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E-Textile Military Jacket

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Abstract: The focus of this paper is on the development of textile-based wearable electronics that can be integrated into military protective clothing. The manufacturing survey was conducted to determine the best performing and most durable materials to withstand the rigors of textile manufacturing and potential military use. Narrow woven technology was selected as one of the most promising textile manufacturing methods. In the battle field if our soldier gun down by enemy it will sense by piezoelectric sensor then automatically SMS sends to our army office. By this idea we easily found the soldier status in battle area. If soldiers strength is not enough against enemy's strength then we sends extra force to the battle area. It is very easy to save our country.
Keywords:global positioning system (GPS), local area network (LAN), EDR (Enhanced Data Rate), AFH (Adaptive Frequency Hopping Feature), SPP (Serial Port Protocol).

I. INTRODUCTION

In battlefield our army soldiers facing lot of problems because of the enemies. Sometimes they attack our soldiers without any intimation in border. Main aim of this paper is to intimate illegal attack or sudden attack to the base station using piezoelectric crystal, microcontroller and GSM. We keep the piezoelectric crystal over the jacket it is used to sense the vibration. Whenever our soldiers are in duty for watching in border if anybody attacks, the piezoelectric sensor get vibrates so it produce some voltage, it sense by the microcontroller. Then the microcontroller signals the base station by using GSM.

II. LITERATURE SURVEY

This chapter deals with the operation of existing methods and their limitations. From the literature survey, the integration of sensors and actuators can increase the functionality of military uniform. However, this may lead to decrease in the real protection for soldiers from weapons and other related threats. The integration of sensors and actuators into the uniforms should not compromise a soldier's capabilities in terms of mobility, survivability and sustainability.

A. Modern Helmet Systems

In today's modern helmet systems, the soldiers can get up-to-the-minute information via a helmet- mounted Global Positioning System (GPS), wireless voice and data communication system, and a wearable computer linked to an wireless Local Area Network (LAN). A flip-down display on the helmet allows the soldier to scan the surroundings in the darkness, using thermal and night-vision sensors connected to his weapon. This display also gives each soldier a view of a situation map that can pinpoint where both the friends and the foe are located, in real- time. With that knowledge, the soldier can better figure out how to tackle the enemy. Modern Helmet is shown in the fig.1.

On the other hand, an electric wire integrated into the helmet cover would be connected to another part of the uniform. The goal is to provide the soldier with executable functions that require the fewest possible actions on their part to initiate a response to a situational combat need by means of intelligent textiles.

Fig.1 Modern Helmet

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Modern helmet communicates the base station or other soldiers manually when send the information throughout the mail. If any accidents or attacks happen to the soldiers, possibly they cannot pass it manually.

III. METHODOLOGY

Electronic textiles, or simply e-textiles, are textiles with embedded electronics and some fiber materials possessing electrical characteristics and providing some useful functions. The various functionalities where electronic textiles are making inroads include communication (both wired and wireless), enhanced mobility, survivability. Developments in sensors and wireless technology enable improvement in the performance of personal combat equipment. Some of the recent functionalities achieved by integration of e-textiles include physiological status monitoring, wearable power supplies, and sensing of environmental conditions as well as the detection of chemical and biological threats. The fig.2 shows the Block diagram of E-Textile military jacket and it illustrates how each and every component is interfaced to do respective function.

