

Solar Battery Powered Heating and Cooling Suit

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ABSTRACT

Temperature related inconveniences such as heat stroke, heat rash, frostbite, hypothermia and others, have been a persistent problem for people throughout history. Some of these conditions, when left unchecked, have led to unfortunate deaths. What is even more common is the dissatisfaction that people have with the weather at various points of the year. People often complain that it is either too hot or too cold. The current technological solutions made to keep people thermally comfortable such as air conditioning and heating units have come a long way and have been successful in helping people obtain comfort in their dwellings (e.g. home or car), but are not personal mobility solutions. What if one has to be out in the weather? The addition or subtraction of layers with coats and jackets or beach wear, are popular solutions to that problem, but do not always yield utmost satisfaction, for layers become cold over time and sunburn is a serious problem. This is why a heating/cooling suit is a very beneficial product for the masses. Such a suit allows the user to control and monitor the internal temperature of the suit from high temperatures to low temperatures, depending on the season. Creating the most comfortable thermal environment for the user within an enclosed space of small proximity while providing comfort, practicality and mobility is the objective of this suit. With the use of the thermoelectric effect, microcontroller technology and a bit of ingenuity, this suit can be realized.

Keywords- Heating/Cooling suit; Garment temperature, Microcontroller, Battery, RF Communication, Metal detector, Temperature Sensor.

INTRODUCTION:

Both very cold and very hot temperatures could be dangerous to health. Excessive exposure to heat is referred to as heat stress and excessive exposure to cold is referred to as cold stress. In a very hot environment, the most serious concern is heat stroke. At very cold temperatures, the most serious concern is the risk of hypothermia or dangerous overcooling of the body.

In this project we are going to design an E-Uniform which gives better protection to the soldiers who are working in extreme weather conditions. This Uniform will make the soldier to work in any kind of environment. Here we are using Solar Panels to power up the internal circuitry of the E-uniform. A 12 V DC lead acid rechargeable battery is used for storing the energy. We are using conventional battery charging unit also for giving supply to the circuitry. Microcontroller is the heart of the circuit as it controls all the functions.

The project is operated in two modes summer mode and winter mode. By selecting the mode of operation such that it can drive body heater/cooler. The heater/cooler in turn will help us to provide chilling or warming effect inside the uniform which helps the soldier to bear to any kind of external environment and he can work efficiently without heat stress or cold stress. A 12 V DC lead acid rechargeable battery is used for storing the energy. We are using conventional battery charging unit also for giving supply to the circuitry. Here we are also using a metal detector and RF communication to know about the presence of any explosive material at the other place. At that location a

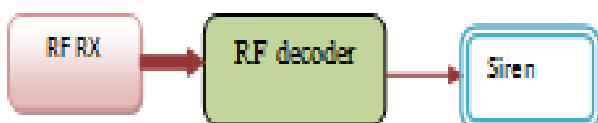
siren is placed, so when ever such material is detected siren alert is given.

This Conventional power source uses regulated 3.3V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/12V step down transformer.

