National Conference on Information, Communication, VLSI Design and Embedded system (ICVE 2K17)
(9 - 10 March 2017)
International Journal of Engineering Research & Science (IJOER)
ISSN: [2395-6992] [Vol-3, Issue-3 March- 2017]

Peltier Module based Temperature Control System for Power Semiconductor Characterization

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Abstract— *Due to fuel price spike and global warming, several countries are now more interested in searching and developing of the renewable energy sources. The use of thermoelectric power generators for electrical power generation at the low temperature heat sources is one of the most important energy sources. The enormous of wasting thermal energy (heat) could be produced from various sources, such as factories, transportation systems and even private houses or public buildings. Therefore, the utilization of direct heat to electricity conversion plays an important role in determining an actual and acceptable performance.*

Keywords— Temperature Control System, Power Semiconductor Characterization, energy sources, thermal energy.

I. INTRODUCTION

A thermoelectric module consists of many thermocouples. A thermocouple produces low voltage and high current. Thus, to obtain high voltages, a number of thermocouples are connected electrically in series and thermally in parallel to form a module. The direct conversion of Peltier module from heat sources looks like geothermal energy, solar energy or waste heat into electrical energy. The main advantages of Peltier module are the low maintenance requirement, the high modularity and the possibility of utilizing heat sources over a wide temperature range. In addition, the more advantages of Peltier module are no moving parts, no Freon refrigerant, no noise, no vibration, compact, highly reliable, and environmentally friendly, etc.

II. EXISTING SYSTEM

- The existing system of this project the overall mechanical appearance of the concentrator thermo electric generator (CTEG) module which consists of parabolic dish concentrator (collector), thermo electric cells, linear single-axis tracking system (tracker), heat transfer system (receiver plate and liquid cooled heat sink), system structural support and data acquisition system. Each component of the module is explained in detail in next subsections.
- The dish is required to track the sun continuously by means of two-axis electronic tracking system so that the beam solar radiation can be collected and reflected on the thermo electric cells installed near the focal plane of the parabolic dish.
- C.O.P. is less as compared to conventional refrigeration system.
- Suitable only for low cooling capacity.

III. PROPOSED SYSTEM

- Peltier module, also known as thermoelectric module, is the small solid-state devices that combine thermal, electrical, and typically, also semiconductor properties to convert heat into electricity or electrical power directly into cooling.
- A thermoelectric module consists of many thermocouples. A thermocouple produces low voltage and high current. Thus, to obtain high voltages, a number of thermocouples are connected electrically in series and thermally in parallel to form a module.
- The main advantages of Peltier module are the low maintenance requirement.

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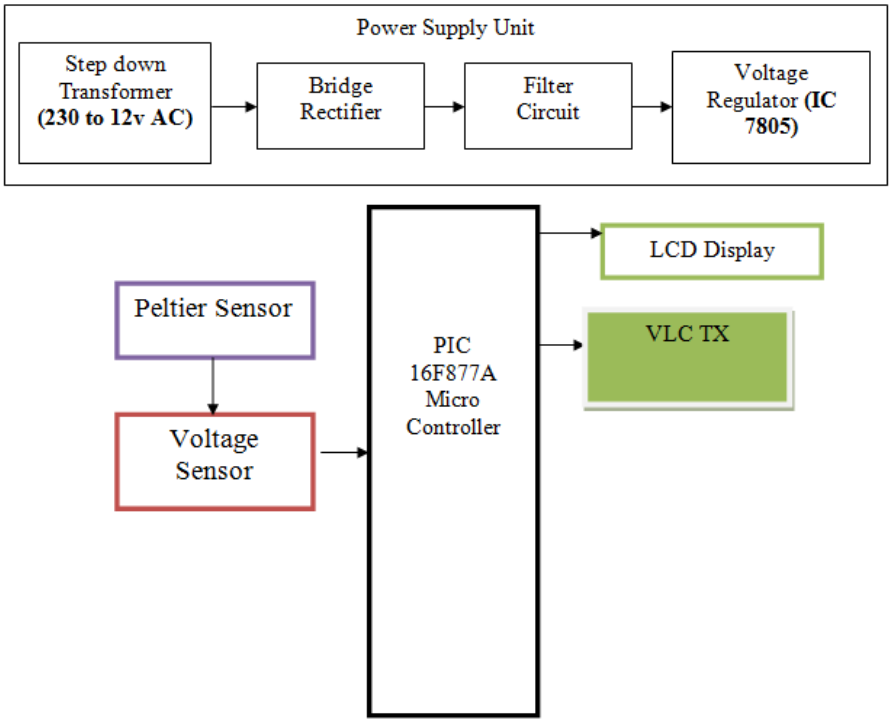
3.1 Block Diagram



