IOT BASED VOICEROWAVE OVEN

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ABSTRACT

In this paper, we are developing a Microwave Oven that has the ability to hear to the user and fetch instructions using Voice Commands apart from its usual way of getting commands from Keypad. The project is supported with Internet so that user can easily control it online and feed command on it, if the user is far from it. Aside from this, there is a predefined database which stores some food item with their quantity and timing to cook it, just for fast cooking. There is a smoke sensor that cuts the supply if the food item gets burnt or produces any gas or smoke.

Keywords: Magnetron, Raspberry Pi, Microwave Oven, Proteus Software, Python, Embedded System, Smoke Sensor, IOT.

HISTORY

Percy Lebaron Spencer was an American physicist and innovator who patented the microwave oven in 1946. He was the leading expert in Radar Tube designing and works under the US Department of Defense as the Chief of Power Tube Division.

He was working on Magnetrons, a high powered vacuum tube used to generate microwaves, and being close to a dynamic radar, he came to know that a candy in his pocked had softened down and melted. He was the first to notice this and research this wonder of microwave cooking. He drove out numerous experiments which incorporates the cooking of popcorns and eggs inside an encased metal box. He, in this manner had created his first microwave oven by encasing a high density electromagnetic field generator over an enclosed metal box which forbids the escape of radiations outside the box. He had given the name "Radarange" to his first microwave oven, which is commercialized in 1947.

INTRODUCTION

A typical microwave oven works on generation of microwave radiation from a high density electromagnetic field generator such as a Magnetron which takes 2200V electrical input supply and produces a frequency of 2340MHz, which is simply ideal for a microwave oven to play out its task. The magnetron is settled inside a solid metal box. There, the microwaves are then fired on the food through waveguides, which guides the microwaves from magnetron to the food compartment of the oven. The food inside the food chamber is kept on a glass turntable, which is a high thickness glass plate that permits the microwave to go through it. The turntable spins gradually as the microwaves are being fired onto the food. This process is done to evenly cook the food inside out.
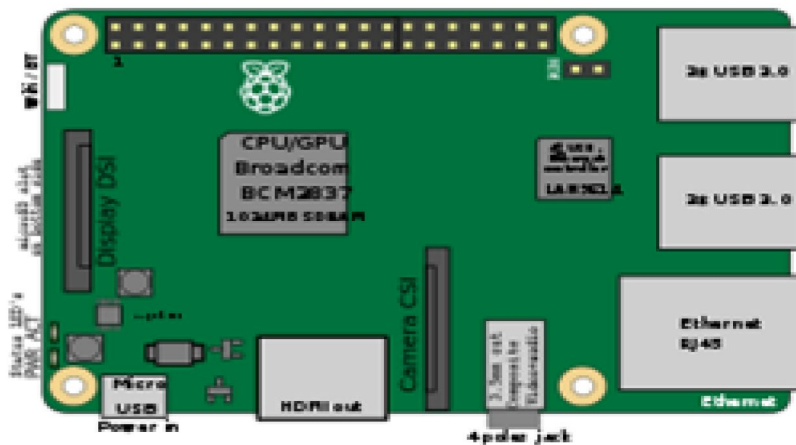
MAGNETRON

A magnetron is a high powered, multi-cavity vacuum tube device that fills in as an oscillator and aids in the production of electromagnetic RF waves. A magnetron consists of a cathode (yellow), a ring shaped anode (red) with multiple cavities. When a magnetron is turned on, the electrons emit from cathode and move towards anode in a straight line (black arrow). A strong magnet is set below the anode which generates magnetic strength along the length of tube.
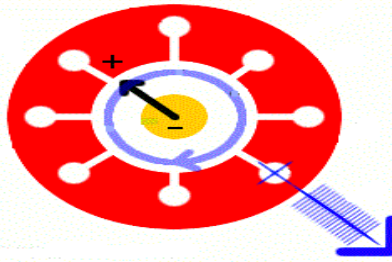
When the electrons move from cathode to anode, they go through an electric field extended between the cathode and the anode, and a magnetic field which is produced by the magnet, in the meantime. An electrically charged particle which moves in this magnetic field, experience the field force and follow a bended path (blue hover) instead of a straight path, speeding up in between the cavity of cathode and anode. The electrons then transmit its energy to cavity and the cavity then starts resonating. This resonation ultimately results in outflow or emission of microwave radiation.

