

SMART JACKET FOR SOLDIERS

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Abstract: The climatic conditions are varying from time to time effecting the environment. Extreme hot or extreme cold are very dangerous to the health. Excessive exposure to heat as well as keeping the body too cold causes serious health issues. In extremely hot environment, the most serious problem is heat stroke. At very cold temperature, the most serious problem is the risk of hypothermia or dangerous overcooling of the body. Sometimes, these unusual climatic conditions may cause unfortunate death of people. So we have designed a jacket, named as "Smart-Jacket", which is aimed to give better protection to the people living in extreme weather conditions. This jacket maintains the desired temperature inside the jacket. The Smart-Jacket is very much useful especially for our soldiers, working in extreme weather conditions. By using this jacket the user can control and monitor the internal temperature inside the jacket, by using the peltier effect. As an added application, GPS & GSM modules are also used in this jacket to trace the location of the soldier and this jacket also monitors the health conditions of the soldier body temperature and heart beat.

Key words– Smart Jacket, Arduino, Peltier Effect, Extreme weather, Temperature Sensor

I. INTRODUCTION

Indian Soldiers are the most important resources of our country. They play a very vital role to protect the country and its citizens. Army, Air Force, Navy and Marines all comes under the term soldier. They are always ready for taking up and holding the duty tasks in extreme weather conditions, whether it may be cold or hot atmosphere throughout the year. While providing security to the nation, they may face troubles in these extreme climatic conditions.

The specially designed Smart-Jackets will give better protection to the soldiers working in extreme weather conditions. This Smart-Jacket will operate in two modes: summer mode and winter mode. Depending upon the set threshold value, the mode of operation can be decided; A jacket is mounted with the circuit and it is operated by the person by selecting the mode of operation depending on the person's requirement. We operate the H-Bridge IC so that it can drive body heater/cooler. The jacket is powered by Solar.

The jacket includes GPS to track the current location of the soldier. It also shows the health conditions of soldiers using temperature and heart beat sensor. Temperature and heart beat rate will be send to the department if it exceeds the threshold value, through GSM module.

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. This Conventional power source uses regulated 5V, 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. EXISTING SYSTEM

A suit is available in the market which provides controlled temperature inside it, but its cost is very high. It is because; many parts of the suit are mechanical and gripping devices. The suit consists of pumps & radiators to provide warm and chilling effect. To cool the body, these pumps spray water on human body.

Another tool is the Electric Blanket. The electric blanket uses carbon fiber wires to provide heat to the user. These wires are inserted into fabric that heats when it is plugged in. The temperature control unit is placed between the electrical outlet and the blanket, which manages the amount of current entering in the heat elements of the blanket. These blankets have a shut off mechanism to prevent the blanket from overheating or catching fire. But the main drawback of these blankets is their maintenance and they cannot be used while doing some work.

III. LITERATURE SURVEY

Adarsh K S, Arun Dinesh, Jyouthy Elizebeth D [1], they designed a jacket, named as "E-Uniform", which gives better protection to the people living in extreme weather conditions. This jacket maintains the desired temperature inside the jacket. This jacket is powered up by solar panel. By using this uniform we can monitor the body temperature of the soldier.

Prof. Varsha Bendre [2] This paper concentrate on tracking the location of soldier from GPS, which is useful for control room station to know the exact location of soldier and accordingly they will guide them also soldier-to-soldier wireless communications to relay information on situational awareness and GPS navigation, Bio-medical sensors, Wireless communication

Somali Kavitate, Onkar Jallapelli, Hanumant More, Assistant Prof. S.A.Nirve, Department of Electronics & Telecommunication.[3].they designed a jacket, named as "E-Jacket", which gives better protection to the people living in extreme weather conditions. This jacket maintains the desired temperature inside the jacket and help to monitor the body temperature of the soldier.

IV. METHODOLOGY

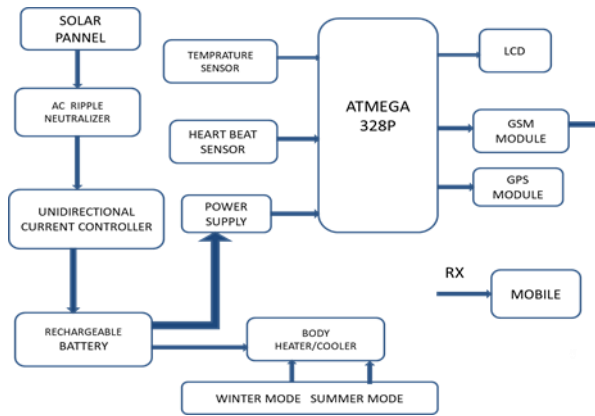


Figure 4.1: Block Diagram

Fig 4.1 shows the block diagram of smart jacket for soldier that consists of Solar panels that are used for charging a lead acid battery (12V, 1.2Amp hrs).and to power up the internal circuitry of the system. A Solar Panel contains a set of solar photovoltaic modules electrically connected and mounted on a supporting structure.

