Battery Powered Heating and Cooling Suit With location spotter

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ABSTRACT:

The design of an E-Uniform (suit) 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 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 and also using conventional battery charging unit also for giving supply to the circuitry. ARM7 Microcontroller is the heart of the circuit as it controls all the functions. The E-Uniform is operated in two modes, summer mode and winter mode. Which helps the soldier to bear any kind of external environment. This project has an Extension Part which includes the interfacing of GSM and GPS, which gives the location of the soldier exactly with the latitude and longitude value and is also messaged to the concern person at the war or at boundaries. .

Keywords:

Solar panel, 12v lead acid battery, Peltier plate, ARM7 lpc2148 controller and GPS, GSM modules.

I. INTRODUCTION:

There is a suit like this available in market and cost is very high .Because many of that suit parts are mechanical, gripping devices that devices are made with nano, fiber technology. This suit consisting of pumps to provide cool and heat. This pumps sprays water on to human body for cooling body. We can provide both cooling and hot service with E-Uniform. Temperature related inconveniences such as heat stroke, heat rash, frostbite, hypothermia and others, have been a persistent problem for people throughout history. These conditions have led to unfortunate deaths.

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. 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.

Soldiers are the Army's most important resource. Soldiers play a vital role to protect one's country. The term soldiers include service men and women from the Army, Air Force, Navy and Marines. They will always be the one responsible for taking and holding the duty in extreme weather conditions throughout the year. While providing securityfor the nation, they may face troubles in extreme hot/cold weather conditions.

The proposed system is battery powered heating and cooling suit with location spotter, by which the people/ user can easily control the temperature of the suit and peltier plate. The user controls the peltier plate temperature by varying the variable resister. The suit is very flexible to wear, convenient, cozy, healthy and less in weight.The user wears an E-Uniform as a dress, and also there is a facility to switch on TEC in the E-Uniform.

II. BLOCK DIAGRAM:

The final design is a microprocessor based system that the systems makes heat and cool both sides of TECs by using battery power supply.

That the heat and cool functionality selected by using push button switch/mode and we can adjust heat and cool by variable resister. The solar panels are used to power up circuitry and the output of solar panel is stored in lead acid battery. Generally The TECs are outside of the circuitry which are connected through wires and posed with in the suit so user can easily adjust position of TECs it is not harmful to user body. The system also using the GPS, GSM modules, LM-35 temperature sensor and 16X2 LCD screen. The temperature sensor are using to sense the climatic temperature continuously and display it on LCD screen.
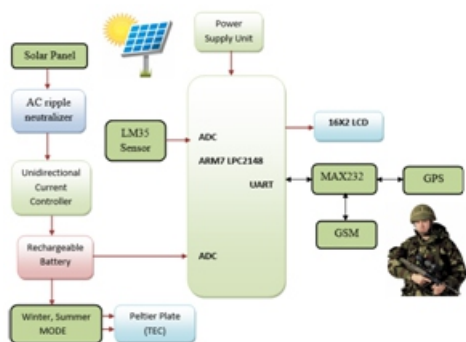

Figure1.Block diagram of proposed system

III.HARDWARE DESIGN:

Figure2. Hardware design

A) Solar cell/Plate:

Solar panel designed to absorb the sun's rays as a source of energy for generating electricity or heatingWe call this energy as thermal energy. Assemblies of cells are used to make solar panel or solar module or photovoltaic arrays. The Amount of electricity is generated by the Solar panel is depends on number of photovoltaic cells embedded in that panel.

1. Photons in sunlight hit the solar panel and are absorbed by semi conducting materials, such as silicon.

2. Electrons (negatively charged) are knocked loose from their atoms, allowing them to flow through the material to produce electricity. Due to the special composition of solar cells, only allow the electrons to move in a single direction. The complementary positive charges that are also created (like bubbles) are called holes and flow in the direction opposite of the electrons in a silicon solar panel.

3. An array of solar panels converts solar energy into a usable amount of direct current (DC) electricity.

The output of the solar panel is aDC electricity which is fed to the battery via ac ripple neutralizer and unidirectional current controller, which provides unidirectional electrical connection from panel to battery if the battery reaches maximum voltage level we can turn off the connection. AC ripple neutralizer removes ac ripples present in the DC electricity. Equivalent symbol of solar panel shown in below figure2.
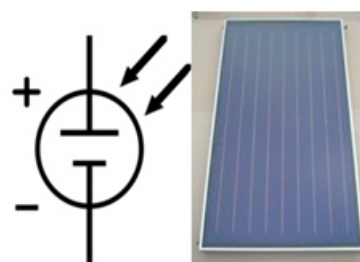

Figure3. Equivalent symbol of solar   panel

B) LM35 Temperature sensor:

The LM35 Precision Fahrenheit-Celsius temperature sensor was used and it is connected ADC pin of LPC2148 micro-controller. The LM35 is used to sense climatic temperature and gives analog voltage as output. This analog voltage is converted into decimal form by programming LPC2148 controller and also this will be displayed on the 16X2 LCD, which is shown in below figure.

Figure4: climatic temperature on 16X2 LCD

C) Thermoelectric coolers:

Thermoelectric coolers (TECs), also called as peltier plates or peltier coolers. Which works based on principle of thermoelectric cooling. In 1834, the peltier was discovered thermoelectric cooling principle. The peltier plate is combination of two different types of semiconductor devices (plates), one device is N-type semiconductor another one is P-type semiconductor. The two semiconductors must be different, we need two different electron densities to produce heat or cool. Peltier plate converts voltage into heat (temperature) and heat into voltage. When voltage applied to the peltier plate then the current passing through peltier plate.