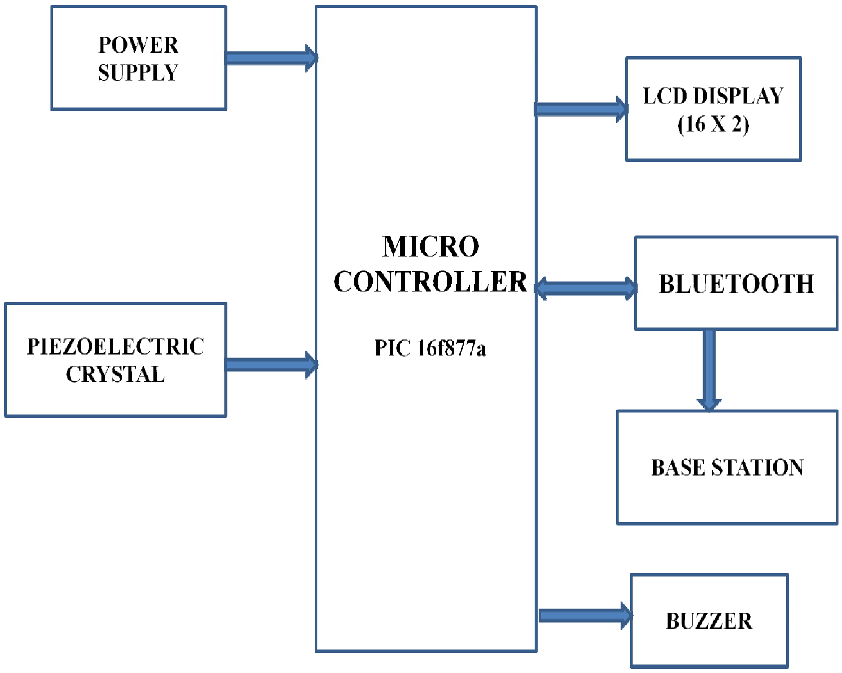

Fig.2 Block Diagram of E-Textile Jacket

The regulated power supply acts as a source for all the components involved in this project. Piezoelectric crystal used here plays the role of sensor which senses the vibration produced in the battlefield and develops an equivalent voltage. Microcontroller PIC 16F877A functions as a mediator between sensor and output devices. LCD is used to display the commands which are passed by the microcontroller.

IV. INTERFACING CIRCUITS

The control of E-textile jacket has to be interfaced with piezoelectric sensor which gives input to the microcontroller. The microcontroller is the heart of the E-textile jacket and operates all the output of the jacket. The input to the controller is piezoelectric sensor which detects the vibration acting in jacket. The microcontroller and other devices are powered by DC (Direct Current) battery source. The output of system is locally indicated by LCD (Liquid Crystal Display) and with the help of GSM (Global System for Mobiles), message passing to the base station. Fig.3 illustrates the overall circuit diagram of E-Textile military Jacket. A DC (Direct Current) power source of 6V is given as input to the overall circuit and the power for each device is divided accordingly. The input from piezoelectric sensor is given to the microcontroller through inbuilt ADC (Analog to Digital Converter). Piezoelectric crystal has linear relationship between vibration and voltage whereas vibration increases with output voltage also increases. When voltage from piezoelectric crosses the predefined limit, microcontroller signals the base station through GSM (Global System for Mobiles).

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When a bullet hits the person, the body experiences vibration and this vibration is transferred as a force to piezo electric crystal. Unit cell is symmetrical in most of the crystals whereas in the piezo electric crystal it is not. Normally they are electrically neutral. i.e. the atoms present inside the piezo electric crystal may not be arranged.

