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Research Article

Automatic Dosa Making Bot Using Artificial Intelligence And Real-Time Image Processing

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Abstract

Nowadays, in this cutting edge and innovative way of life, cooking may be a major frenzied, boring and time expending assignment that a person has to perform. Subsequently this circumstance is made less demanding by the exceedingly inventive cooking robot. This paper describes about the design of an automatic dosa making robot that uses the real time image processing with the assistance of a raspberry Pi module stacked with sensors performing the programmed task and a camera for monitoring. The objective of our project is to make an expansive sum of perfectly finished delicious crispy dosas in a constrained time which eliminates the manpower and time consumption. The stepper motors connected in this framework for carrying and rotation motion of the system. The 3D printed gear box increases the torque and for efficient rotation of gear works in 1:16 ratio. The input is given through the LCD touch display to determine the shape and size of the dosa. It uses the Single Shot Detection technique in object detection algorithm to perform the task which is coded in python language. The cooking process is being persistently observed to dodge cooking flaws.

Key words: Object Detection Algorithm,3D printed gear box, Python, Raspberry Pi4

1. Introduction

Nowadays, preparation or cooking of food has become hectic, boring and time-consuming task for most of the people especially for women. This project aims to develop intelligent service robots that operate in standard human environments, automating common task. This device is surely going to eliminate the manual power as it is completely automatic and will replace most of the human work, time and energy. Robot and automation are said to reduce manufacturing jobs but actually they create more desirable jobs, like engineering, equipment maintenance, and also free up man power critical constraints. They also provide an appropriate user interface for controlling complicated real-world tasks. Raspberry pi has found its way in many useful and changeable implementation in robotic systems. It does not implement any usual motor control peripherals and it is available at low cost. The python code has been used for adjusting servo motor position manually.

The main objective of this project is to design a system using Raspberry pi4 which could

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enable efficient cooking in lesser time. This model aids in time efficient cooking in the absence of manpower. It also satisfies the criteria of fast production, stable and moderate cost. This paper proposes to create robotic arm with real time image processing using pi cam which uses artificial intelligence for the identification and working process in comparison with the video and pictures already being saved in its memory. The stepper motors are used for carrying and rotation motion. The cooking is being continuously monitored to avoid cooking flaws. These instructions are being fed to the raspberry pi inbuilt in python language using ROS. The sensing of temperature is done for obtaining a perfect finish in cooking.

2. Existing system

The aiding of number of algorithms of analytical approach in computer for depicting identical dosas on the original pan which is the working of the embedded system. This article deals with the interconnection between regions, as long as there is technology in this region that can be extended to different regions to achieve the necessary goals. This technique is able to developing good dosa with desirable size &shape without effort of human and gives an advantage of excessive definiteness and accuracy. In implementation of this larva, Inkscape open deliver software program system, G -code sender and warming system square had been degree hired.

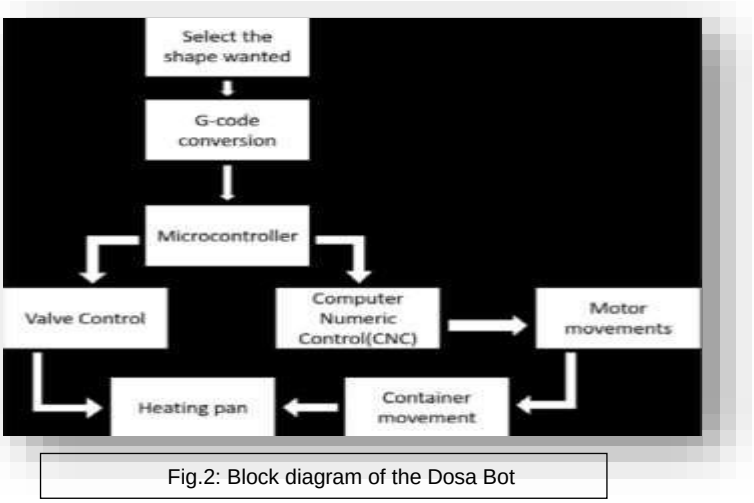

Fig.2: Block diagram of the Dosa Bot

The operated space of the larva twins because the dimension of the inducting pan. The creation of moveable larva which can also additionally circulate round and recognize matters by itself. It generates DOSA on completely different metals and transfers heat between the DOSA and the pan. By combining the Arduino ATMEGA 328 controller with computer options, a low-cost CNC machine tool can be manufactured. It makes use of the G-code for the operating system. Different three-dimensional layering techniques square degree hired in numerous food manufacturing machines.

