Irish Interdisciplinary Journal of Science & Research (IIJSR)
Vol.4, Iss.3, Pages 112-119, July-September 2020

A New Automatic Cooking Machine for Indian Dishes

Emmanuel Derek C.[1], Jebastin Jacob J.[2], Mahesh I.[3] & Prem Ananth[4]

[1,2,3]*UG Student,* [4]*Asst. Professor, Department of ECE, Francis Xavier Engineering College, Tirunelveli, Tamilnadu, India.*

Article Received: 21 June 2020 Article Accepted: 29 August 2020 Article Published: 22 September 2020

ABSTRACT

Up to now, most of people are still cooking in the kitchen, which makes them feel fatigued and also makes air polluted. With the development of the numerical control technology, it becomes more and more urgent to apply the related technology to the automatic cooking field. In this paper, the cooking technics for the Indian dishes is introduced and an automatic cooking machine is presented. The machine mainly consists of four parts: the wok mechanism, the stirring-fry and dispersing mechanism, the feeding mechanism, and the mechanism of leaving the material in the middle process. In order to adjust the temperature, the fire control system is also given in this paper. Experiments show that the new machine will be a milestone in the cooking automation science, because of its cooking technics.

Keywords: *Automatic machine, Cooking principle, Indian dishes.*

1. Introduction

Indian cooking technics is the most complicated of the three cuisine systems in the world (Indian cuisine, French cuisine, Turkish cuisine). The cooking equipment's available now can only make simple cooking processes such as heating with the microwave oven, baking with the roaster, boiling with an electric kettle, broiling with the frying pan. They cannot complete the core part of the Indian cooking processes such as pan-frying, stir-frying, burst-frying, quick-frying and re-frying without the related automated operations. Indian dishes are very famous, but their cuisine makes cooks tired. During the traditional cooking process, cooks often work hard in the hot kitchen. In the case it is not surprising that the taste of most dishes is not as good as we desired. Furthermore, the high pressure of the modern life makes people spend less time in cooking, as well as the Indian cuisine is very difficult. So it is urgent to design the machine for cooking to take the place of people.

The automatic cooking machine for Indian dishes is a new machine with the following functions: It can put the raw materials into the wok automatically. It can make the food in the wok heated evenly.It also should be easy to operate by people and the dishes that are cooked by the automatic cooking machine should be delicious. The Indian cuisine has its own features, understanding the principle of Indian cuisine is necessary for the design of the automatic cooking machine. This paper is organized as follows: in section 2, the essential Cuisine principle of Indian foods is introduced; in section 3, the system of the Indian foods cooking machine is introduced; in section 4, the experiments are introduced.

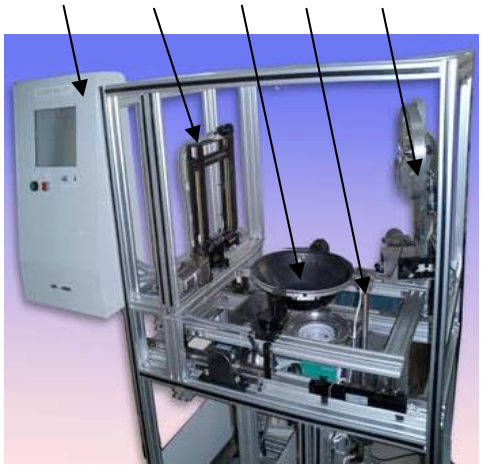
2. The Essential Cuisine Principle of Indian Foods

Table 1: The steps of cooking for Indian foods

No.	Type	The steps of cooking
1	Stir-fry dishes Series	Add the oil, Add the major ingredients, Add seasoning, pan-fry and stir-fry, Add water and starch, stir, serve and finish
	Braise and stew dishes	Add the oil, Add the major ingredients, turn and stir-fry,

2	Series	add water, Add seasoning, shakes the wok, serve and finish
3	Pan-fry and deep-fry dishes Series	Add the oil, Add the major ingredients, shovel the ingredients, Add seasoning, pour the oil, serve and finish
4	Saute dishes Series	Add the oil, Add the major ingredients, turn the ingredients, Add seasoning, pour oil, add seasoning juice, add water and ingredients, add the ingredients, stir, serve and finish
5	Soup Series	Add stock, Add the major ingredients, Add seasoning, take away the spume, add water and starch, drench the oil, serve and finish

