

SAM-The Smart Adaptable Management Jacket

Swetha T N, Nageshwar Rao A, Chethan D, Pradeep Kumar S M, D Jayashree

Abstract— People were feeling uncomfortable due to change in temperature day by day. The sudden change in environmental conditions may leads to major health issues. The proposed paper enables us to sense both body temperature, environmental conditions and controls the temperature either manually or automatically. The main components of the paper are Arduino Uno interfaced with a temperature sensor, an LCD display, Peltier module, Bluetooth module, Relay module and Rechargeable battery. The overall operation is to measure the temperature of the body and environmental conditions that displays on LCD module and mobile screen through Bluetooth module. The heater and cooler in turn will help user to provide either warming or chilling effects inside the jacket. This jacket acts as a guard and helps people to work comfortable irrespective of the weather conditions against the temperature variations.
Keywords— Arduino Uno Board, Peltier Module, LM35 Temperature sensor, Relay and LCD Display.

I. INTRODUCTION

The Weather conditions are extremely changing day to day. Currently the climatic conditions are very infernal and abnormal for the people. Even if any person who interested to travel outdoor must be deal with all sorts of weather conditions. Irrespective of the temperature changes [1]. The sudden change in climatic conditions can leads to major health problems such as hypothermia and heat strokes [2]. An appropriate solution is introduced by providing a touch of a single button; where people can control the body temperature with respect to the external environment conditions. Similarly in cold climatic areas it is unsuitable for the humans to continue to live. In every such surrounding of a places the jacket helps the user effectively. The main aim of this project is to help the user to control and monitor the internal temperature of the jacket as per requirements, depending on the season, the jacket will protects as a guards to the user from such illness caused due to changes in a climatic conditions and suddenly changings in the both heating or cooling effects.

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Prof. Swetha T N Assistant Professor in the department of Electronics & Communication Engineering, S.J.C.I.T, Chikballapur

Mr. Nageshwar rao A Student Electronics and communication Engineering, S.J.C.I.T, Chikballapura,

Mr. Chethan D Student in Electronics and communication Engineering S.J.C.I.T, Chikballapura

Mr. Pradeep Kumar S M Student, Electronics and communication Engineering S.J.C.I.T, Chikballapura

Mr. Pradeep Kumar S M Student, Electronics and communication Engineering S.J.C.I.T, Chikballapura

The jacket can act as both heating and cooling system. When climate is too hot, the jacket cools down the body and when climate is too cold, the jacket heats up the body. This system is thus an efficient and adamant solution to the drastic change in weather which causes many ill effects to humans due to sudden changes in the temperature. The usefulness and feasibility of such a suit is the motivating factor to commence on this proposed system. This jacket allows the user to keep tracking the internal temperature of the jacket from high to low temperatures, with the use of the thermoelectric effect and displays the results in both LCD module and a smart phone. A 12 V Direct Current Lipo rechargeable battery [6] is used for storing the energy

II. BLOCK DIAGRAM

The proposed system is based on the microcontroller. The heating and cooling function is obtained by using peltier module and it can be done using relay operation. The power supply to the circuit is provided by the lead acid rechargeable battery. The system consists of LM-35 temperature sensor, Bluetooth module, and 16X2 LCD screen. The climatic conditions are sensed by the temperature sensor continuously and it will display on the LCD screen. Bluetooth module is used to communicate Arduino with mobile application.. The LM35 temperature sensor [1] continuously senses the surrounding temperature and gives the analog data to the arduino. The arduino takes the analog data as its input and gives the digital data to the LCD module. The LCD module displays the current temperature every second. The peltier module made up of two type semiconductor namely n type and p type. If the n type terminal is connected to n type and p type terminal connected to p type, the peltier module one side produces heat and the other side it produces cooling effect. If the polarity changes the heating side produces cooling and the cooling side produces heating. So this can't be done manually so we are using H-Bridge circuit to change the polarity. The H-Bridge circuit gives control over to the peltier module for heating and cooling of a Jacket. The power is supplied to the H-Bridge circuit through rechargeable battery.

