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Portable DC Induction Stove using Solar Energy

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Abstract

The purpose of the project is to replace old wood fuel stoves with an eco-friendly solar stove .A solar stove is a device which uses the energy of sunlight to heat food or drink or to sterilize it.the vast variety of the solar stove presently in use are cheap ,low tech devices.becausethey use no fuel and cost ,nothing to operate ,they reduce air pollution and deforestation. Solar cooking is a form of outdoor cooking and is often used in situations where minimal fuel consumption is important, or the danger of accidental fires is high.Alternate source of energy is always a green approach of energy consumption, in the time of crises of energy and global warming. Use of solar energy for cooking is a better solution, but still not established as user friendliness and economic aspect. Food is the basic need of human beings. Food can be cooked with conventional fuels like wood, cow-dung, kerosene, Liquid Petroleum Gas and electricity. Solar stove is a clean and eco-friendly energy device for cooking. There are a large number of solar stovesdesignedanddeveloped by scientistsandresearchersall overthe worldbutstill the utilization of solar stoves is not sufficient. There are many reasons for the insufficient use of a solar stove like, its bulky size, heavy weight, lack of open space, slow cooking, fixed timing for cooking, less awareness etc. In these paper different solar stoves like solar panel stoves, solar parabolic stoves, solar box type stoves and hybrid solar stoves etc. are discussed in detail. Still a lot of modifications are required to make the solar stoves user friendly, lighter in weight, smaller in size and still economical. Development of a photovoltaic and thermal hybrid solar stove has started a new horizon in the field of solar stove as the cooking is faster than conventional box type solar stove and can be used at a user's convenient time. The stove wasconvertedintoasolar dryer by small modification and was used fordrying vegetables. Still lots of scopes are there for research in solar stove especially for small size domestic solar stove.

Keywords– Induction stove, magnetic field, heatingperformance, coil.

1. Introduction

There is an ongoing effort to reduce the CO_2 footprint released into the atmosphere; this is a pending concern due to recent studies in climate change and other studies. Many initiatives have been considered to protect the environment, among these , there have been somesuggestions for the implementation of renewable energy.It is also important to note that it is just as important to use this energy efficiently in a responsible manner.

In recent years, Ecuador had an increase in generation of clean power from hydro plants projects, and it will become energy independent for current demand, and in the future, it will be a source of energy forneighboring countries. For these reasons, Ecuador is also planning for reducing the natural gas consumption, at this moment subsidized by the government which will make better use of the energy surplus. As an additional measure to contribute to the new direction in energy production and management, there is a governmental initiative to migrate the current use of natural gas to electrical power for induction stoves. Induction cooking differs from all other methods of cooking; this is due that the heat from the pot is directly generated at the pot from the stove. This technology is currently one of the highest rated, in terms of efficiency of power transfer is above 80%. However, the current topology employed for most stoves produces a large amount of switching noise and harmonic distortion due to its high commutation frequencies required for heating the pot; these problems can be solvedby using solar energy.

2. Existing System

Various attempts have been made by the researchers to use portable dc induction stoves using solar energy.Some of the existing systems are an induction cooking system with an induction heating system comprising a shell, a heat insulation clapboard, a power supply layer and a base board. Control keys are arranged on the panel.The Induction Heating system utilizes electricity to generate heat, whereas solar energy is the largest available energy source for heat generation. Combining solar energy with the induction heat generation technique is the efficient solution for heat generation. The existingsystem shows an effective control scheme incorporated in half-bridge series resonance induction heating using solar energy. Induction Cooking demonstrates the possibility of cooking food for done people within 36 minutes using 0.7kWh of energy. More efficient than traditional methods.Use of expensive and higher rated 220v AC 3kVA inverter

3. Proposed System

Induction heating is generated thru an electromagnetic power transfer from alternating current at the wall outlet into a metal item. The flow of alternating current is conducted electrically through a coil, which generates an alternating magnetic field at high frequency, this magnetic field is then coupled into the metal container or item; where the flow of magnetic currents induces a current flow thru the item as described by Ampere’s and Faraday’s law, the inflow of current thru the metal item generates heat as per Joule’s heating principle The magnetic field generated by the coil will only induce currents in conductive mediums, for this reason it will only heat metal utensils used for cooking such as pots, frying pans,cooking trays, etc.The material of these utensils also must be taken into account as this has an effect on the operation. The direct energy transfer from the stove into the cooking utensil does not heat up the surfaces separating the working coil from the utensil, this power transfer and low dispersion heating losses is what gives induction stoves their efficiency.

The solar provides the energy to heat the coil. Since we use solar, it can be gotten from a natural source itself. We can store the energy and use it later. This project will focus on using electric power for cooking using solar panels. There is a common way for electric stoves to function which is driving current through the resistive element.Using induction heating, efficiency as high as 90% or more can be realized.

