IOT Based Low Power Solar Induction Heater with Auto Power Control

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ABSTRACT

Induction cooking is used now a days due to its high efficiency and safety. It is one of the most efficient cooking technology. In this system the temperature of the induction coil is automatically controlled by thermostat. The maximum temperature is 250c. In this system we have using DC-DC buck_boost converter. It has low power, the power consumption is about 500W. The components in this systems are solar panel, rechargeable battery, induction coil and power module. This project aims to design and build a solar powered induction heater. The merits of this system is less energy consumption, safe, efficient, quick heating and more efficiency.

Keyword: Solar panel, Induction coil, Buck- Boost converter

I. INTRODUCTION

In this paper, one of the most serious problem in the present days is the increasing cost and scarcity of cooking gas. Solar energy is used for cooking but this energy is not available for 24 hours. So it is not possible to use it in the night. So this energy has to be stored in the battery. This stored energy can be use to produce the electricity and further for induction heating. Induction cooking is the highly efficient technique for the cooking purpose when it combines with solar system it will provide the further solution for the cooking technology.

In solar induction have high initial cost, safety. The cooker presents the quick warming energy saving with high speed cooking with many temperature ranges. Induction cooking working the principle of electromagnetic induction by heating the cooking vessel directly. In case of rural area cooking is heavily dependent on inefficient biomass based cooking. The main problem include the time that is needed to collect the fire wood and other biomass by the people indoor air pollution induced health hazards and various other environmental concerns.

Now a days induction is widely used in domestical appliances because of it cleanness, high efficiency, safety, low cost and high performance. It is necessary to use the utensils made from conductive, magnetizedmaterial as cast iron, enamel and other specialized materials with a flat bottom, which can be 12-29 cm in diameter. Cooking is completely safe as the surface of the plate remains cold during cooking.

II. LITERATURE REVIEW

The journal paper[1] the two designs of box type cookers have been tested. The first type has a painted black base and second type has a painted black with goal. These design were examined under two modes of operation at fixed position and on tracking system. In paper [2] the advanced semiconductor induction heating equipment essentially consists of a power supply and a high power oscillator. The oscillator frequency is equal to the resonant frequency of the oscillating circuit.

The paper [3] to generate sufficient heat for cooking, cookware must be used that has relatively high permeability and resistivity. Typical induction cookers operate at switching frequency between 25 kHz and 50 kHz. The conventional electric and gas ranges chosen to represent baseline technologies in this side by side evaluation. The electric range has four resistive heating elements with exposed resistive coils, the largest of which is 8” and 2kW. The paper [4] says there are two types of electric heating, resistance heating, and induction heating. First one is low cost and second one is

easy maintains but there is low efficiency. Another method is induction heating, in this method inverter topology supplies high frequency current to the induction coil by producing alternating magnetic field.

The paper [5] says the resonant converter is of quasi resonant type. It uses a single switch implemented by IGBT which is operated in zero voltage switching condition. The output power is the function of the ON time of the IGBT. The resonant converter is capable of producing output power in the range from 40.8W to120W by drawing current in the range from 1.9A to 62.5A.Theanother paper [6] saystwo methods are used to generate high frequency namely hard switching and soft switching technique. Hard switching has higher power frequency in the LC circuit and it produces positive cycle as switching losses in the switching devices. Soft switching reduce those switching loses. However, it requires devices with low on state power losses. So MOSFET is preferred for switching operation.

The paper [7] says, this research is more about making the cooker a standalone, portable and smart in operation by switching between solar and mains automatically. Also the high frequency harmonics from a direct current supply is converted to alternating current using half bridge inverter. The FEM simulation model of conventional induction cooker is discussed in. This model focuses more on the two parts are namely wok and the coil. In paper [8] discussed about the solar powered induction cooking system. Each stage from solar panel, control circuit, battery, inverter and cook top is presented in details. The microcontroller and the LCD for cooking level indications and control.

In the paper[9] the main power circuit of a parallel resonant converter, such as typically used for induction heating applications. But the disadvantage is that it requires a bipolar power supply. In this paper, for the construction of the power system the IGBT is the most suitable to be used as a power source. The paper [10] says that the coil is connected to the source of pulsation with the frequency of about 25kHz. The half bridge series resonant inverter is the most employed topology due to its simplicity, its cost effectiveness and the electrical requirements of its components.

III. METHODOLAGY

The primary input to the system is solar energy coming from the sun. It is received by the array of photovoltaic cell and further converted into electric energy. This electric energy is utilized to charge the rechargeable lead acid battery.