The switch is used to turn on/off of a peltier module. The Bluetooth module is connected to a Arduino board. The Bluetooth is connected to smart phone for manual control of a jacket and it was operated to smart phone. The power is supplied through a Lipo rechargeable battery. The battery is used to supply the current throughout the jacket.

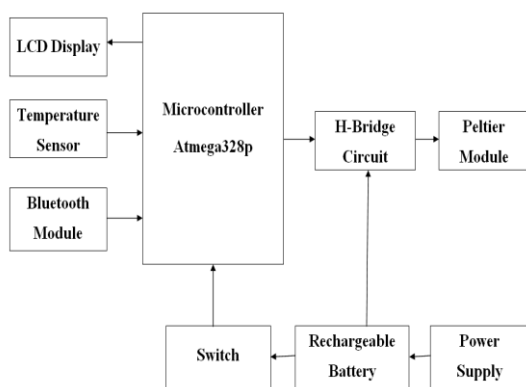


Fig 1: Block diagram of smart adaptable management jacket.

III. HARDWARE DESIGN

A. Arduino Uno:

The Arduino Uno board contains Atmega3248p microcontroller [2], it is a 28pin IC microcontroller as shown in figure 2. In that 28pins, 7pins are power pins, 6 are input/output analog pins and 14 input/output digital pins. This Arduino board operates at 5volts and it requires 7 to 12volts of input voltage. It has flash memory of 32Kb in which, 0.5Kb is used by systembooter, 2Kb of static random access memory and 1Kb of electrically erasable programmable read only memory. Microcontroller is a heart of computer which is placed on a single IC. It consists of multiple CPUs, input output ports along with programmable memory. Here the microcontroller is used to control the heating and cooling of a jacket.



Fig 2: Arduino Uno board.

B. Peltier Module:

The Peltier modules [3] are commonly called as Thermo Electric Coolers (TEC's), it can be used either to produce heating or cooling effect shown in figure 3. It uses the Peltier effect to create the temperature difference between the two junctions of different materials.

Thermo Electric Coolers are operated on Peltier effect in general which is also called as thermo electric effect. The device is made up of two semiconductors n-type and p-type. When the DC current flows through the device, the Peltier module brings heating and cooling effect. The one side of the Peltier module is heated and other side of the Peltier module is cooled. The hotter side connected with the heat sink, so that the heat remains at surrounding temperature, while the cooler side goes below the room temperature. More number of Peltier modules are connected together in parallel for lower and higher temperature.

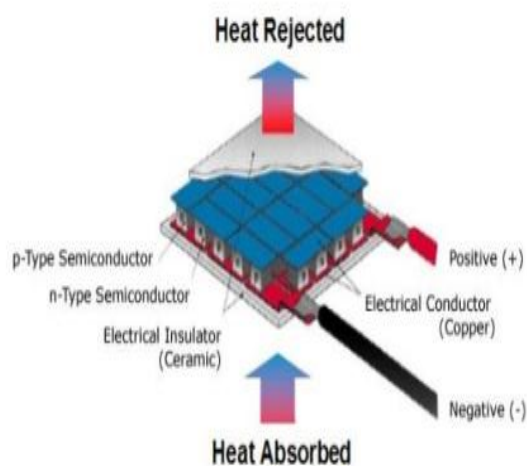


Fig 3: Peltier module.

C. Temperature Sensor:

LM35 Temperature sensor [5] is used to sense the current surrounding temperature as shown in figure 4. It consists of 3 pins in which first pin is VCC, which is connected to 5volts supply in Arduino, second pin is analog output pin, which is connected to A1of analog input/output pin in Arduino and third pin is a ground pin, which is connected to ground in Arduino. It senses the surrounding temperature in the analog form and is given to arduino where it is converted to digital form and displayed in the LCD module. It has an advantage over the linear sensor which calculates in Kelvin, we can get the output in Centigrade scaling directly without any conversions. It can sense from -55° C to 150° C range and

ensures 0.5°C accuracy. It operates from 4volts to 30volts supply.

