Implementation of Peltier Sensor for Voltage Generation from Human Body

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Abstract— The established scientific facts can be used to produce power from anything where there are two different sources of temperatures. Generally it is difficult to take conventional electricity to all places. Hence by using the human body heat as one source of temperature and the surrounding climate as another source of temperature we can generate power using the Peltier effect. The Peltier effect is a temperature difference created by applying a voltage between two electrodes connected to the sample of semiconductor material. The Peltier effect can also be reversed and used to generate power in conditions where there are differences in temperature additionally the amount of power produced is proportional to the difference in the temperatures. The power thus produced can be used for various applications ranging from charging portable communication devices like radios and phones to even lighting up a dark place and many other applications.

Key words: Voltage Generation from Human Body, Peltier Sensor

I. INTRODUCTION

Thermoelectric effects involve a fundamental interplay between the electronic and thermal properties of a system. These effects are most often observed by measuring electrical quantities (voltage and current) induced by thermal gradients [1]. While not as straightforward to measure, electrical voltages and currents can induce heat flow. Electrically induced heat flow generates a temperature gradient and should not be confused with Joule heating. The two primary thermoelectric effects are the Seebeck effect and the Peltier effect, which when combined with the laws of thermodynamics, can be used to derive all other thermoelectric effects [2]. When a conductive material is subjected to a thermal gradient, charge carriers migrate along the gradient from hot to cold; this is the Seebeck effect. In the open-circuit condition, charge carriers will accumulate in the cold region, resulting in the formation of an electric potential difference [3].

In particular, thermoelectric materials have drawn attention because thermoelectric effects enable direct conversion from thermal to electrical energy, and provide an alternative source of power generation[4].

II. PROPOSED SYSTEM

In this paper, we use peltier sensor for generating voltage from human body. With the development of cell phones and smaller devices that we carry with us has come with the problems of keeping the batteries charged. It would be wonderful if people could use energy produced by their body as a backup power source for their electronic devices. So in order to overcome these problems, we have used PELTIER Effect which can also be reversed and used to generate electrical power in conditions where there are differences in temperatures. DC/ DC Converter is used which increases the operating voltage and reduces the cost of the equipment. Fig.1 shows the block diagram of the proposed system.

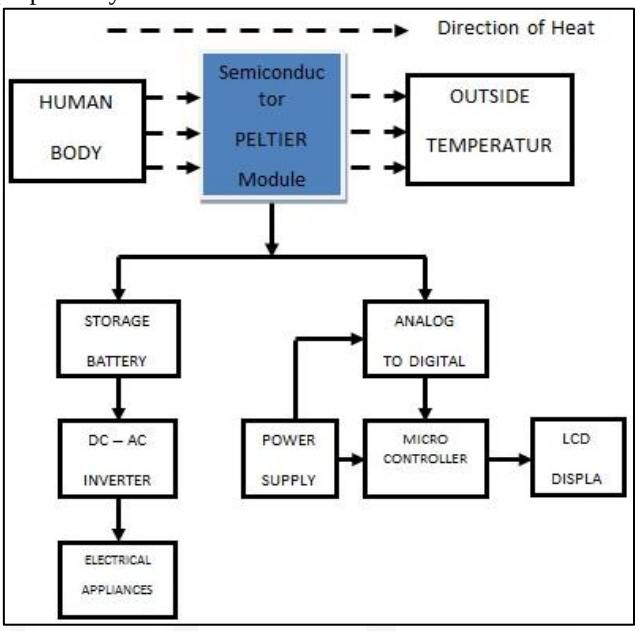

Fig. 1: Block Diagram

III. HARDWARE COMPONENTS

A. Peltier Sensor

Fig. 2 shows the peltier module. It has become imperative for the power and energy engineers to look out for the renewable energy sources such as sun, wind, geothermal, ocean and biomass as sustainable, cost effective and environment friendly alternatives for conventional energy sources. It uses heat energy from human body as a source for producing power and also it doesn't require any external source for generation. The main theme of this paper is to generate a small amount of electricity from human body as much as we can get it from Peltier Sensor.

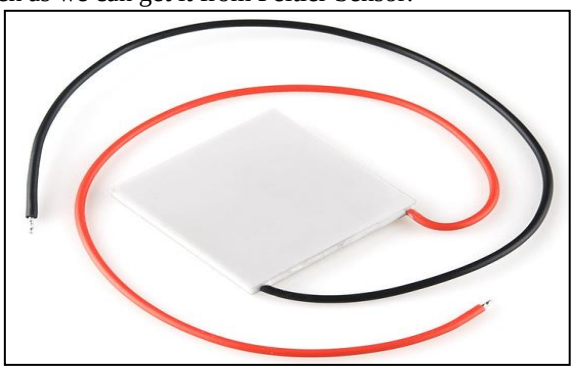

Fig. 2: Peltier Module

Thermoelectric modules are solid-state heat pumps that operate on the Peltier effect. A thermoelectric module consists of an array of p-type and n-type semiconductor elements that are heavily doped with electrical carriers. The elements are arranged into array that is electrically connected in series but thermally connected in parallel. This

array is then affixed to two ceramic substrates, one on each side of the elements.