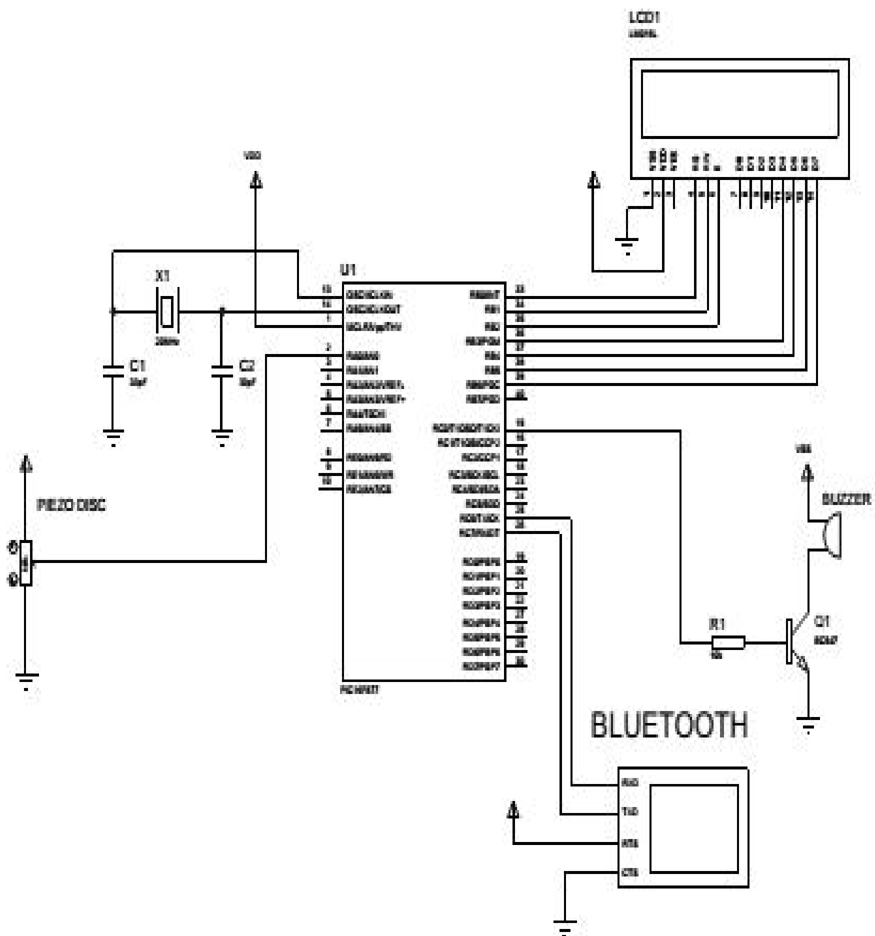

Fig.3 Overall Circuit Diagram of Military Jacket

Symmetrically, but their electrical charges are perfectly balanced. Both positive and negative charges are present in equal amount inside the piezo electric crystal. So that a positive charge in one place cancels out a negative charge nearby. Hence the force exerted on the piezo electric crystal tends it to deform thereby unbalancing the positive and negative charge present inside the crystal and causing net electrical charge to flow. (i.e.).a voltage is produced across its opposite faces. The voltage signal produced by the piezo electric crystal is given as the signal to the microcontroller. The microcontroller compares the signal fed to it by the piezo electric crystal with the set point value (pre defined value given to the microcontroller).

V. SIGNAL CONDITIONING CIRCUITS

A. Power supply circuit

A 6V DC (Direct Current) source is used in this circuit, but microcontroller and other electronic devices work only in 5V. It may leads to damage the overall circuit due to over voltage. Voltage sources in a circuit may have fluctuations resulting in not giving fixed voltage outputs. Voltage regulator IC maintains the output voltage at a constant value. Fig.4 shows the connection diagram of power supply 7805 IC, a voltage regulator Integrated Circuit (IC) is a member of 78xx series of fixed linear voltage regulator ICs used to maintain such fluctuations. The xx in 78xx indicates the fixed output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add heat sink as well. Table 1 shows the pin functions of 7805.

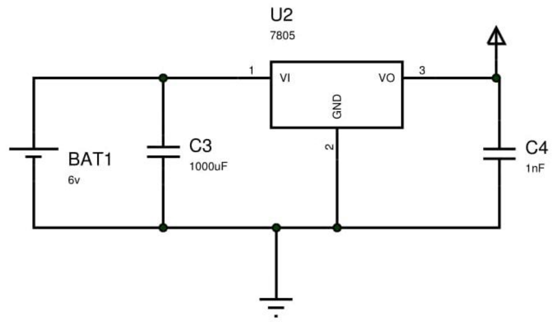

Table 1: 7805 Pin Functions

PIN No.	PIN DETAILS	DESCRIPTION	
1	INPUT	Input voltage (7V-35V)	In this pin of the IC positive unregulated voltage is given in regulation.
2	GROUND	Ground (0V)	In this pin where the ground is given. This pin is neutral for equally the input and output.
3	OUTPUT	Regulated output; 5V (4.8V-5.2V)	The output of the regulated 5V volt is taken out at this pin of the IC regulator.

B. Design Of Amplification Circuit

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. Normally they are electrically neutral. i.e. the atoms present inside the piezo electric crystal may not be arranged when it is in normal condition. Vibration (force) is applied on the piezoelectric crystal; it produces voltage due to unsymmetrical arrangement of positive and negative ions. Fig.5 shows the piezoelectric sensor amplifier circuit. For example, Design amplification circuit with gain of 100, because piezoelectric

$$\frac{V_{out}}{V_{in}} = A_v = 1 + \frac{R_2}{R_1}$$

sensor produces mill volt (mV) output.