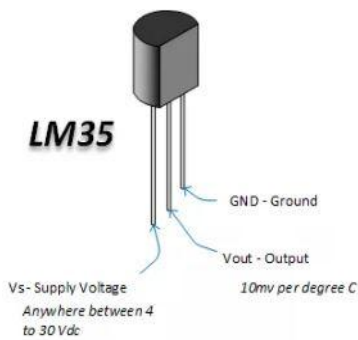


Fig 4: LM35 Temperature sensor.

D. Bluetooth Module HC-05:

The HC-05 Bluetooth module as shown in figure 5 is used to establish the communication between Arduino and mobile application. It communicates through serial communication, this is because RX and TX of Bluetooth module [4] is connected to TX and RX of Arduino and works at 9600 baud rate. Bluetooth stands for exchanging data for a shorter distance without wire and builds a personal area network. It ranges up to 100 meter and operating voltage is 5V.



Fig 5: Bluetooth module.

E. (16x2) LCD Display:

Liquid Crystal Display (LCD) as shown in figure 6 is an electronic display module. It is most commonly used in embedded papers because of cheap price, availability and provides programmer friendly. The LCD displays 32 characters, in each character there will be 5 crystals for displaying a character. In our day to day life we come across these kinds of displays such as PCO's or calculators. It operates in the range of 4.7V to 5.3V. The temperature sensed from the LM35 sensor is displayed in the LCD module.

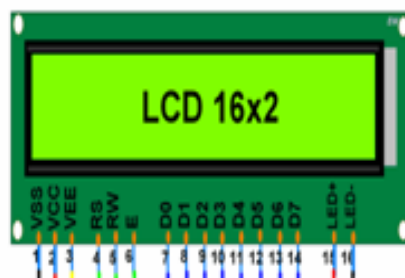


Fig 6: (16x2) LCD display.



Fig 7: H-Bridge.

G. RECHARGEABLE BATTERY:

Lipo battery is nothing but Lithium polymer battery as shown in figure 8 and these are new type of batteries, now used in many consumer electronic devices. There are many superiority to use these batteries i.e. it can capable of holding much lighter weight, and can be made in almost any shape or size. These batteries have higher capacities allowing them to hold more power and higher discharge rates. As other lithium-ion cells, Lipo works on the principle of intercalation and de-intercalation of lithium-ions from a positive electrode material and a negative electrode

material, with liquid electrolyte providing a conductive medium to prevent the electrodes from touching each other directly, a micro porous separator is in between which allows only the ions and not the electrode particles to migrate from one side to other.

This Rechargeable battery[7] is a 12v 2200mah Lipo battery. Specially designed for the system devices which use 12v DC power supply, It contains built-in ON/OFF switch to save power usage. The circulation charge and discharge occurs more than 500 times.



Fig 8: Lipo battery.

IV. WORKING PRINCIPLE

The Arduino coding is programmed in the following manner. The code starts with defining of variables and declaring of functions. The main loop of the program will takes the input as a surrounding temperature from LM35 sensor in the binary form. The Arduino is responsible to convert it from binary to decimal form. The LCD module exhibits the current temperature which is sensed by the LM35 sensor which was given as an output by the Arduino. If the conditional statement is true that is, if the temperature is greater than 30°C, the cooling effect will be started with the help of Peltier module, else it goes for another conditional statement. If this conditional statement is true that is, if the temperature is less than 10°C, the heating effect will be started by connecting heat sink on one side of the Peltier module, else it goes for the main statement. After the heating/cooling effect, it enters into the main loop. The one side of the peltier heats up, if we want chillness after some time we need to change the polarities of the peltier from p type to n type and n type to p type. This change of action is done by H-Bridge circuit. Only two peltier module turns on, if the temperature is near to 30°C and 10°C. This is done because the battery consumes less current. This jacket can work automatically or we can set manually also, according to the user requirement. If the temperature rises it chills or if the temperature goes down the heating effect comes. By manually we can alter the temperature by providing the input through smart phone using wireless Bluetooth technology.

