E-JACKET

Sonali Kavitake, Onkar Jallapelli, Hanumant More, Assistant Prof. S.A.Nirve

[1] *Student, Department of Electronics & Telecommunication, Marathwada Mitra Mandal's Institute of Technology, Lohgaon, Pune, India*

[2] *Author Student, Department of Electronics & Telecommunication, Marathwada Mitra Mandal's Institute of Technology, Lohgaon, Pune, India*

[3] *Student, Department of Electronics & Telecommunication, Marathwada Mitra Mandal's Institute of Technology, Lohgaon, Pune, India*

[4] *Assistant Prof. S.A.Nirve M.E. (Electronics) Marathwada Mitra Mandal Institute of Technology Lohgaon, Pune, India*

ABSTRACT

The climatic conditions are varying from era to era. Both the temperature conditions i.e. hot or cold are very dangerous to the health. Excessive exposure to heat causes heat stress and excessive exposure to cold causes cold stress. 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 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, naturally. The E-Jacket is very much useful 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. GPS & GSM modules are also used in this jacket to trace the location of the soldier. All these devices are controlled centrally by arduino lilypad (Atmega 328V).

Keyword - *Atmega 328V, DPDT relay, GPS & GSM modules, LCD display, Peltier plates, Temperature Sensor(LM35)*

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1. INTRODUCTION

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

The specially designed E-Jackets will give better protection to the soldiers working in extreme weather conditions. This E-Jacket will operate in two modes: summer mode and winter mode. Depending upon the set threshold value, the mode of operation can be decided; also by operating the DPDT relay it can drive body heater/cooler. The heater/cooler in turn will help to provide chilling or warming effect inside the uniform which helps the soldier to bear any kind of external environment and he can efficiently work without heat stress or cold stress.

This project 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 output of secondary of 230/12V step down transformer.

2. EXISTING SYSTEM

Now-a-days, 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 fibre 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 there maintenance and they cannot be used while doing some work.

3. PROPOSED SYSTEM

The specially designed E- Jackets operates on the concept of peltier effect, to provide a sense of normal temperature, inside the jacket, in extreme weather conditions. The heart of this system is the arduino lilypad board. The temperature sensor (LM35) detects the temperature and sends the details to the arduino board. The arduino send the signals to the DPDT relay which in turn drives the peltier heater/cooler. The GPS & GSM modules are used to spot the location of the soldier. The GPS locates the position of the soldier and GSM is used to send the location to the authorized personnel or department. The LCD display is used to display the temperature and also location of the soldier.

3.1 BLOCK DIAGRAM

The design of E-Jacket consists of :

1) Arduino Lilypad (Atmega 328V)
2) Peltier Plate (TEC 12706)
3) GPS Module
4) GSM Module
5) LCD Display
6) DPDT Relay

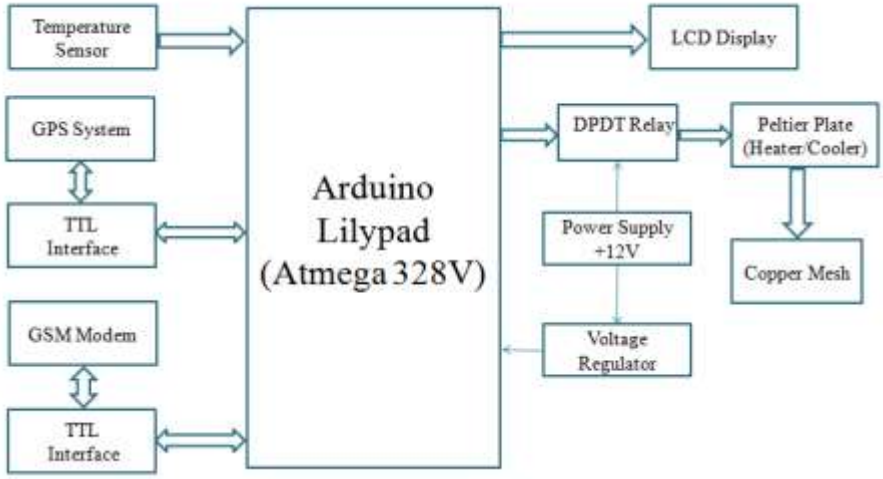

Fig-1: Block diagram of E-Jacket

The power supply is used to provide the DC voltage to the arduino board and to the peltier plate. Now our main task is to regulate the temperature inside the E-Jacket as per the requirements of soldier. This can be achieved by using the peltier plates. These peltier plates are capable of providing both hot and cold sensations. These hot or cold sensations are provided uniformly on the body of the person by using copper mesh. The DPDT relay is used to drive the peltier heater/cooler to provide heating or cooling effect as per the instructions given by the soldier. The

GPS and GSM systems are also interfaced with the arduino to track the location of the soldier and to send it to the authorized department only. A LCD display is also provided which will display the temperature s well as the location of the soldier.