When the current passing through two different semiconductors then there will be produced heat. The electric current flow changed from the electrons less in bound side to electrons more in bound side when the two different semiconductors are in contact. The reason for this is the Fermi level energy of N-type semiconductor and P-type semiconductor are different.so the electrons always move from high Fermi level side to low Fermi level side .This process repeated up to the both semiconductor Fermi level energies become equal. The diagram of TEC are shown in below figure3.
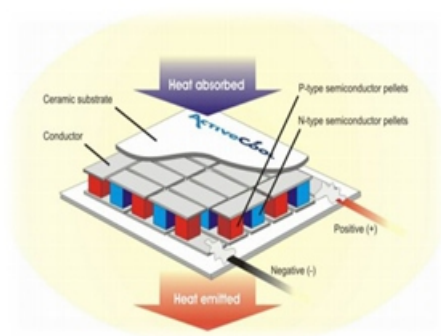

Figure6.Thermoelectric coolers (TECs)

It produces heat from one side semiconductor plate to another, typically the temperature is 40°C to 70-80°C when we use modern peltier plate. In this project 5vTEC1-04905 Peltier plate are used andit is connected to Battery through power supply unit, which is shown in below figure.

Figure5: TEC1-04905 5v Peltier plate.

Technical specifications:

• Max current: 1.5A @ 5V

• Suggested Voltage range: 5V to 7V

• Maximum temperature differential (Tmax @ Qc = 0): 65°C

• 127 Peltier elements

• Silicone seal

• Dimensions: 30mm / 1.18" x 30mm / 1.18" x 3.29mm / 0.12"

• Wire Length: 289.56mm / 11.4"

• Weight: 11.43g

The power supply unit regulates the battery voltage into 5v because to give it to the peltier plate, so it becomes heat or cool depends on the current flow direction. By using peltier plate we can easily create heat or cool. There is a temperature gradient that depends on the current flowing through the junction either in forward bias or reverse bias. The N-type and P-type semiconductors are connected side by side to form contact and the upper and bottom sides of semiconductors are covered with ceramic plates in a TEC.The amount of heat or cool produced is directly proportional to the applied voltage i.e. current and its duration at the junction.Peltier coefficient is depends on the observed heat or released heat at the junction and the material type of semiconductor (N-Type & P-Type).Typically 5V peltier plate provides 40°C, 20°C heat and cool respectively.

D) LPC2148 Microcontroller:

LPC2148 Microcontroller Architecture. The ARM7TD-MI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue.The heart of the circuit is LPC2148 microcontroller. This LPC2148 microcontroller has in built ARM7TDMI-S CPU core and it is 32/16 bit microcontroller with 512KB of programmable flash memory also it has 64 pins from which 45 pins programmable I/O lines with 2 ports, 14 ADC channels and 2 UARTS. LPC2148 controls the interfacing units of the circuitry.The LM35 Precision Fahrenheit-/Celsius temperature sensor was used and it is connected ADC pin of LPC2148 microcontroller. The LM35 is used to sense climatic temperature and gives analog voltage as output. This analog voltage is converted into decimal form by programming LPC2148 controller and also this will be displayed on the LCD.

E).GPS (Global Positioning System):

GPS modules are popularly used for navigation, positioning, time and other purposes. GPS antenna receives the location values from the satellites. GPS gives information about:
1)Position at that time
2)Precise orbital information (the ephemeris)
The GPS device continuously transmits serial data to LPC2148 controller through RS-232 serial protocol. UART is anasynchronous serial communication protocol, actually which is used to provide the communication between two off-board devices or modules or microcontroller units. Here UART are used to interface GPS with LPC2148 microcontroller. We need three signals to interface GPS module with UART, which are RXD, TXD and GND. The TXD, RXD, GND pins of UART connected to GPS module via RS-232 DB-9 connector.A serial driver MAX232, it is a 16 pin IC is used for converting RS-232 voltage levels into TTL voltage levels. There are four electrolytic capacitors which are used with MAX232. And also we need to generate a serial interrupt from LPC2148 to receive data from GPS. That the transmitted data of GPS consisting latitude and longitudes values of location in the form of NMEA (National Marine Electronics Association) standard.

The serial data received from GPS device is stored in SBUF register by using UART. This information is transferred to authorized or concerned person via GSM. So we can widely use proposed suit (E-Uniform) in military applications.The latitude and longitudes values also displayed on LCD, which is shown in below figure.

Figure7. 17.44And 78.44 are latitude and longitudes values

F).GSM (Global System for Mobile Communication):

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM converts analog data into digital and compress digital data then sends it via dedicated channels with two user's data. Each user have own time slot to communicate with another user .In proposed design using GSM-SIM 300 model GSM module ,it works at different frequencies i.e., 900MHz or 1800MHz and PCS 1900MHz .In proposed system GSM is used for send the suit wearing person latitude , longitude ,battery voltage and climatic temperature values to another person.it is shown in below figure.
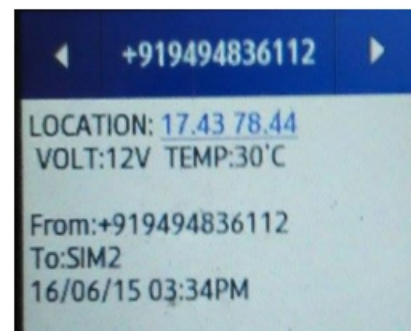

Figure8: massage received by another person.

IV.CONCLUSION:

The project "Battery powered heating and cooling suit with location spotter" is successfully tested and implemented. This system is smaller, lighter and with lower power consumption, so it is more convenient. Which can help soldiers to work even in extreme climatic applications.

It is a highly durable and self-repairing solar technology and also ideally suited for mobile applications. It provides the conveniences of back-up and always on, on-demand small scale solar electrical power.

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