Block Diagram

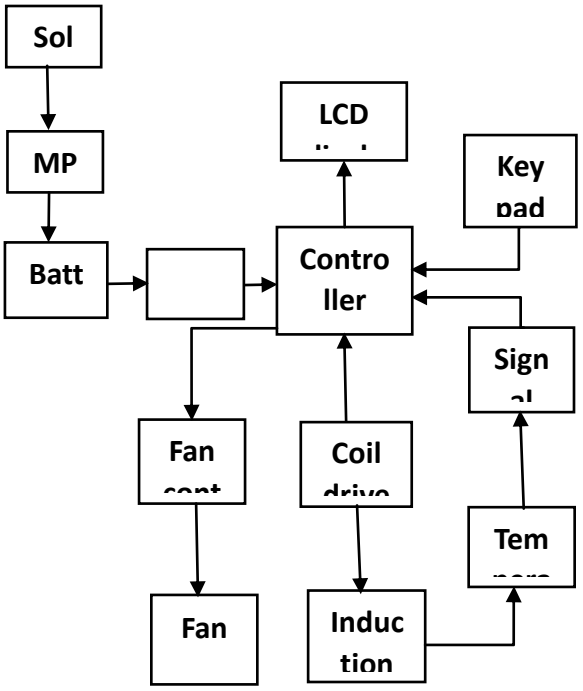

Figure 3.1

*A.*SOLAR PANEL

Figure3.2 Solar PV panel

Solar is made of photovoltaic cells that converter solar energy into electrical energy in the form of DC.PV modules generate electricity from sun. The output power is not constant all the times throughout the day. In this

design, batteries, Dc to DC converter work together with PV systems to regulate the voltage of the PV systems. Solar is the main source power for heating the induction coil and a100W solar panel is used. This unit depends on the sun radiation to supply energy.

***B.*INDUCTION COIL**

Figure 3.3 Induction coil

The coil is used to transfer the energy from the power unit and work head to the work piece. Inductors range in complexity from a simple wound solenoid consisting of a number of number f turns of copper tube wound around a mandrel, to a precision item machined from solid copper, brazed and soldered together. Coil design is one of the most important elements of the system and is a science in itself.

Induction heater works on the principle of electromagnetic induction by heating the cooking vessel directly. The cooking vessel is a ferromagnetic material of which is capable of allowing eddy currents to flow and produce heat on the material. Oscillating magnetic field induces current in the pot. The heater is faster and gives more than 90%of efficiency during cooking.

***C.*RECHARGEABLE BATTERY**

Figure 3.4 12V Battery

A rechargeable battery, storage battery, secondary battery a type of electrical battery which can be charged, discharged into a load and recharged many times as opposed to a primary battery which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term accumulator is used as it accumulates and stores energy through a reversible electrochemical reaction.

Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electro materials and electrolytes are used.

***D.* CHARGE CONTROLLER**

Figure3.5Charge controller

The buck- boost converter is a type of DC to DC converter that has an output voltage magnitude that is either greater than or less than input voltage magnitude. It is equivalent to a fly back converter using a single inductor instead of a transformer. The boost portion of the buck-boost converter is used to make the input voltage produce the output voltage that is greater than the input voltage

.*E.*TEMPERATURE SENSOR

Figure3.6Temperature sensor

Temperature sensor is a device to measure the temperature through an electrical signal it require a thermocouple or RTD(Resistance Temperature Detector). The LM35 IC has 3 pins-2 for the power supply and one for the analog output. It is low voltage IC

which uses approximately +5V DC of power. The output pin provides an analog voltage output that is linearly proportional to the Celsius temperature. The LM35 is operate at -55degree to +120 degree c.

***F*.VOLTAGE REGULATOR**

Figure3.6 Voltage regulator

A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed forward design or may include negative feedback. It may use an electromechanical mechanism or electronics components.

IV. WORKINGFLOWCHART

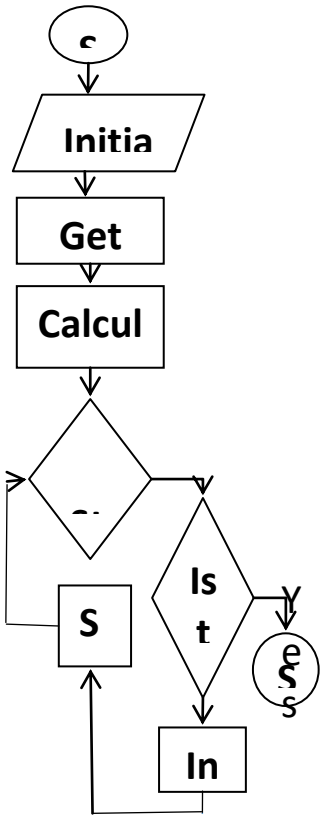

Figure 4.1

V. CONCLUSION

In this paper solar powered induction heatinsystem is presented. The designed is a standalone product where by the batteries are charged from solar and grid.This makes the system environmental friendly as it is using clean free energy from sun. Induction cooking technolgy was found to maintain high efficiency regardless of cookware size.The maximum output power will be around 500W. This project has been designed with the locally available components to get the optimum performance. It proves advantages in cost compared with the induction heater imported from abroad. Therefore, this project will be a good fountation for high quality product manufacture.

VI. REFERENCE

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