B. DC-DC Converter

Fig.3 represents the DC-DC converter. The boost converter is a popular non-isolated power stage topology, sometimes called a step-up power stage. Power supply designers choose the boost power stage because the required output is always higher than the input voltage. The input current for a boost power stage is continuous, or non-pulsating, because the output diode conducts only during a portion of the switching cycle. The output capacitor supplies the entire load current for the rest of the switching cycle.

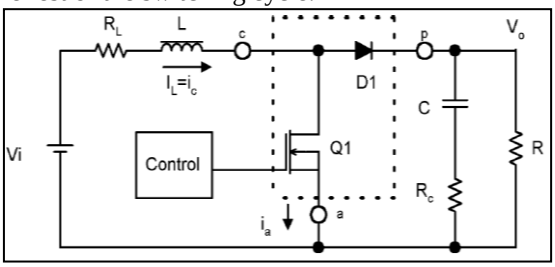

Fig 3. DC-DC converter

A power stage can operate in continuous or discontinuous inductor current mode. In continuous inductor current mode, current flows continuously in the inductor during the entire switching cycle in steady-state operation. In discontinuous inductor current mode, inductor current is zero for a portion of the switching cycle. It starts at zero, reaches peak value, and return to zero during each switching cycle.

C. Battery System

Storage batteries are the heart of all inverter electrical systems. The function of battery is to balance the outgoing electrical requirements with the incoming power supply. They offer a reliable source of electricity which can be used when solar or wind power is not available. Batteries are able to provide short term power output many times higher than the charging source output. A battery stores electrical energy in a reversible chemical reaction or in a chemical form inside a closed energy system. They can be recharged and reused as a power source in small appliances, machinery and remote locations. The renewable energy source produces electricity and the battery stores it for low or no renewable energy production. Low voltage DC appliances (mostly 12V DC) can be operated directly from batteries or photovoltaic modules.

D. DC-AC Inverter

An inverter is an electric apparatus that changes direct current (DC) to alternating current (AC). The output of inverter is an AC voltage whose amplitude and frequency is precisely controlled. Solid-state inverters have no moving parts and are used in a wide range of applications, from small switching power supplies in computers, to large electric utility high-voltage direct current applications that transport bulk power. Inverters are commonly used to supply AC power from DC sources such as solar panels or batteries. The electrical inverter is a high-power electronic oscillator.

E. Microcontroller

A Micro controller consists of a powerful CPU tightly coupled with memory, various I/O interfaces such as serial port, parallel port timer or counter, interrupt controller, data acquisition interfaces-Analog to Digital converter, Digital to Analog converter, integrated on to a single silicon chip. AT89S52 is 8-bit micro controller, which has 4 KB on chip flash memory, which is just sufficient for our application. The on-chip Flash ROM allows the program memory to be reprogrammed in system or by conventional non-volatile memory Programmer. Moreover ATMEL is the leader in flash technology in today's market place and hence using AT89S52 is the optimal solution.

F. Liquid Crystal Display

LCD-Liquid Crystal Display is an electronic device for displaying text or characters. We are using 14 pin LCD. 16*2 represents 16 characters and 2 line display. LCD's are economical and easily programmable and can easily display special and custom characters.

G. Analog to Digital Converter

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs.

The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications. For 16-channel multiplexer with common output (sample/hold port) see ADC0816 data sheet.

IV. HARDWARE DESCRIPTION

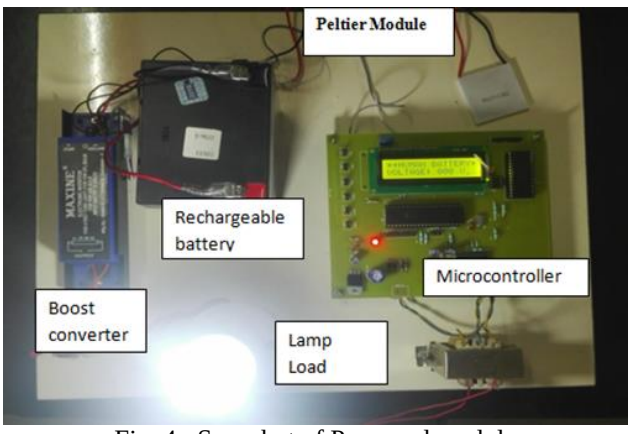

Fig. 4: Snapshot of Proposed module

One of the most efficient methodologies of generating voltage with the use of the heat of Human Body is by using thermoelectric effect. In order to attain the output, initially 5V output obtained from power supply unit to be given to micro controller. A/D converter is used for converting analog signal to digital signal which is given to microcontroller unit. From microcontroller it controls voltage and output of peltier to be shown in LCD display. On the other side, the heat of Human body is detected by Peltier sensor which converts temperature differences to electric voltage. As the output from the sensor is lesser, it is increased by using boost converter. The voltage is boosted upto 12 V DC. Output is then stored in rechargeable battery and then DC output is converted into AC by using Inverter. This method is used in lower power applications such as mobile phone charging, AC lamp, radios etc.

V. CONCLUSION

In this paper, it was presented to obtain the physiological parameters like body temperature. Inverse Peltier Effect is used to generate power from the human body to provide supply to the low power application devices. With some modification, the system can be made available commercially. Future improvements will focus on the usage in smarter ways, so that it could be made as a wearable device, making it more comfortable for the wearer.

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