3.2 Receiver

3.3 Peltier Sensor

This technology is far less commonly applied to refrigeration than vapor-compression refrigeration is. The main advantages of a Peltier cooler are its lack of moving parts or circulating liquid, and its small size and flexible shape. Its main disadvantage is that it cannot simultaneously have low cost and high power efficiency. Many researchers and companies are trying to develop Peltier coolers that are both cheap and efficient.

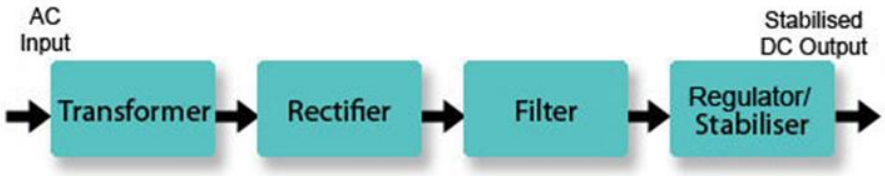
Peltier element schematic Thermoelectric legs are thermally in parallel and electrically in series. Thermoelectric coolers operate by the Peltier effect.

3.4 Voltage Sensor

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

3.5 PIC16F877A Microcontroller

PIC microcontroller is the smallest microcontrollers that can be programmed to carry out a huge range of tasks. These microcontrollers are found in many electronic devices such as phones, computer control systems, alarm systems, systems.



Every PIC microcontroller architecture consists of some registers and stack where registers function as Random Access Memory (RAM) and stack saves the return addresses. The main features of PIC microcontrollers are RAM, flash memory, Timers/Counters, EEPROM, I/O Ports, USART, CCP (Capture/Compare/PWM module), SSP, Comparator, ADC (analog to digital converter), PSP (parallel slave port), LCD and ICSP.The 8-bit PIC microcontroller is classified into four types on the basis of internal architecture such as Base Line PIC, Mid Range PIC, Enhanced Mid Range PIC and PIC18.

3.6 LCD Display

Liquid crystal cell displays (LCDs) used to display of display of numeric and alphanumeric characters in dot matrix and segmental displays.They are all around us in laptop computers, digital clocks and watches, microwave, CD players and many other electronic devices.

An LCD is made with either a passive matrix or an active matrix display grid. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time. Passive matrix LCD's have dual scanning, meaning that they scan the grid twice with current in the same

3.7 LI-FI

Li-Fi technology is a ground-breaking light-based communication technology, which makes use of light waves instead of radio technology to deliver data. Using the visible light spectrum, Li-Fi technology can transmit data and unlock capacity which is 10,000 times greater than that available within the radio spectrum. The visible light spectrum is plentiful, free and unlicensed, mitigating the radio frequency spectrum crunch effect.