The cooking method of Indian foods is different from that of western foods. According to different cooking process, Indian foods can be divided into five types. The cooking steps of each type are showed in table 1. By table 1, we divide the actions of cooking Indian foods into five parts: add the oil, add ingredients, pan-fry and stir-fry, stir, pour the oil or water. Where, pan-fry, stir-fry and stir are both achieved by pancake turner. However, the cooking machine is impossible to achieve different action by using different mechanism, if that, such mechanism will be extremely complicated. By synthesizing the characteristics of various actions, we can divide the process of cooking into four parts: feeding module, the module of leaving the material out in the middle process, cooking module and fire-controlling module. Each module can achieve some special functions. In other words, the feeding mechanism can put the right ingredients into the wok accurately. The wok movement mechanism and stirring-fry and dispersing mechanism can accomplish nearly all the cooking methods, and can drain the oil with the mechanism of leaving the material in the middle process. The stirring-fry and dispersing mechanism is propitious to the cooking of soup. At the meantime, the automatic cleaning mechanism will be designed into the stirring-fry and dispersing mechanism. The fire-control system is closely related to the wok movement mechanism, the fire-control should be performed in the whole cooking process.



The materials of the dishes are arranged according to the traditional Indian technics, and the motion information every dishes are produced by Indian cuisine experts using the wok mechanism 2. stirring-fry and dispersing mechanism 3.The feeding mechanism 4. the mechanism of leaving the material out in the middle process 5.

3. The System of the Indian Foods Cooking Machine

The cook is playing the primary role in the cooking process that is finished by manual work. He can decide when to add the ingredients, how much to add and how to operate in order to make the food taste better. However, the machine is limited in flexibility, it is impossible to imitate people cooking completely. It must coordinate various movements of mechanisms in order to fulfil the requirement of manual cooking. The structure of the Indian cooking machine consists of four essential parts: feeding mechanism, the mechanism of leaving the material out in the middle process, wok movement mechanism and stirring-fry and dispersing mechanism. The cooperation of these four parts can fulfil. The wok movement mechanism is the core mechanism of the automatic cooking machine. The wok is shook and leaned by hand, when this work is finished manually. So the design of the wok movement mechanism is the key for the machine. The functions are shown in the following:

1) Heat the ingredients evenly.

2) Cooperate with the stir-fry and dispersing mechanism.

3) Cooperate with the mechanism of leaving material out in the middle process.

4) Make the agglomerate ingredients in the wok turn over fully or partly.

5) Pour the used oil or water into the oil tank or waste trough.

Therefore, we can obtain ș, the angle of acceleration of point c with the direction x. These movements can implement the actions below:

- *Level moving can move the wok center along the curve. In different positions, the wok can cooperate with others to add ingredients and put the material out in the middle process.*
- *Shaking the wok is the basic movement of Indian Cuisine, which can make the food heated evenly, and also can fully turn over the agglomerate ingredients in the wok by changing the velocity and acceleration. The velocity of shaking wok should not be too fast, or the ingredients may be thrown out. he angle curve of acceleration in the direction x. It is noted that the wok will make shift of velocity and rotation movement even though the shaking makes uniform motion. Moreover there is always a time when the acceleration changes most greatly in one period of motion. At that moment, the force applied to the ingredients is the biggest, and the state of motion change is also the most obvious.*

The feeding mechanism

For automatic cooking machine, there will be a standard menu in which the kinds and rates of ingredients have been determined, so this mechanism just needs to send the various ingredients into the wok accurately at the pre-arranged time. According to the steps of cooking in Table 1, we can divide the feeding box into 4 parts, and keeping oil, major ingredients, and minor ingredients and seasoning separately in each parts, then seal them with the film.

When the driving wheel rotates clockwise, force F1 and F2 will make the elastic axis rotate clockwise and move parallel in *x* direction, thus tear out the film, so that the ingredients will drop into the wok which has already been moved accurately under it. So the function of feeding ingredients is automatically achieved.

The fire control system

The fire control is the key and also the difficult points for automatic cooking machine to imitate the real cooking methods. It aims at achieving intelligent step-less nonlinear control of the cooking-power according to different dishes, flow-rate of flammable gases in different area.

The fire control unit consists of the micro-processor controlling part, the action performing part, the temperature closed-loop part and the safety monitoring part.

The micro-processor controlling

We use the micro-processor MC56F8322 deal with the signal processing, the temperature closed-loop control, safety monitoring and the control of different valves.

These tasks require wide temperature adaptation and high operation speed. We can also run the corresponding real-time operation system

Temperature Closed-Loop

Temperature closed-loop control can be achieved by detecting temperature at fixed positions. Because wide temperature adaptation is required, we can choose the thermal radiation sensor and platinum resistance by means of difference amplifying and nonlinear revising to get reliable temperature measurement. Temperature measured at fixed positions is not only a reference for the cooking-power control but also a feedback of the control effect.