RASPBERRY PI

Raspberry Pi 3 Model B is the third generation of Raspberry Pi series. It is powered with Broadcom BCM2837 (1.2GHz Quad-Core ARM Cortex A53) microprocessor which is 10x more powerful and fast than its predecessors. It has 1GB of RAM and up to 32GB of Hard Drive. In terms of connectivity it support Wi-Fi, Ethernet and Bluetooth. The device works on Raspbian OS and is best suited for IOT application.

WORKING OF MICROWAVE OVEN

When the oven is turned on, the microwaves are fired onto the food chamber by magnetron. The microwaves bounces back and forth off the reflective metal surface of the food chamber. When it reaches food, it does not reflect, instead it penetrates the food. The water molecules in the food are polar in nature, therefore the molecules tries to arrange itself in the direction of electromagnetic wave and starts oscillating. This oscillation generates heat in the molecule and hence the food starts heating up. The more microwaves are fired on the food, the more heat is generated. This way, the food is cooked at molecular level and produces even cooking of food.
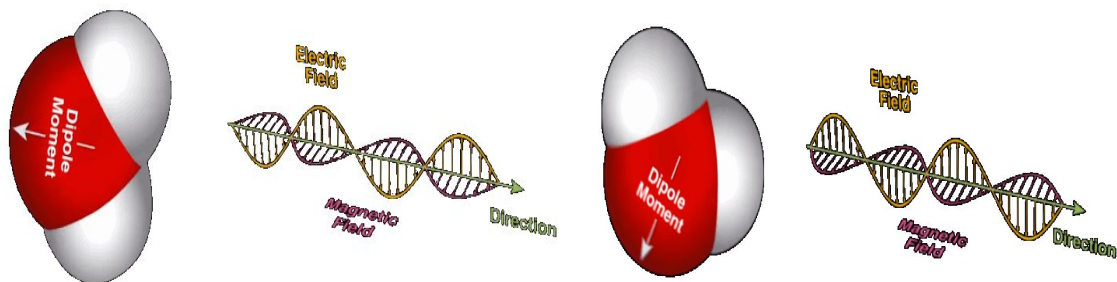
NEW DEVICE ACTION

When the device is turned on, the control unit gets power and it waits for the instruction from the user. The magnetron during this time will not receive any power. The device has dual operating modes, voice mode and manual mode which is specified by a 2 way switch. In manual mode, the gadget is controlled with keypad and it is indistinguishable to the conventional microwave oven. In voice mode, the device is controlled utilizing microphone and speech recognition. Condition for voice controlling is accessibility of working internet association.

When the command is received by the control unit, the magnetron gets powered on and will stay on till the control unit again removes the power.

A speaker is additionally interfaced and work only in voice mode. It provides voice output for every command received and task fetched via internet or task completion. Speakers will also act as buzzer for smoke sensor and will produce alarm sound if smoke is produced during cooking. If smoke is detected, the oven immediately turns off.

During availability of internet, the oven is likewise included with its cook menu database. It means that its pre-stored cook menu database can be accessed and commands can be given to the oven remotely.
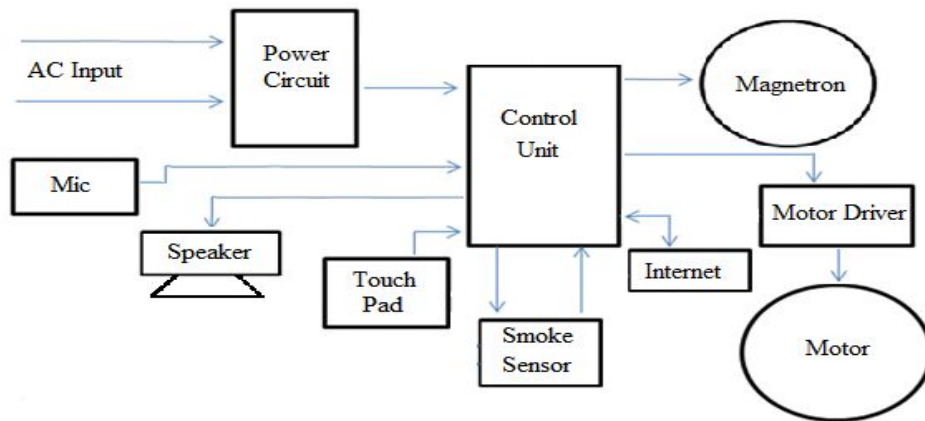

