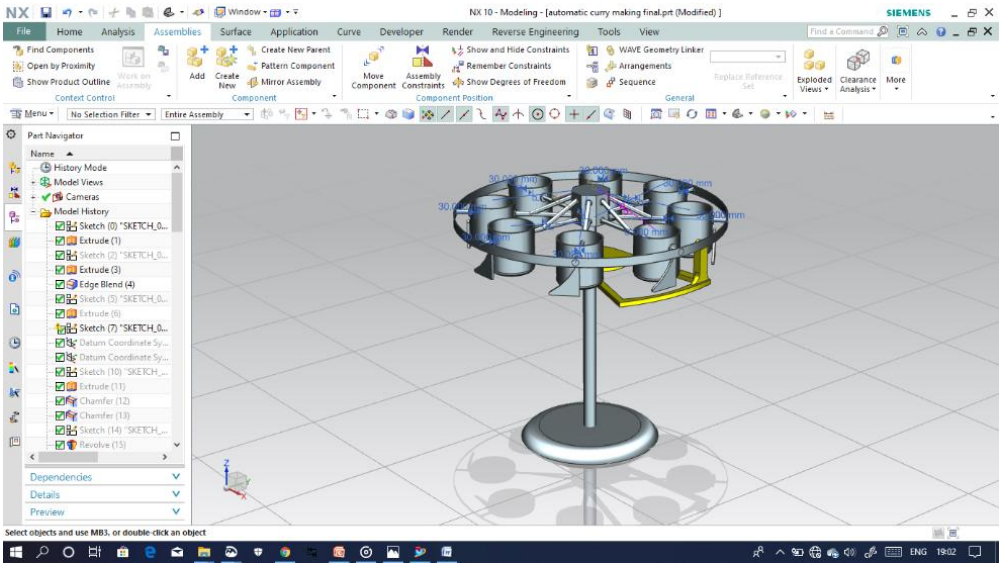


Fig. 2: 3D model of curry maker.

4. STATIC ANALYSIS OF AUTOMATIC CURRY MAKER

Structural analysis is probably the most common application of the finite element method as it implies bridges and buildings, naval, aeronautical, and mechanical structures such as ship hulls, aircraft bodies, and machine housings, as well as mechanical components such as pistons, machine parts, and

tools. **Static Analysis** - Used to determine displacements, stresses, etc. under static loading conditions. ANSYS can compute both linear and nonlinear static analyses. Nonlinearities can include plasticity, stress stiffening, large deflection, large strain, hyper elasticity, contact surfaces, and creep.

4.1. Material Properties

AISI 1050 Steel

Carbon steels contain carbon as the main alloying element. They are designated by AISI four-digit numbers and contain 0.4% of silicon and 1.2% of manganese. Molybdenum, chromium, nickel, copper, and aluminium are present in small quantities.

Young's modulus (Mpa)	Tensile strength (Mpa)	Poisson's ratio	Density (kg/mm3)
700000	690	0.29	0.00000785

Aluminium Alloy 7075

The 7000 series aluminium alloys are usable in a variety of applications. The light weight and toughness characteristics of grade 7075 are valued highly by manufacturers and end users. As a strong, machinable aluminium alloy, it is universally used in the automotive, aircraft and aerospace industries.

Young's modulus (Mpa)	Tensile strength (Mpa)	Poisson's ratio	Density (kg/mm3)
71700	280	0.33	0.00000028

5. RESULTS AND DISCUSSION

Imported model

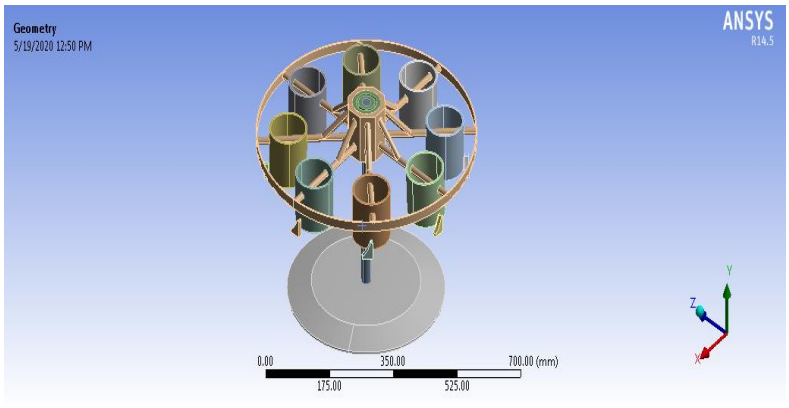


Fig. 3: imported model form modelling software.