AC ripple neutralizer is used to protect AC from damage then unidirectional current controller is used because some times the current flow in an opposite direction from battery so we are using a diode as a unidirectional current controller. Rechargeable battery here we are using 12v lead acid battery.

We are using an 5v battery separately to supply the power to the peltier plate. A peltier thermoelectric device when connected to battery, it generates cooling effect on one side and heat is dissipated on other side. The project is operated in two modes i.e. summer and winter.By selecting the mode of operation such that it can drive the body heater or cooler.

The LM35 sensor series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 linear temperature sensors calibrated in ° Kelvin.

Heart beat sensor this Heart Beat sensor is designed to give digital output of heart beat when a finger is placed inside it .This digital output can be connected to arduino directly to measure the Beats Per Minute (BPM) rate. Its working is based on the principle of light modulation by blood flow through finger at each pulse.

GSM is interfaced with the ARDUINO and GPS can also be interfaced such that the tracking of the location of the soldier is observed and the health conditions of a soldier are messaged to the concerned person or department.

Arduino allows dynamic and faster control. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins,6 analog inputs,a 16 MHz ceramic resonator, a USB connection.LCD makes the system user friendly LCD is used to display the temperature and heart beat rate and also the location of the soldier. Liquid crystal displays (LCD’s) contain the materials which combine the properties of both liquids and crystals.

4.1. ARDUINO UNO (At Mega 328P)

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins,6 analog inputs,a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller and connect it to a computer with a USB cable or power up with a AC-to-DC adapter or battery to get started.

The board has the following new features:

- 1.0 pinout: It will added SDA and SCL pins that are near to the AREF pin and it has two other new pins placed near to the RESET pin, the IOREF it will allow the shields to adapt to the voltage provided from the board. In future the shields will be compatible with both the board that uses the AVR, which operates with 5V.
- Stronger RESET circuit.

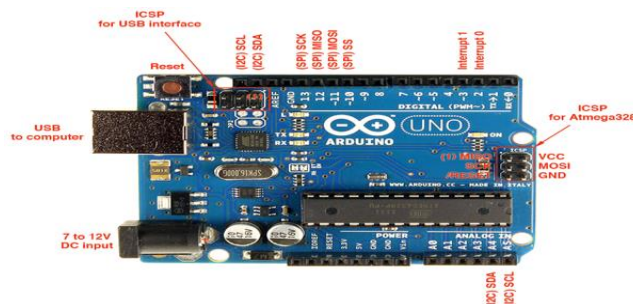


Figure 4.1.1: Arduino UNO Kit

4.2. HARDWARE

4.2.1. Peltier plate

The peltier plate works on the principle of peltier effect. The peltier effect is a type of thermoelectric effect that observed in an electric circuit. This peltier effect is defined on the bases of creating a temperature difference by applying a voltage between

the two electrodes connected to a semiconductor material. This phenomenon is very much useful when it is necessary to transfer heat from one medium to another which works on the bases of summer mode and winter mode.

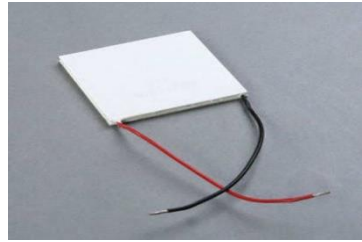


Figure 4.2.1: Peltier Plate

4.2.2. Temperature Sensor [LM_35]

LM 35 is a precision integrated circuit temperature sensor whose output voltage is linearly proportional to temperature .This sensor is used to collect the information of body temperature and sends the signals to the arduino board and the same is displayed on LCD.its of low cost due to wafer of level trimming .It has low self heating, it ranges from -55C to 150C.

Pin configuration

- Vic : Input voltage of 5v
- Analog out
- Ground : connected to ground terminal of the circuit



Figure 4.2.2: Temperature sensor

4.2.3. Heart Beat Sensor

This Heart Beat sensor is designed to give digital output of heart beat when a finger is kept inside it. This digital output can be connected to the main board directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation when the blood flows through the finger at every pulse .The sensor consists of IR LED and a Photo diode as its inner parts.

Specifications:
 Operating voltage: 3.3v-5v
 Current: 4mA



Figure 4.2.2: Heart Beat Sensor

4.2.4. GPS Modem

GPS works in five logical steps

- The very important factor for GPS modem is “triangulation”.
- To triangulate a GPS receiver it should measure distance with help of the time travelled by radio signals.
- To measure travel time, GPS needs almost accurate timings.
- Along with the distance we need to know the exact location of the satellites in space.
- If the signal come across any delays when it travels through the atmosphere, they need to be corrected.