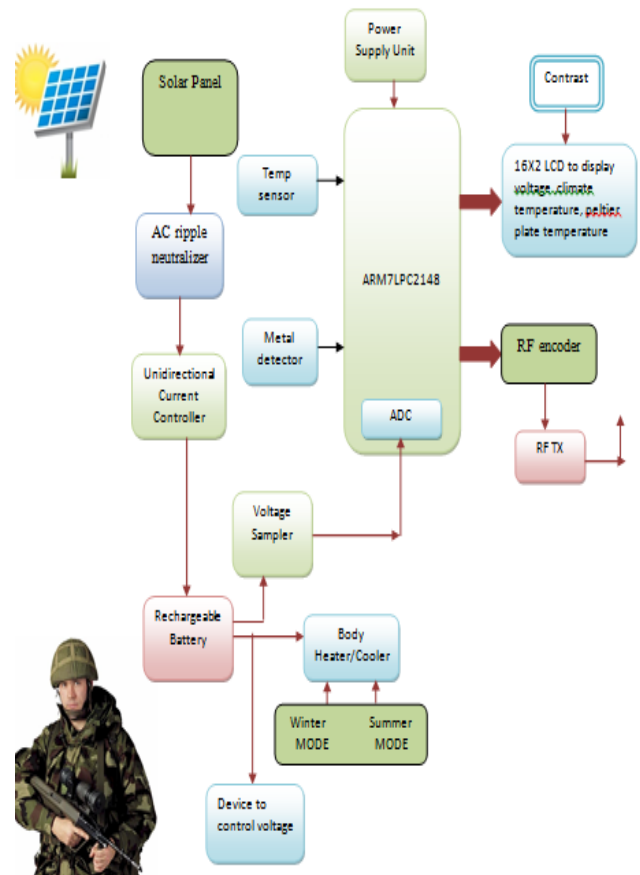
II. LITERATURE REVIEW

As we know that, the physical principles upon which modern coolers are based actually date back to the early 1800's, although commercial modules were not available until almost 1960. The first important discovery relating to thermoelectricity occurred in 1821 when a German scientist, Thomas Seebeck, found that an electric current would flow continuously in a closed circuit made up of two dissimilar metals provided that the junctions of the metals were maintained at two different temperatures. Seebeck did not actually comprehend the scientific basis for his discovery, however, and falsely assumed that flowing heat produced the same effect as flowing electric current. In 1834, a French watchmaker and part time physicist, Jean Peltier, while investigating the "Seebeck Effect," found that there was an opposite phenomenon whereby thermal energy could be absorbed at one dissimilar metal junction and discharged at the other junction when an electric current flowed within the closed circuit.

Receiver

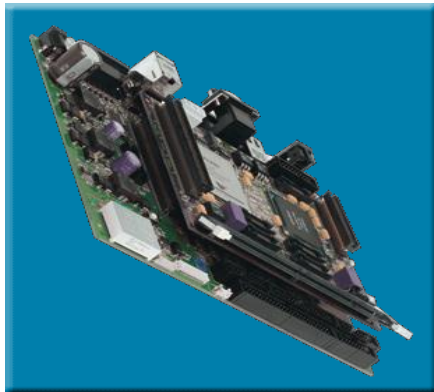


Block Diagram:



III. HARDWARE MODULES ARM7TDMI PROCESSOR CORE

- Current low-end ARM core for applications like digital mobile phones
- TDMI
 - T: Thumb, 16-bit compressed instruction set
 - D: on-chip Debug support, enabling the processor to halt in response to a debug request
 - M: enhanced Multiplier, yield a full 64-bit result, high performance
 - I: Embedded ICE hardware
- Von Neumann architecture

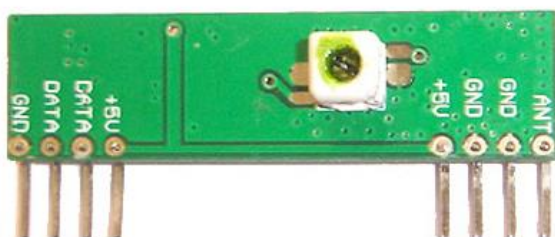


RF communication

Radio frequency (RF) is a frequency or rate of oscillation within the range of about 3 Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate that most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits or electromagnetic radiation



STT-433 MHz TRANSMITTER



RF RECEIVER STR-433 MHz

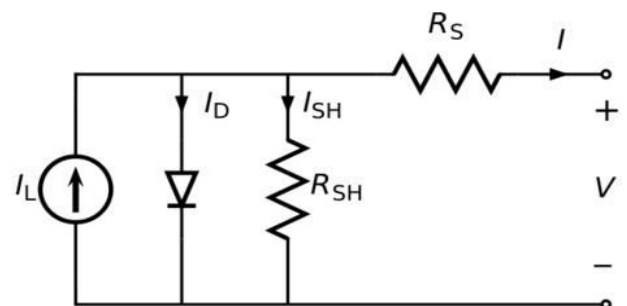
Solar cell/Plate

A solar cell or photovoltaic cell is a device that converts solar energy into electricity by the photovoltaic effect. Sometimes the term solar cell is reserved for devices intended specifically to capture