Meshed model

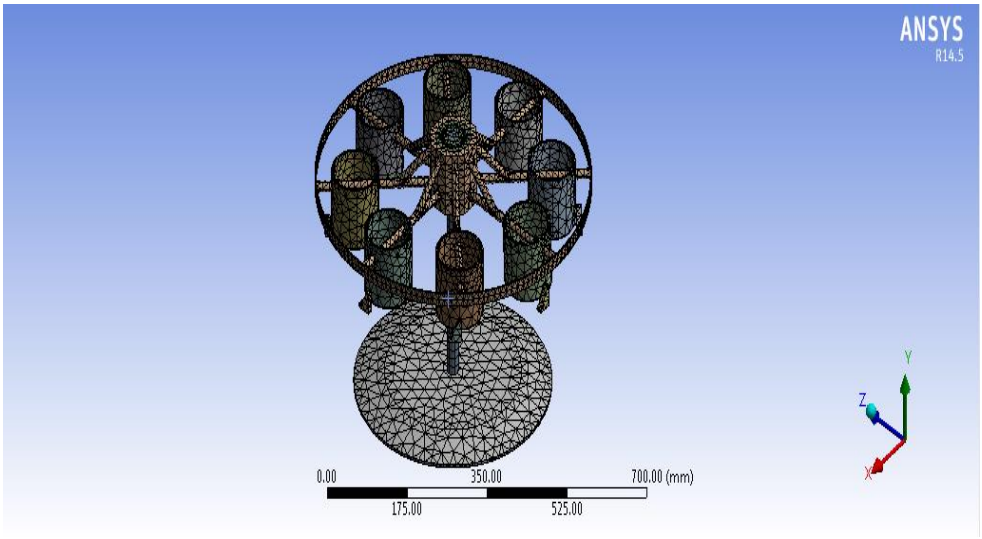


Fig. 4: Meshing model.

According above figure shows divided by elements through fine meshing.

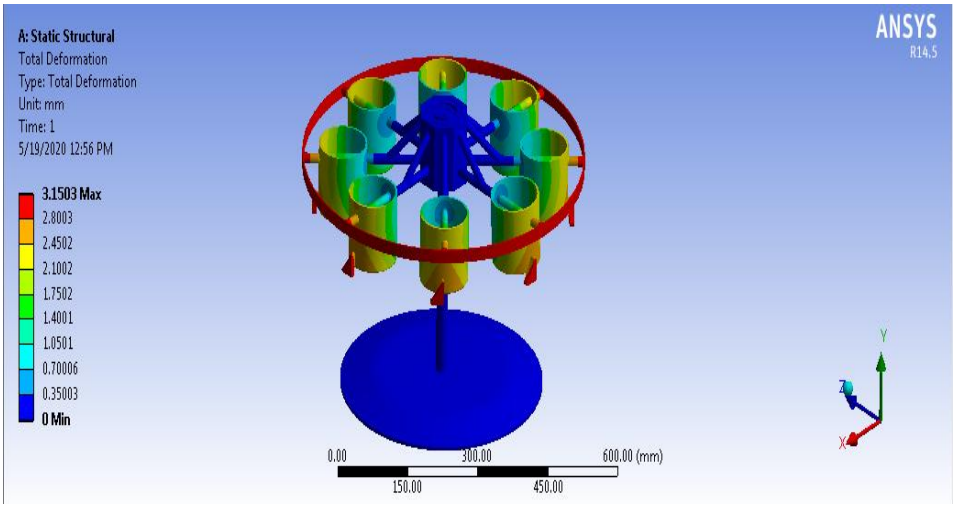
Solution A6>insert>total deformation>right click on total deformation>select evaluate all result.

Insert>stress>equivalent (von misses)>right click on equivalent >select evaluate all results.

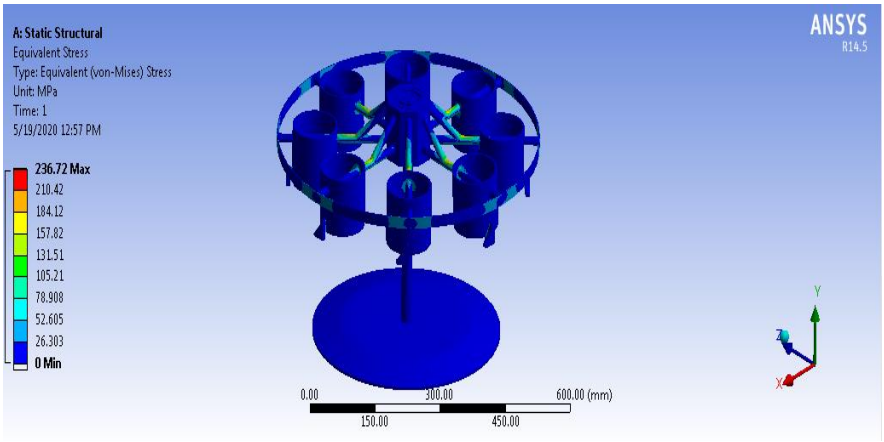
Insert>strain>equivalent (von misses)>right click on equivalent >select evaluate all results.