So the key point is the determination of reliable measuring points. The temperature measuring can monitor the cooking-power. With repeated linear fittings having been made and parameter compensated in formal simulation we can make accurate calculation of the cooking- power intensity.

The Safety Monitoring

As it concerns the flow-rate control of flammable gases and gas appliances should reach the safety certification standards, so the security of the system is especially important. CO concentration sensors are used for safety monitoring, and the flow-rate of flammable gas is controlled by the security valve.

Safety alarm can be made by the cooking-power intensity controlling system and the main controlling system, which require timely maintenance.

4. Experiments

In order to validate the function of the cooking machine, experiments are performed. By the automatic cooking of several kinds of dishes, such as Shredded Pork with Garlic Sauce, Curry Pinion of Chicken, Bean Curd Home Style and Double Cooked Pork, the machine can cook delicious foods automatically and achieve the anticipated effect.

Fig.1 The dishes auto-cooked by the machine

Table 2: The final score for the four typical Indian dishes by Indian cuisine experts

No	Name	Color	Scent	Sapor	Meaning	Shape	nutrition
1	Shredded Pork with Garlic Sauce	E	G	E	E	G	E
2	Curry Pinion of Chicken	G	E	E	E	G	E
3	Bean Curd Home Style	E	G	E	E	G	E
4	Double Cooked Pork	E	E	E	E	G	E

By analyzing the system requirements, the function and characteristics of the machine, the paper designs the mechanisms of the machine as 4 parts: feeding mechanism, the mechanism of leaving the material in the middle process, wok movement mechanism and stirring-fry and dispersing mechanism. Experiments proved that, the cooperation of these 4 parts can fulfil automatic cooking of most Indian foods, especially the stir-fry dish series. Meanwhile it also provides upgrading space for promoting the system. Experiment results show that, the machine has already realized Indian cooking technics, and achieved perfect effects in colour, scent, sapor, meaning, shape and nutrition. Because the new cooking machine produce different dishes under the different digital files without any help from human being in the meantime of the cooking process, so the efficiency of the cooking machine can be greatly improved.

The Table 2 shows the final score for the four typical Indian dishes by Indian cuisine experts. We can see from above table, the score of the shape of these dishes is only G because they are placed by operator himself. Except the score of the shape, others are almost excellent. Experimental results prove that the new automatic cooking machine for Indian dishes is effective, stable and convenient.

5. Conclusion and Future Work

Indian cuisine is the most difficult cooking method in the world. At present, cooking labor is the main part in social activity. Based on Indian cooking technics, an automatic cooking machine for Indian dishes is developed in this paper. By analysing the system requirements, the function and characteristics of the machine, the paper designs the mechanisms of the machine as 4 parts: feeding mechanism, the mechanism

of leaving the material in the middle process, wok movement mechanism and stirring-fry and dispersing mechanism. Experiments proved that, the cooperation of these 4 parts can fulfil automatic cooking of most Indian foods, especially the stir-fry dish series. Meanwhile it also provides upgrading space for promoting the system. Experiment results show that, the machine has already realized Indian cooking technics, and achieved perfect effects in colour, scent, sapor, meaning, shape and nutrition. Because the new cooking machine produce different dishes under the different digital files without any help from human being in the meantime of the cooking process, so the efficiency of the cooking machine can be greatly improved.

Declarations

Source of Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Consent for publication

We declare that we consented for the publication of this research work.

Code availability

The programming code that we have used for this research is available and authors are willing to share when it is required.

References

[1]. Mary Varsha Peter, V. Priya, H. Petchammal, N. Muthukumaran, 'Finger Print Based Smart Voting System', Asian Journal of Applied Science and Technology, Vol. 2, No. 2, pp. 357-361, April 2018.

[2]. F.M.Aiysha Farzana, Hameedhul Arshadh. A, Ganesan. J, N. Muthukumaran, 'High Performance VLSI Architecture for Advanced QPSK Modems', Asian Journal of Applied Science and Technology, Vol. 3, No. 1, pp. 45-49, January 2019.

[3]. A.Srinithi, E.Sumathi, K.Sushmithawathi, M.Vaishnavi, N. Muthukumaran, 'An Embedded Based Integrated Flood Forecasting through HAM Communication', Asian Journal of Applied Science and Technology, Vol. 3, No. 1, pp. 63-67, January 2019.

[4]. N. Muthukumaran and R. Ravi, 'VLSI Implementations of Compressive Image Acquisition using Block Based Compression Algorithm', The International Arab Journal of Information Technology, vol. 12, no. 4, pp. 333-339, July 2015.

[5]. F.M. Aiysha Farzana, Hameedhul Arshadh. A, Sara Safreen. M, N. Muthukumaran, 'Design and Analysis for Removing Salt and Pepper Noise in Image Processing', Indo-Iranian Journal of Scientific Research, Vol. 3, No. 1, pp. 42-47, January 2019.