Figure 2.2.4: GPS Modem

4.2.5. GSM Module

A GSM module that is used in this smart jacket for soldiers is SIM800.GSM (Global System for Mobile Communications), it is a standard set that is developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) used by mobile phones GSM plays a very important role in our paper. GSM in this jacket is to send a message to the concern department that includes heart beat, temperature sensor readings and current location of the soldier. GSM supports voice calls and data transfer speeds of up to 9.6kbit/s



Figure 2.2.5: GSM Module

4.3. SOFTWARE EMBEDDED C

Embedded systems are electronic devices that include microprocessors with in their implementations. The microprocessors are used to simplify the system design and provide flexibility. Embedded computer systems are electronic systems that include a microcomputer to perform a specific dedicated application.

The algorithm for such system is as shown below:

Step 1 : Include header files for interfacing the LCD, temperature sensor, GPS and GSM systems with the Arduino board.

Step 2 : Initialize analog ports of arduino for interfacing temperature sensor to measure temp.

Step 3 : Initialize ports for the LCD operating in 4-bit Mode.

Step 4 : Initialize ports of the relay that controls peltier plate to maintain the temperature inside the jacket.

Step 5: Begin the infinite while loop, read the Temperature values from sensors in ADC port and display the values in the LCD.

Step 6: Now, when the surrounding temperature will go above 42 °C, then the DPDT relay will drive peltier cooler.

Step 7: When the temperature detected by temperature sensor goes below 20 °C, DPDT relay will drive peltier heater.

4.4. Whole system working

In this paper we are finding the health conditions and the current location of a soldier by using GPS and GSM module. The process of finding of health condition of a soldier is that if it exceeds the threshold values of temperature and heart beat it will send the message to the concern department to take the actions to protect a soldier. And GPS is used to find the current location of a soldier if it faces any difficulties it will send a message to the department. Also the major part of our project is monitoring the temperature of a soldier as per is requirement. By using a thermocoupler a peltier plate.

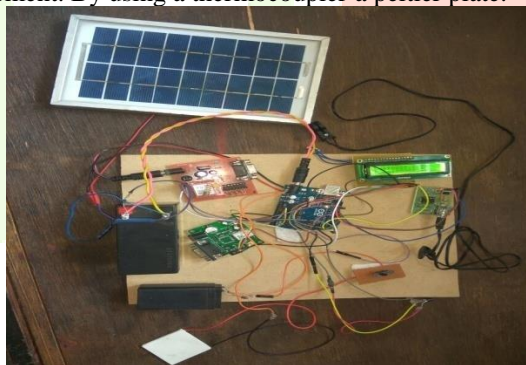


Figure 4.4.1: Whole System

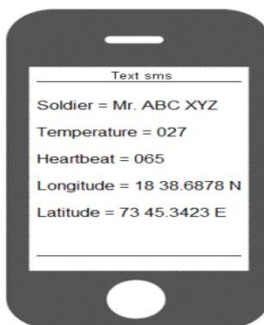


Figure 4.4.2: Temperature, Heart Beat and Location Of Soldier Through GSM And GPS Module

V. ADVANTAGES

- It provides protection from extremely cold temperature such as sub zero temperature.
- It also maintains the body temperature even at very high temperature (up to 85 °C).
- The jacket is easy to wash, as the electrical parts deattachable.
- To trace out the position of the soldier the GPS will find out the position of soldier and send the messages via GSM to the control room.
- Reliable (temperature can be controlled as required) .
- Compact size and meagre weight.
- Affordable prize (Low cost).
- Low Maintenance

VI. LIMITATIONS

- Slow cooling action.
- Limited power resources.

VII. APPLICATIONS

- Used in military applications under all the climatic conditions.
- It can be used by scientists who are working in extreme weather conditions like in Antarctica.
- This uniform can also be used by the common people. Such as the persons living in extreme weather conditions (hot and cold).
- It can also be used in mines and at high temperature furnaces etc.

VIII. CONCLUSION

Soldiers are one of the important factors in a country. Because they are the forces who protect our country day and night living behind sleep and rest. Therefore it is our responsibility to protect them. Same is the significance of this project. So here design an E_Uniform which gives better protection to the soldiers who are working in extreme weather conditions. This project is operated in two modes summer mode and winter mode. If the weather condition is too hot then the cooling system will operated and if it is too cool then the heating system will operated. If this system may fail GPS will find out the position of soldiers and send messages via GSM to the control station. This project has a significant role in our day to day life .Also it can be used in various streams of industrial applications The specially designed E-uniforms are very much useful for military applications especially, in unlike climatic conditions for soldiers and other civilian people.

IX. FUTURE SCOPE

For the future expansion, this jacket can easily powered by a small portable solar panel and make it more eco friendly. The use of solar panel gives continuous output of power with less maintenance. We can also add humidity sensors, rain drop sensors etc for efficient working of jacket, so that these jackets will become wearable in all conditions and in all seasons. We can utilize this jacket to protect us from over-heating and over-cooling

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