3.1 Solar

The solar is the primary source of supply for the cooker. Solar is made up of photovoltaic cells that convert solar energy into electrical energy in the form of direct current. PV modules generate electricity from the sun. Due to the non-linear characteristics of the PV system, the output power is not constant all the times throughout the day. In this design, batteries, and DC-to-DC converters work together with PV systems to regulate the voltage of the PV systems.

Figure 1 Stove

In this research, solar is the main source power for heating the induction coil and a 300W solar panel is used. This unit depends on the sun radiation to supply energy. The solar panel (PV) is connected to the super capacitor, and it is to store the millivolt which comes out from the PV. The super capacitor connected to the DC/DC (Buck Boost) converter. That the PV output voltage is unstable and it changes to high and low voltage depends on the luminous intensity. Also, the PWM driver is connected to the DC/D converter because it gives the constant pulse to the voltage. So the DC/DC converter gives the stable output like 12V/24V.From that, directly given to charge the battery. Then the battery again connected to the DC/DC converter and it directly connected to the DC heater. In this process the PIC microcontroller will act as CPU and control all the process and timing given to the other components. For that, the power supply is given to the PIC Microcontroller.

3.2 Components Required

3.2 1 Hardware Used

- PIC16F877A Microcontroller
- Solar panel (PV)
- Supercapacitor
- DC/DC (Buck-Boost) converter
- Battery
- DC heater
- Capacitor
- Diode
- 7805 regulator IC
- SG3525 Driver

3.2.2 Software Used

- PicKit 2
- CCS Compiler

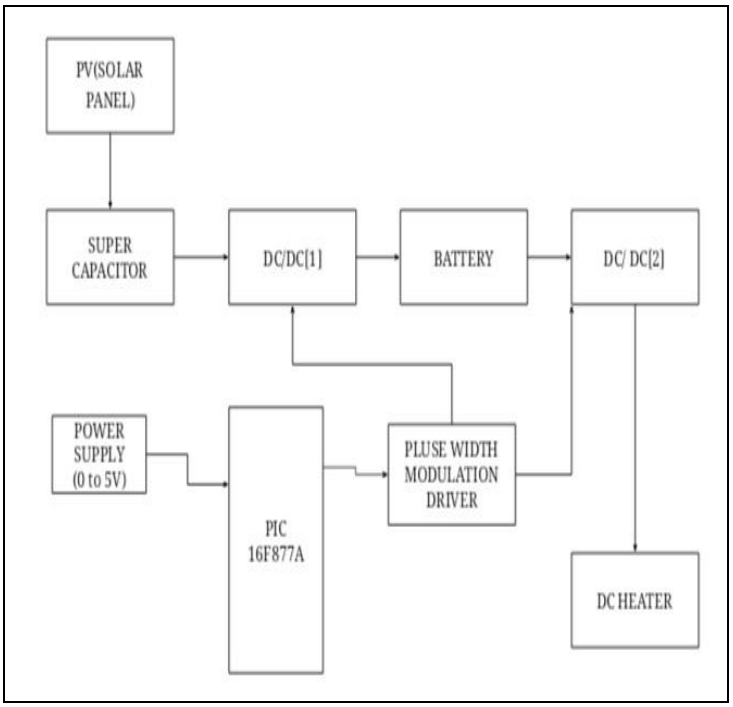

Figure 2 Block Diagram

Faster meal preparation with induction, heat is transferred directly to your cookware, not the surface of the cooktop.Easyto clean.Always the right Fit Consistent Delicious results with induction cooktop, you can control the temperature more precisely than gas or electric.Most widely in home use. Used also as a solar heater. It can be taken as wherever it is needed and it's a prototype model.

4. Conclusions

Developing an induction stove requires taking into account a vast number of variables for design and implementation, this includes both the power stage and the communications. This was handled with a single chip solution via a dsPIC microcontroller, which was able to handle all the scheduled tasks. As seen in the results from section III, the harmonic distortion of a full bridge series resonant converter is relativity low, and is capable of handling more power than conventional single ended parallel resonant converters; however this adds a level of complexity in the switching and timing signals and additional cost of the converter. However, the cost is justified with the additional features. The implementation of the application Smart Cook can benefit both beginners and experts, by adding remote access to both monitor and command the stove at the palm of their hands; this greatly reduces the time a person has to spend cooking, which frees time for other tasks.

5. Future Scope

For future works, it seems favorable to add an option for the user to input their own cook profiles and recipes tailored to their needs. Also as an option of future improving the power section; a space state control for both temperature and power simultaneously, this will grant better performance for boost operation.

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