3.8 How It's Works:

- Li-Fi and Wi-Fi are quite similar as both transmit data electromagnetically. However, Wi-Fi uses radio waves while Li-Fi runs on visible light.
- A VLC light source could comprise of a fluorescent or light emitting diode (LED) bulb. Since a robust Li-Fi system requires extremely high rates of light output, LED bulbs are most ideal for implementing Li-Fi. LED is a semiconductor light source, which implies that LED light bulbs can amplify light intensity and switch rapidly. Therefore, LED cells can modulate thousands of signals without the human eye ever noticing.
- In turn, the changes in light intensity from the LED light source are interpreted and converted as electrical current by the receiving photodiode device. Once the electronic signal is demodulated, it is converted into a continuous stream of binary data comprising of audio, video, web, and application information to be consumed by any Internet-enabled device.
- For example, data is fed into an LED light bulb; it then sends data at rapid speeds to the photo-detector.

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- The tiny changes in the rapid dimming of LED bulbs are then converted by the 'receiver' into electrical signal.
- The signal is then converted back into a binary data stream that we would recognise as web, video and audio applications that run on internet enables devices.
- Li-Fi is a Visible Light Communications (VLC) system for data transmission. A simple VLC system has two qualifying components:
    - One device with a photodiode able to receive light signals
    - A light source equipped with a signal processing unit.

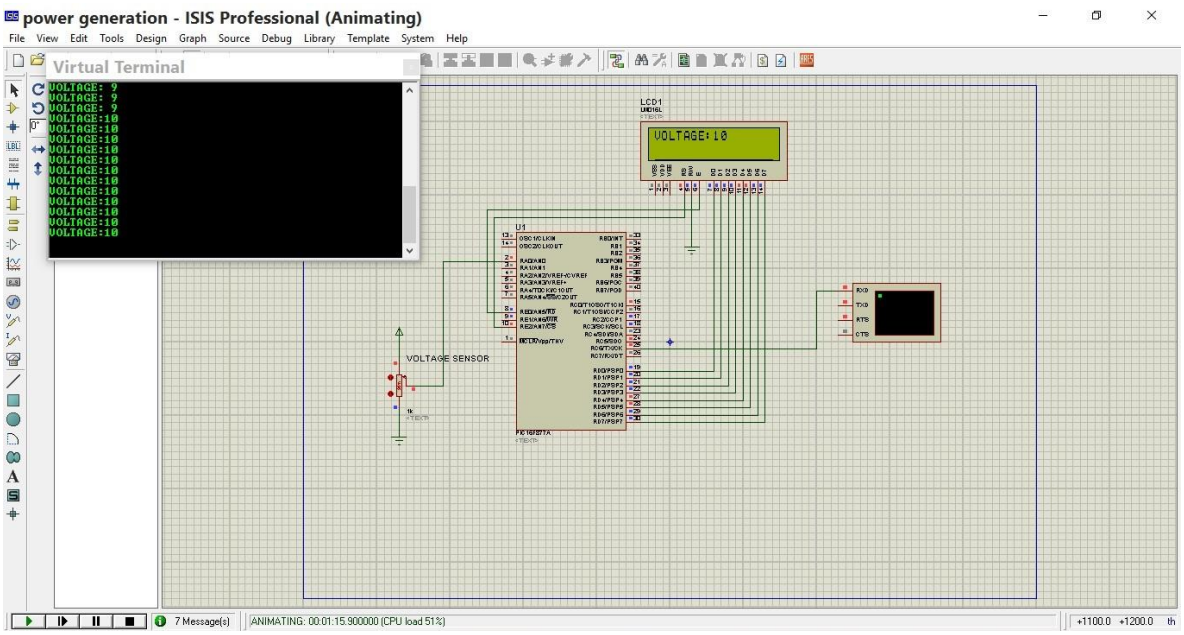
3.9 Proteus

Proteus is a software technology that allows creating clinical executable decision support guidelines with little effort. Once a guideline for a condition has been created, it can be executed to provide stepwise advice for any patient having that condition.

This site is dedicated to the Proteus executable guidelines model, tools based on the Proteus approach and the automated guidelines created using those tools.

A software tool that allows creating and executing clinical decision support guidelines using the Proteus approach is available. The tool called Protean may be downloaded from here. Protean allows creating new guidelines or editing existing ones very easily. Much of the editing is done by dragging and dropping

3.10 Output



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