3.2 PROGRAMMING IN ARDUINO IDE

The Arduino IDE (integrated development environment) is a cross-platform application written in the programming language Java. It is originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

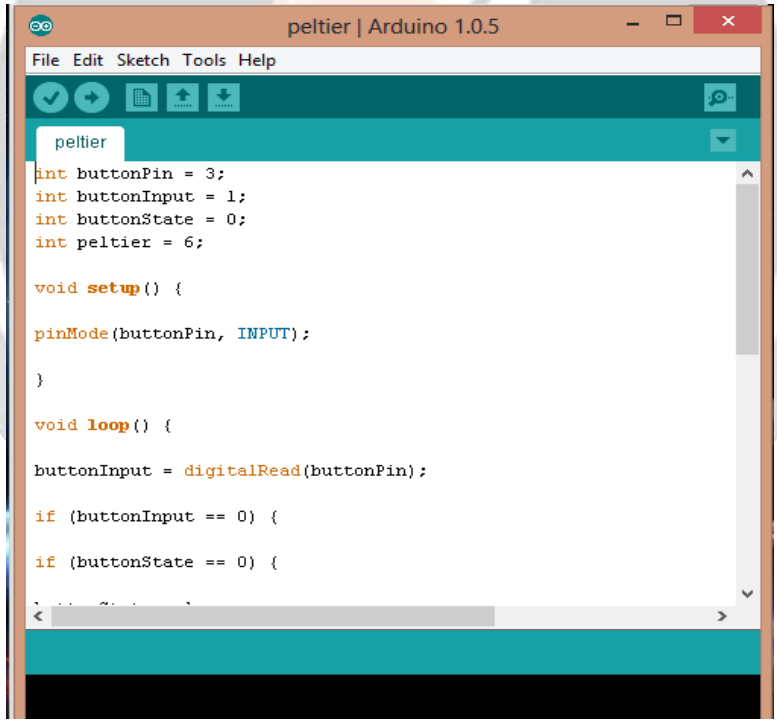

Fig-2: Programming in Arduino IDE

3.3 SOFTWARE ALGORITHM

The system is programmed in such a way that LM35 (Temperature Sensor) will monitor the temperature values, input the values to the Arduino via ADC port and the values are displayed in the LCD for visual inspection. In order to control the heat dissipated at the hot side of the peltier plate, a small heat sink is placed on it and connected to the Microcontroller using Relay. To control the extreme temperatures and provide a temperature that is

tolerable to the soldier another relay is connected to control the supply of power to the peltier plate. 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 temperature.
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. SYSTEM DESIGN

4.1 ARDUINO LILYPAD

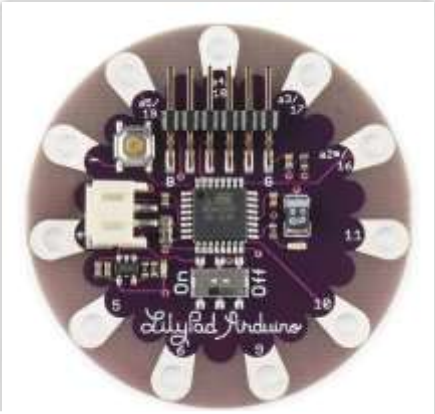

Fig-3: A View of Arduino Lilypad

The Arduino Lilypad is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread. The board is based on the ATmega168V (the low-power version of the ATmega168) or the ATmega328V.The Lilypad Arduino is a circle, approximately 50mm (2") in diameter. The board itself is 8mm (1/32") thick (approximately 3mm (1/8") where electronics are attached).

The Lilypad Arduino can be powered via the USB connection or with an external power supply. If an external power supply is used, it should provide between 2.7 and 5.5 volts.

4.2 PELTIER PLATE

In this project TEC-12706 is used. The peltier plates work on the principle of peltier effect. The Peltier effect is defined as creating a temperature difference by applying a voltage between 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 on a small scale. The Peltier effect is one of three types of thermoelectric effect.

In a Peltier-effect device, the electrodes are typically made up of a metal with excellent electrical conductivity. The semiconductor material between the electrodes creates two junctions between dissimilar materials, which in turn, create a pair of thermocouple. Voltage is applied to the electrodes to pass electrical current through the semiconductor, thermal energy flows in the direction of the charge carriers.