Material :aluminium alloy

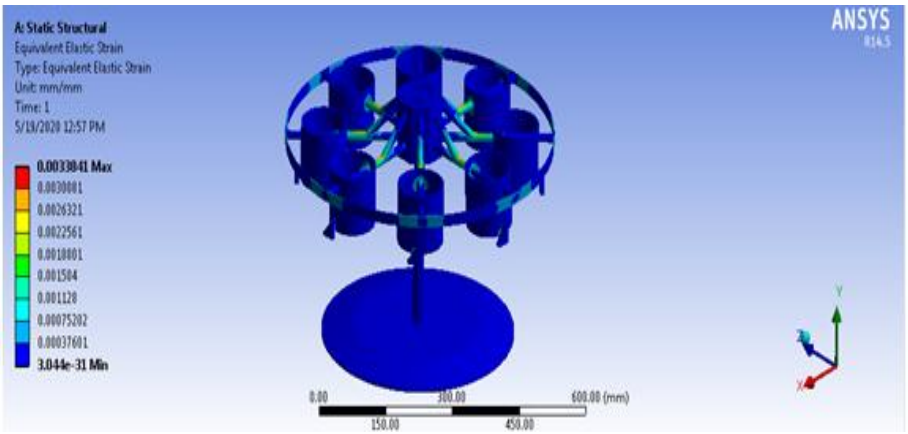
Total deformation



Stress

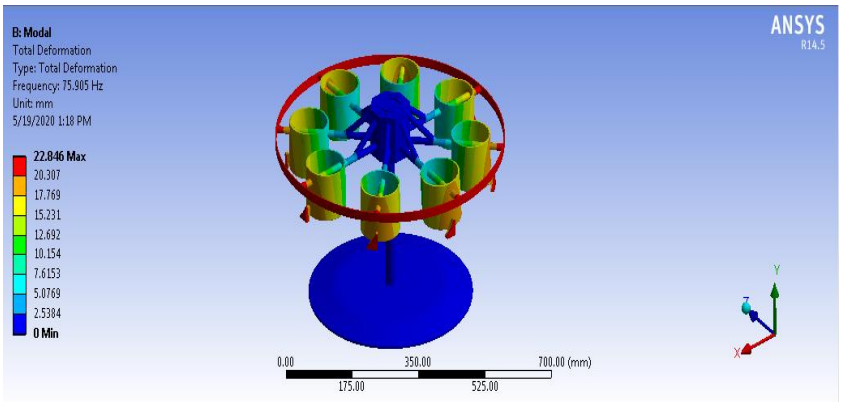


Strain

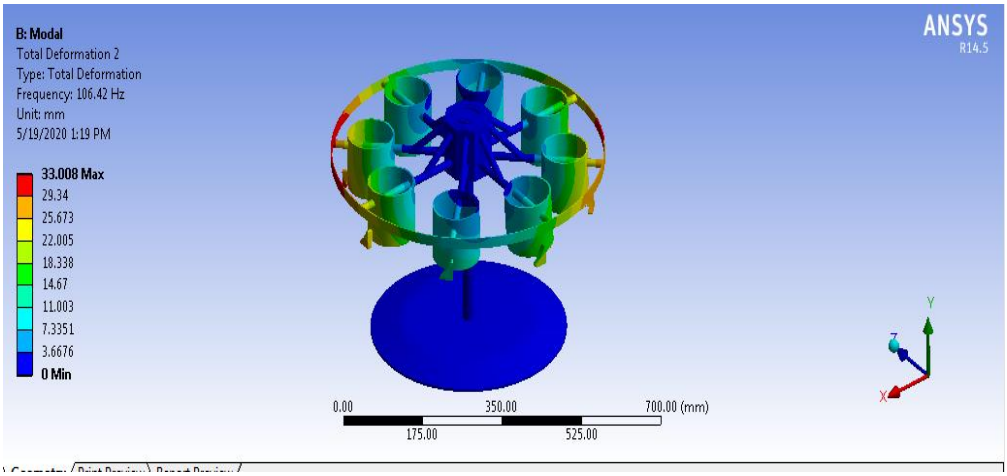


MODAL ANALYSIS OF BIKE CHASSIS FRAME

Total deformation 1



Total deformation 2



Total deformation 3

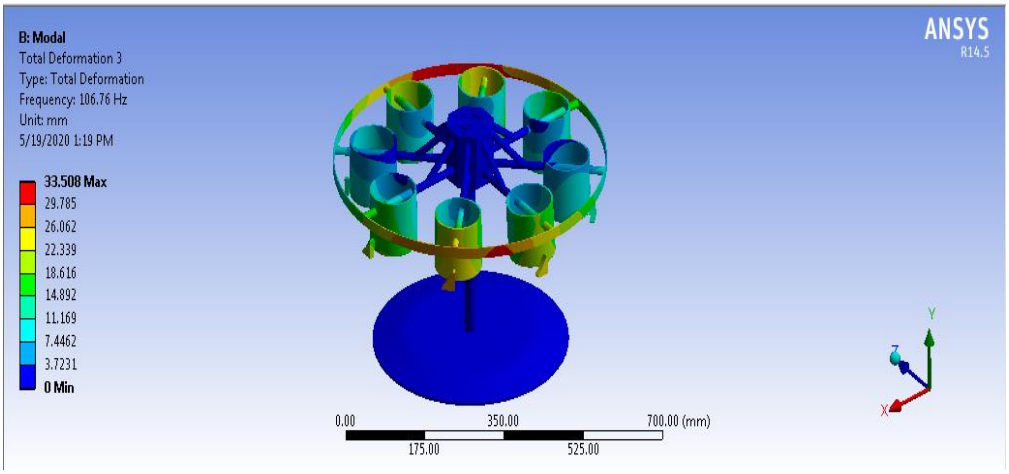


Table : Static Results tables

Material	Deformation (mm)	Stress (N/mm^2)	Strain
Steel	1.1219	238.01	0.0012078
Aluminium alloy	3.1503	236.72	0.0033841

Table: Modal analysis results

Material	**Mode 1**	**Frequency (Hz)**	**Mode 2**	**Frequency (Hz)**	**Mode 3**	**Frequency (Hz)**

Steel	13.588	75.598	19.656	106.03	19.971	106.36
Aluminum alloy	22.846	75.905	33.508	106.42	33.508	106.76

6. Conclusion

Automatic curry maker was modelled using parametric software. The Automatic curry maker model was imported to ANSYS software to perform structural analysis (i.e. static and modal analysis). The analysis was done on the Automatic curry maker for different materials (AISI 1050 steel and aluminium alloy). By observing the static analysis results, the stress values less at aluminium alloy material when we compared to steel material.

References

[1] Y. Nakauchi, T. Fukuda, K. Noguchi, And T. Matsubara, "Intelligent Kitchen: Cooking Support By Lcd And Mobile Robot With Ic-Labeled Objects," In 2005 Ieee/Rsj International Conference On Intelligent Robots And Systems, Vols 1-4, 2005, Pp. 2464–2469.

[2] H. Rong, X. Dai, And X. Liu, "Trajectory Planning Method Of The Pot In Cooking Robot," In 2010 2nd International Asia Conference On Informatics In Control, Automation And Robotics (Car 2010), Vol 1, 2010, Pp. 129–132.