At the point where the dosa dough falls on the bowl (X-Y coordinates), we tend to use a reverse mechanism to follow the rotation of the motor so that the nozzle of the dough bowl reaches here. This calculation is done in software, and the directions squared address is transferred to the microcontroller so that it can send the information to the CNC one by one. Then, the CNC revolves the motor accordingly. However, in order to bring the bowl to the actual

position, the motor is connected by a belt, and the belt moves in accordance with the rotation of the motor. Usually, we don't just connect the belt to the motor, but use four pulleys to run the belt. Due to this structure, we only need 2 stepper motors to achieve 2-axis motion. The pulleys are located at the four corners of the net. Therefore, we tend to choose a square layout. The belt runs on the four pulleys and has a design similar to the ("+") mode. When the two motors move clockwise or counter clockwise, the bowl moves along the coordinate axis. And, every time the motor moves incorrectly, the glass will move along the coordinate axis. By combining these two methods, you can reach the desired position wherever the bowl moves. The CNC next to the G code command controls the movement of the motor to make the beaker reach its target. After setting up the entire mechanism, move the beaker to the target position and open its mouthpiece through the servo motor as the batter is poured on the pan. This servo motor works according to the instructions given. There is a vacuum pump that endlessly pumps air into the beaker to build pressure and push the mass. The pan is heated by the induction coil under the pan. The heat of the pan is maintained by electrical equipment. At the end of the dosa, the beaker returns to its original position and is fixed.

3. Proposed system

Our project aids human less cooking with the usage of this robotic bot arm with artificial intelligence and real time image processing with the aid of using object detection algorithm (ODA) and the usage of Single Shot detector (SSD) for detecting a couple of gadgets in single shot. The ontological memory that's fed into the main memory of the robot is used for detection algorithms known as Single Shot multibox Detection (SSD). The components like camera and temperature sensor are attached to the raspberry pi and on the gripper for monitoring the whole setup and to sense the temperature of the pan respectively. The camera scans the ingredients and objects

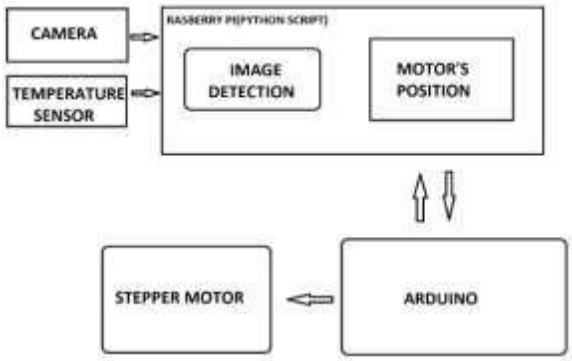

Fig 3.a. Basic Block Diagram Architecture of robotic arm

which are needed for cooking the dosa and the temperature sensor record the temperature of the entire cooking process. These data from the camera and the temperature sensor are fed into the raspberry pi where the image detection takes place. For every image detection task, the motor position is determined. Once the image detection and the motor's positions are decided, the raspberry pi transmits that data to the Arduino through the establish serial communication. After the data are received, they are fed to the stepper motors in the robotic arm for the motion and rotation of the system in the desirable direction.

Object detection algorithm

Object detection is one of the techniques that related to image processing and computer vision that offers with semantic item detection including building, car, or humans in the form of digital images and videos. Computer vision such as retrieval of photograph and video surveillance are the regions in which the item detection has many applications. Among the numerous strategies in object detection strategies, we use Single Shot MultiBox Detector (SSD) in Neural network approaches.

the classification of objects with the aid of using KNOWROB*3.1.1. 3.1.1. Single Shot MultiBox Detector*

that's an open-source knowledge processing machine

framework. The Time-of-Flight Camera (TOF) is used for taking pictures for resolving the gap among the item being detected and the robot camera's photo for every factor of time by using the laser or LED by measure of the signal of round- trip time which is given by Drost'etal method

Fig3.a, gives the block diagram of the serial communication is established between a capable of little device which acts as a tiny and affordable computer called raspberry pi and a physical programmable circuit board called Arduino. This communication platform is constructed for the data transmission between them.

In raspberry Pi, the two major function such as image detection and motor's position control are carried out. These works are performed and executed by raspberry pi using the instructions which are coded in a python language. Then detection of the image is achieved using one of the object Using multibox, the Single Shot detector detects the couple of gadgets in a photograph through taking best one shot. This item detection set of rules is surprisingly correct and quicker in speed. The two components play principal function in SSD, they are the spine version and SSD head. From the input image, the semantic which means it is extracted while on the lower resolution, the spatial structure of the image has been preserved. The one or greater convolutional layers are joined to shape the SSD head and with inside the spatial area of the very last layers activations, the output including the bounding bins and classes of objects are interpreted

Raspberry Pi

Raspberry Pi is a small tiny board which is capable of performing various tasks is the firm foundation of our project with faster RAM of 8GB, a 1.5-GHz Broadcom CPU and GPU.

An electronic open-source platform which is employed in functioning a perfect task of transmitting and receiving the data from Raspberry pi and the other components and vice versa.