Fig-4: Peltier Plate

4.3 GPS

GPS (Global Positioning System) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. The outcome of a typical GPS survey includes geocentric position accurate to 10 m and relative positions between receiver locations to centimeter level or better.

Fig-5: GPS Module

The GPS receiver is capable of receiving signals from up to 65 GPS satellite and transferring them into the precise position and timing information that can be read over either UART port or RS232 serial port. In this E-Jacket the GPS parallax PAM- 7QM is used. It is used to trace the location of the soldier.

4.4 GSM

Fig-6: GSM Module

The GSM modem used in this jacket is SIM800. GSM (Global System for Mobile Communications, originally Group Special Mobile), is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones. The GSM

standard was developed as a replacement for first generation (1G) analog cellular networks, and originally described a digital, circuit switched network optimized for full duplex voice telephony. This was expanded over time to include data communications, first by circuit switched transport, then packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution or EGPRS).Further improvements were made when the 3GPP developed third generation (3G) UMTS standards followed by fourth generation (4G) LTE Advanced standards. "GSM" is a trademark owned by the GSM Association.

4.5 LCD

Fig-7: LCD Display

A 16x2 LCD module is used in this project to display the temperature and also the current location (longitude & latitude) of the soldier. It consists of 16 columns and 2 rows.

5. EXPERIMENTAL SETUP

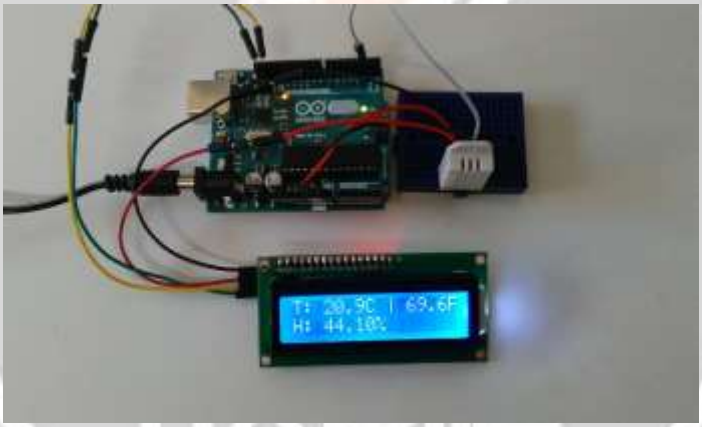

Fig-8: Displaying Temperature on LCD

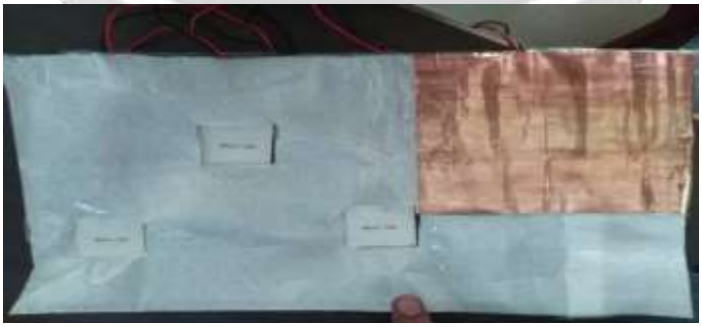

Fig-9: Peltier Plate inside the jacket, also copper sheet to uniformly distribute the heat, across the body

Fig- 10: Cooling unit of the suit

6. 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 detachable
- 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

7. DISAVANTAGES

- Slow cooling action.
- Limited power resources.

8. 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.

9. CONCLUSION

The specially designed E-uniforms are very much useful for military applications especially, in unlike climatic conditions for soldiers and other civilian people.

10. FUTURE SCOPE

For the future expansion, this jacket can easily powered by a small portable solar panel and make it more echo 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.

11. ACKNOWLEDGEMENT

Apart from our efforts, the success of this project depends largely on the encouragement and guidelines of many others. We take this opportunity to express our gratitude to the people who have been instrumental in the successful completion of this project.

We would like to show our greatest appreciation to **Assistant Prof. Mrs. Sheetal Nirve**. We can't say thank you enough for his tremendous support and help. We feel motivated and encouraged every time. Without her encouragement and guidance this project would not have materialized.

We are also grateful to **Prof.J.M.Bakliwal** (H.O.D E&TC) for his kind cooperation offered to us every time regarding the designing and working of the hardware system. We would also like to thank to all the staff members and the laboratory in charges for keeping the labs open and having a number of instruments necessary in the development of the project.

The guidance and support received from all the group members who contributed and are contributing to this project, was vital for the success of the project. I am grateful for their constant support and help.

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