DESCRIPTION OF CIRCUIT DIAGRAM

The circuit diagram consists of three main parts, first is the magnetron unit, second is the chamber unit and last is the control unit. The magnetron unit consist of magnetron, high voltage transformer, high voltage diode, and high voltage capacitor. The chamber unit consist of fan motor, turntable motor and lamp. The control unit consist of Raspberry Pi, AC to DC converter circuit, and switching relays. The AC Power first goes to the control unit where DC 5V is generated which powers the Raspberry Pi and it becomes operational and waits for any command to be received.
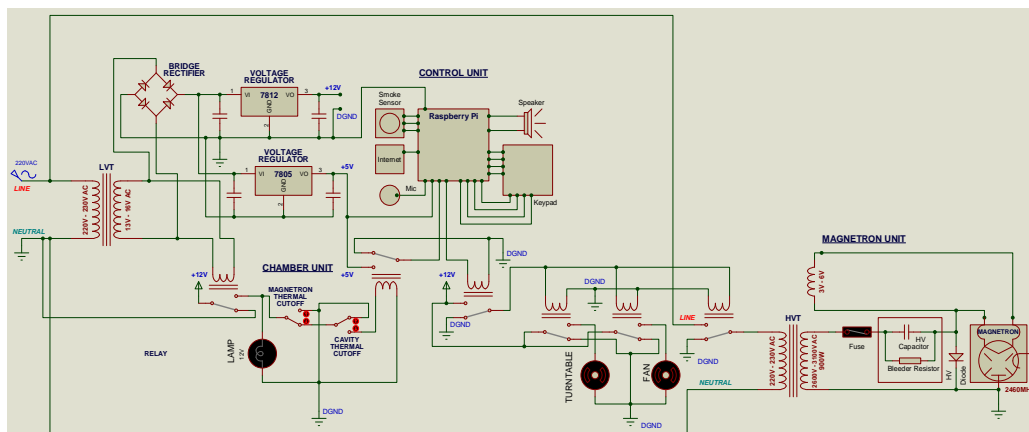
Command can be received either by keypad input or voice input. If voice input is used, Internet should be turned on. As soon as the command is received and recognized, the relays switches and the supply is turned on for magnetron and chamber unit. Apart from this, the door latch act as circuit breaker here, this means, if the door is open during or before operation, the microwave cooking will not process. This mechanism is just identical to the traditional microwave oven.
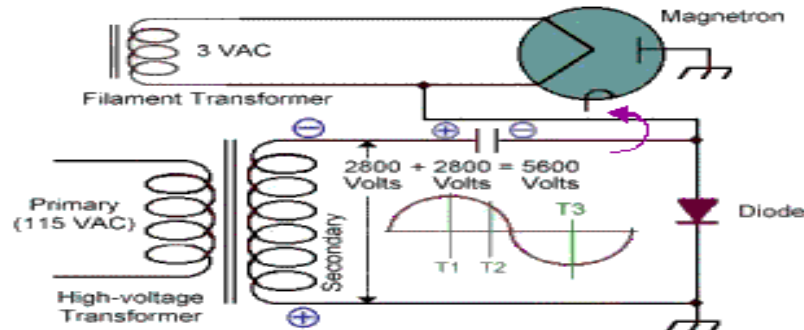
When the magnetron unit gets powered, the high voltage transformer produces 2800V, but this is just not enough to efficiently power the magnetron. Hence, high voltage capacitor and diode circuit is used which act as a voltage doubler circuit. The use of this circuit is to double the applied voltage and produce 5600V which should be applied to the magnetron cathode for the production of microwaves.

CONCLUSION

The new system had been designed using Broadcom BCM2837 microprocessor embedded on Raspberry Pi, Microphone, Smoke Sensor MQ2, Audio Speaker, AC Relays and the traditional microwave oven components. The new system can be controlled using a switch that produces two operating modes of working, Manual and Voice. Manual mode is operated using keypad and Voice mode is operated using microphone. Manual mode will work in unavailability of Internet but Voice mode cannot work. Active internet connection is mandatory for voice mode and online accessibility. The device can be controlled remotely online by use of an app made particularly for this specific gadget. At any point of time, if any sort of smoke is generated in the food chamber, the operation is ended instantly and a buzzer is activated and an Email is sent to the client, informing them about the situation.

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