Pi camera

The Pi camera module, a transportable lightweight weight camera that supports Raspberry Pi. It uses the MIPI camera serial interface protocol which communicates with Pi. It's commonly utilized in various works such as image process, machine learning equipped with a high quality 8-megapixel Sony IMX219 image sensor.

Stepper motors

Stepper motors are one of the DC motors that works in discrete steps. They are wounded with numerous amounts of multiple coils that are organized in gathering known as phases. When these phases are energized, the motor rotates one step at a time which is best choice for application with precision motion control. A hybrid stepping motor with a steep angle of 1.8° that is of 200 steps/revolutionist known as NEMA 17 Stepper motor. The voltage of 1.2 A at 4 V is drawn by each phase in this motor which is allowing of 3.2 kg-cm holding torque. They are used in Printers, CNC machines and Laser Cutters.

A4988 is a motor drive

The A4988 is a motor drive which completely drives the motor by micro stepping technique along with the Arduino. It's an IC which is equipped with a built-in translator for driving any

stepper motor for controlling and easy operation.

An enclosed system in which the mechanical energy is transmitted to all output device in the system. Its main function is of modifying the torque, varying the ratio of speed and rotation rate that is being fed to the output.

Temperature sensor

Nuts and bolts are the fastener components which are joined together using the friction created by the threaded structure in it. They are used for joining, holding and firmly holding the parts of the system perfectly.

Metallic Body

An aluminium along with iron metal is used as the body of our bot for a classic look. This aluminium and iron body gives perfect shape and easy to carry as it is soft, light-weight and malleable material. Nuts and bolts are the fastener components which are joined together using the friction created by the threaded structure in it. They are used for joining holding and firmly holding the parts of the system perfectly.

Circuit Diagram

From fig.3. b. of our proposed system, we conclude that our dosa bot is effective and very efficient in preparing the perfect finished dosa in a fraction of time. This bot not only a cost efficient but also a simple and compact system. It is an automatic dosa preparing system that can prepare numerous numbers of dosas in a limited amount of time. The consumer need not to worry about the cooking process in his/her busy schedule as it eliminates the manly cooking and performs its task by executing the instructions fed in its memory as a python code. By using the object detection algorithm, it easily achieves the identification of the object required in this

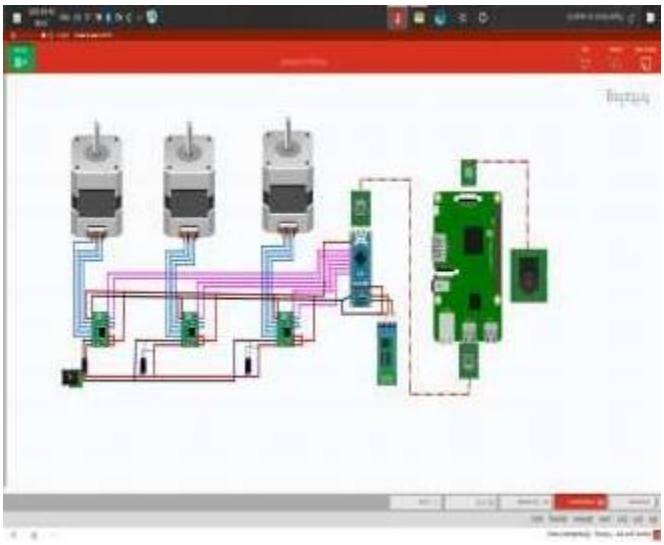

Fig 3.b. Circuit Diagram of the proposed bot

process. It doesn't require any internet sources to operate the system. The power consumption is

less as the cooking process can be finished in a limited amount of time in which it involves in making more dosas simultaneously.

4. Result

This is the working model of our project that we have built and the working process is captured at different states of iits actions.

Fig.4.a: Camera capturing the picture of the surrounding

Fig.4.b: Lifting the spatula and taking the batter

Fig.4.c: Pouring of batter in the pan

Fig.4.d: Rotating the arm to make the batter into circle

Fig.4.e: Camera monitoring the cooking of dosa

5. Conclusion

We presented a conceptual prototype of dosa making bot in this paper. We did a very detailed research on this project to make this bot set aside from crowd for its unique features and abilities. We have successfully made a robotic arm which uses artificial intelligence with corresponding software to efficiently give us a pan cake which can reduce human effort and aid in repeated task of dosa making. It has high capacities of torque, grippers and power in small and large industries with manual control. The main motive of the creation of this bot is that this will be very much helpful for old age people and handicapped people.

6. Future Enhancement

Our future goal is to make it work much effectively in the real world. We will try different varieties of dosa of various sizes and shapes. This dosa making bot is not in moveable, so we are planning to implement a movable bot which can make dosa more easily and the space of cooking will be increased.

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