[3] Y. Chen, Z. Deng, And B. Li, "Numerical Simulations Of Motion Behaviors Of Pan Mechanism In A Cooking Robot With Granular Cuisine," J. Mech. Sci. Technol., Vol. 25, No. 3, Pp. 803–808, Mar. 2011.

[4] S. Taki, K. Fujimoto, H. Osaki, Y. Munesawa, And Y. Kajihara, "Generating Method Of Procedure For Cutting Ingredient By Cooking Robot," In Icim' 2004: Proceedings Of The Seventh International Conference On Industrial Management, 2004, Pp. 32–37.

[5] D. Sakamoto, Y. Sugiura, M. Inami, And T. Igarashi, "Graphical Instruction For Home Robots," 2016.

[6] W. X. Yan Et Al., "A Novel Automatic Cooking Robot For Chinese Dishes," Robotica, Vol. 25, No. 4, Pp. 445–450, 2007.

[7] K. Yamazaki, Y. Watanabe, K. Nagahama, K. Okada, And M. Inaba, "Recognition And Manipulation Integration For A Daily Assistive Robot Working On Kitchen Environments," Pp. 196–201, 2010.

[8] J. Wei And A. D. Cheok, "Foodie : Play With Your Food Promote Interaction And Fun With Edible Interface," Vol. 58, No. 2, Pp. 178–183, 2012.

[9] Y. Matsushima, N. Funabiki, T. Okada, T. Nakanishi, And K. Watanabe, "A Cooking Guidance Function On Android Tablet For Homemade Cooking Assistance System," Pp. 249–254, 2013.

[10] N. Yoshida, T. Yoshimi, M. Mizukawa, And Y. Ando, "A Study Of Egg Breaking Motion By Single Robot Arm," In 2013 32nd Chinese Control Conference (Ccc), 2013, Pp. 6057–6062.

[11] M. Sutiono, H. Nugroho, And K. Karyono, "Appliance Hub : A Wireless Communication System For Smart Devices (Case Study : Smart Rice Cooker)," No. 978, Pp. 125–130, 2016. Authors Profile