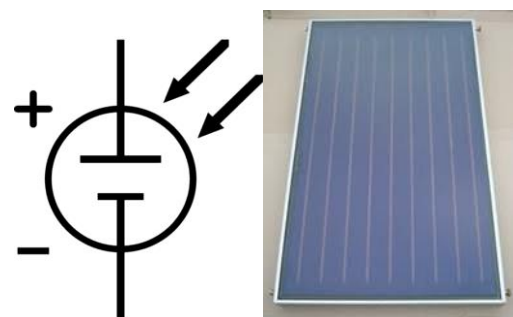
energy from sunlight, while the term photovoltaic cell is used when the source is unspecified. Assemblies of cells are used to make solar panel, solar modules, or photovoltaic arrays. Photovoltaic is the field of technology and research related to the application of solar cells for solar energy. Solar cell efficiencies vary from 6% for amorphous silicon-based solar cells to 40.7% with multiple-junction research lab cells and 42.8% with multiple dies assembled into a hybrid package. Solar cell energy conversion efficiencies for commercially available multi crystalline Si solar cells are around 14-19%.

Solar cells can also be applied to other electronics devices to make it self-power sustainable in the sun. There are solar cell phone chargers, solar bike light and solar camping lanterns that people can adopt for daily use

Equivalent circuit of a solar cell



The equivalent circuit of a solar cell



The schematic symbol of a solar cell

METAL DETECTOR

Metal detectors use electromagnetic induction to detect metal. Metal detector can help you to find the metals buried deep in the ground. Uses include de-mining (the detection of land mines), the detection of weapons such as knives and guns, especially at airports, geophysical prospecting, archaeology and treasure hunting. Metal detectors are also used to detect foreign bodies in food, and in the construction industry to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors.

Temperature sensor

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. These types of temperature sensors vary from simple ON/OFF thermostatic devices which control a domestic hot water system to highly sensitive semiconductor types that can control complex process control plants. We remember from our school science classes that the movement of molecules and atoms produces heat (kinetic energy) and the more movement, the more heat is generated. **Temperature Sensors** measure the amount of heat energy or even coldness that is generated by an object or system, and can "sense" or detect any physical change to that temperature producing either an analogue or digital output.

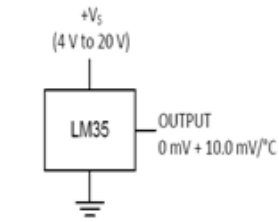
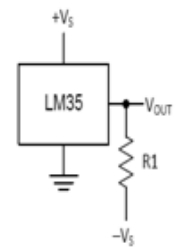


Figure 1. Basic Centigrade Temperature Sensor (+2°C to +150°C)



Choose $R_1 = -V_s / 50 \mu\text{A}$
 $V_{\text{OUT}} = 1500 \text{ mV at } 150^\circ\text{C}$
 $V_{\text{OUT}} = 250 \text{ mV at } 25^\circ\text{C}$
 $V_{\text{OUT}} = -550 \text{ mV at } -55^\circ\text{C}$

Figure 2. Full-Range Centigrade Temperature Sensor

IV. SOFTWARE DETAILS

A. Keil compiler

Keil compiler is a software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

B. Proload

Proload is a software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed.

I. ADVANTAGES

- Fit and forget system
- Reliable
- Compact size
- Affordable prize (Low cost)
- Low Maintenance

II. APPLICATIONS

- Used in military applications.



- This uniform can be used for all the climatic applications.
- Soldiers can work in extreme climatic applications.

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CONCLUSION

Hence this project is implemented using ARM 7 to help the military people in all weather condition.

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