[6]. F.M. Aiysha Farzana, Abhinaya. M.K, Friska, N. Muthukumaran, 'Design of Button Antenna for Wireless Body Network using HFSS', Indo-Iranian Journal of Scientific Research, Vol. 3, No. 1, pp. 48-54.

[7]. J. Keziah, N. Muthukumaran, 'Design of K Band Transmitting Antenna for Harbor Surveillance Radar Application', International Journal on Applications in Electrical and Electronics Engineering, Vol. 2, No. 5, pp. 16-20, May 2016.

[8]. N. Muthukumaran, R. Joshua Samuel Raj, Arumugathammal. E, Karthika. N, Karthika. S, Sangeetha. M, 'Design of Underground Mine Detecting Robot using Sensor Network', International Journal of Emerging Technology and Innovative Engineering, Volume 5, Issue 7, pp. 519-524, July 2019.

[9]. VP. Anubala, N. Muthukumaran and R. Nikitha, 'Performance Analysis of Hookworm Detection using Deep Convolutional Neural Network', 2018 International Conference on Smart Systems and Inventive Technology, pp. 348-354, 2018, doi: 10.1109/ICSSIT.2018.8748645.

[10]. N. Muthukumaran, R. Joshua Samuel Raj, Manjula. R, Pavithra. L, Nagalakshmi. T, 'Automatic Identification and Management in Parking Lot through IOT', International Journal of Emerging Technology and Innovative Engineering, Volume 5, Issue 7, pp. 539-543, July 2019.

[11]. N. Muthukumaran, R. Joshua Samuel Raj, Surya. A, Thameez Muhyideen. M, Narayanan @ Vinoth kumar. T, 'Intelligent Sensor Based Monitoring System for Underwater Pollution', International Journal of Emerging Technology and Innovative Engineering, Volume 5, Issue 7, pp. 576-580, July 2019.

[12]. N. Muthukumaran, 'Analyzing Throughput of MANET with Reduced Packet Loss', Wireless Personal Communications, Vol. 97, No. 1, pp. 565-578, November 2017.

[13]. P. Venkateswari, E. Jebitha Steffy, N. Muthukumaran, 'License Plate cognizance by Ocular Character Perception', International Research Journal of Engineering and Technology, Vol. 5, No. 2, pp. 536-542, February 2018.

[14]. N. Muthukumaran, R.Sonya, Rajashekhara, V. Chitra, 'Computation of Optimum ATC Using Generator Participation Factor in Deregulated System', International Journal of Advanced Research Trends in Engineering and Technology, Vol. 4, No. 1, pp. 8-11, January 2017.

[15]. B. Manoj Kumar, N. Muthukumaran, 'Design of Low power high Speed CASCADED Double Tail Comparator', International Journal of Advanced Research in Biology Engineering Science and Technology, Vol. 2, No. 4, pp.18-22, June 2016.

[16]. B. Renuka, B. Sivaranjani, A. Maha Lakshmi, N. Muthukumaran, 'Automatic Enemy Detecting Defense Robot by using Face Detection Technique', Asian Journal of Applied Science and Technology, Vol. 2, No. 2, pp. 495-501, April 2018.

[17]. M. Ruban Kingston, N. Muthukumaran, R. Ravi, 'A Novel Scheme of CMOS VCO Design with reduce number of Transistors using 180nm CAD Tool', International Journal of Applied Engineering Research, Volume. 10, No. 14, pp. 11934-11938, 2015.

[18]. N. Muthukumaran and R. Ravi, 'The Performance Analysis of Fast Efficient Lossless Satellite Image Compression and Decompression for Wavelet Based Algorithm', Wireless Personal Communications, Volume. 81, No. 2, pp. 839-859, March 2015.

[19]. R. Sudhashree, N. Muthukumaran, 'Analysis of Low Complexity Memory Footprint Reduction for Delay and Area Efficient Realization of 2D FIR Filters', International Journal of Applied Engineering Research, Vol. 10, No. 20, pp. 16101-16105, 2015.

[20]. A. Aruna, Y.Bibisha Mol, G.Delcy, N. Muthukumaran, 'Arduino Powered Obstacles Avoidance for Visually Impaired Person', Asian Journal of Applied Science and Technology, Vol. 2, No. 2, pp. 101-106, April 2018.

[21]. N. Muthukumaran and R. Ravi, 'Hardware Implementation of Architecture Techniques for Fast Efficient loss less Image Compression System', Wireless Personal Communications, Volume. 90, No. 3, pp. 1291-1315, October 2016.