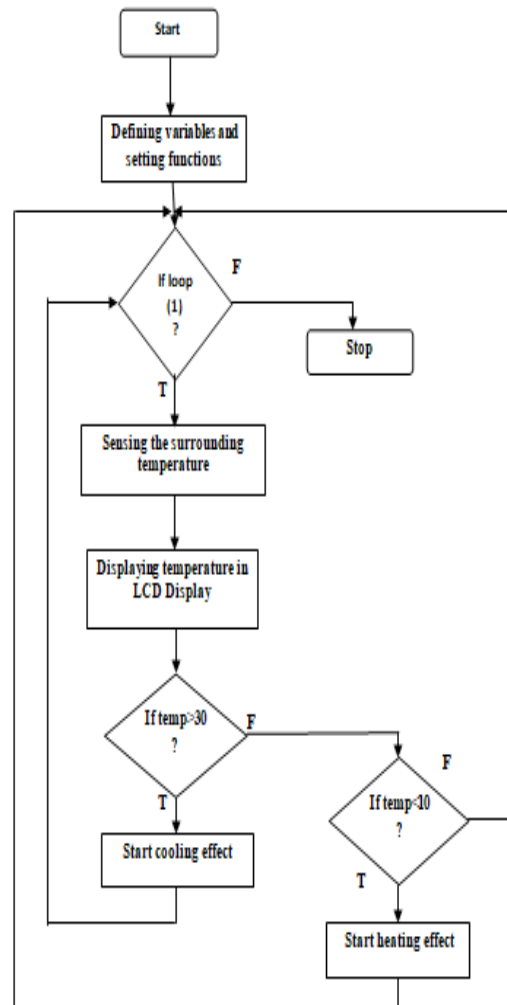


Fig 9: Flowchart of programmable design.

V. RESULTS

As per the result, the SAM Jacket maintains the optimum temperature of 20°C automatically. If the user wants to change the optimum temperature he/she can give it manually also. If the temperature wants to be lesser or greater than the optimum temperature, the user wants to input the data through mobile phone which is connected to the wireless Bluetooth module. Thus the SAM Jacket acts as both heating and cooling system either automatically or manually. Here, the system is built using four Peltier module, increasing the number of Peltier bring out the better performance so that each Peltier can be placed in different parts of the body where the temperature sensitivity is more.



Fig 10: Results of SAM Jacket.

VI. CONCLUSION

The paper SAM- Smart Adaptable Management Jacket concludes that it can be mainly used for the soldiers to maintain their body temperature in the extreme cold and hot conditions. Even though the SAM Jacket may be heavy to carry for normal persons but it will be useful for the soldiers in the snow falling and desert regions. It can also be used for the worker who works at outdoor in cold and hot climatic conditions. This jacket allows them to monitor and to control their internal body temperature from hot and cold. In future there will be reduction of weight and there will be an improvement compared to current standards. Future there will be reduction of weight and there will be an improvement compared to the current situation.

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AUTHORS PROFILE



Prof. Swetha T N is presently working as an Assistant Professor in the department of Electronics & Communication Engineering, S.J.C.I.T, Chikballapur, Karnataka, India. She is having 10 years of teaching experience. Her areas of interest are Communication systems, Cryptography & Network security, Information Theory & Coding, Embedded Systems, Protocol Engineering, Image Processing, Digital Logic Design, Wireless communication. Mail id: swethareddy.t.n@gmail.com



Mr. Nageshwar rao A is presently pursuing his final year in Electronics and communication Engineering, S.J.C.I.T, Chikballapura, Karnataka, India, His areas of interests are basic electronics, VLSI and C++. Mail id: nageshakkishetty@gmail.com



Mr. Chethan D is presently pursuing his final year in Electronics and communication Engineering S.J.C.I.T, Chikballapura, Karnataka, India. His areas of interests are Microprocessor, Linear integrated circuits and C. Mail id: dchethan863@gmail.com



Mr. Pradeep Kumar S M is presently pursuing his final year in Electronics and communication Engineering S.J.C.I.T, Chikballapura, Karnataka, India; His areas of interests are Digital electronics, C and C++. Mail id: Pradeepkumarreddy723@gmail.com



Mr. Pradeep Kumar S M is presently pursuing his final year in Electronics and communication Engineering S.J.C.I.T, Chikballapura, Karnataka, India, Her areas of interests are signals and systems and computer communication networking. Mail id: jayashreed210@gmail.com