Assume the feedback resistance to be 1KΩ and input resistance to be 10Ω,
R1=10 Ω
RF=R2=1KΩ
Since amplifier is used in a non-inverting configuration, gain of the amplifier is
Gain A = 1+ (Rf/R1) =1+ (1000/10)

Therefore, A = 101

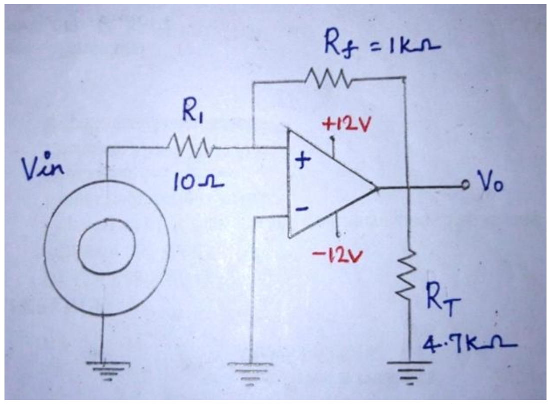

Fig.5 Piezoelectric Sensor Amplifier Circuit

From the piezoelectric sensor amplifier circuit, output voltage is analyzed with respect to the input applied in the crystal. Table 2 shows the piezoelectric sensor analysis.

Table 2 Piezoelectric sensor Analysis

PIEZOELECTRIC STATUS	OUTPUT VOLTAGE
Crystal Voltage	100-140mV
Stable Condition	9-10 V
Minimum Vibration	18-20 V
Maximum Vibration	20-26 V

C. Overcome Method

When piezoelectric crystal produces maximum voltage due to applied force, it causes damage to the microcontroller and other devices which are connected to the system. So, the inverse rule method is followed here. The voltage obtained from the crystal is subtracted from 550mV which is the maximum voltage and the subtracted value is multiplied by a multiplication factor of 10.

Threshold voltage of sensor = 116Mv

Maximum voltage of sensor = 550mV

Output voltage = maximum voltage – input voltage

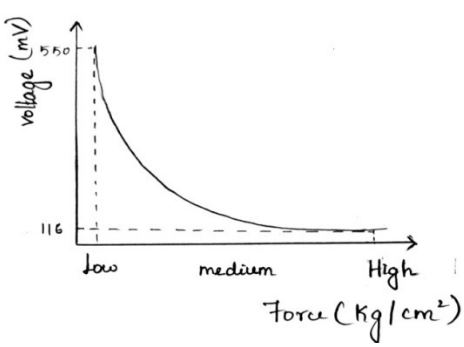

Fig.6 Force Vs Voltage

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With the help of inverse method, relationship between applied force and voltage from crystal as non-linear characteristics is shown in the fig.6. It helps the microcontroller protect from piezoelectric output voltage.

VI. RESULTS AND DISCUSSION

Thus the E-textile military jacket has been designed to intimate the enemies' unlawful (illegal) attack in the border area. When the attack happens in battlefield, microcontroller transfers the message to other soldiers in the predefined path that is already programmed and fed into the microcontroller.

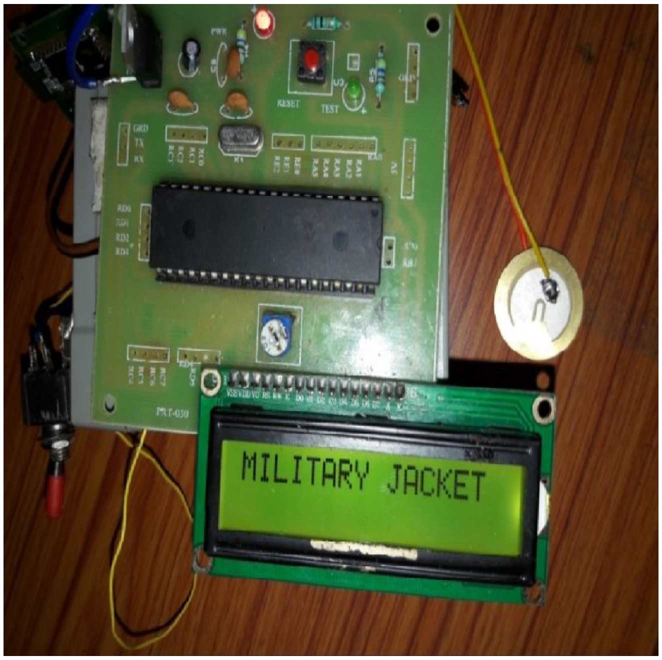


Fig.7 Under Normal Condition

When there is no excitation, LCD displays the message as "E-TEXTILE MILITARY JACKET" as shown in the figure 5.1. If some abnormal condition occurs then the bluetooth receives the command from the microcontroller and it is displayed as "INJURY OCCURRED" as shown in the figure 5.2. Figure 5.3 shows the bluetooth output.

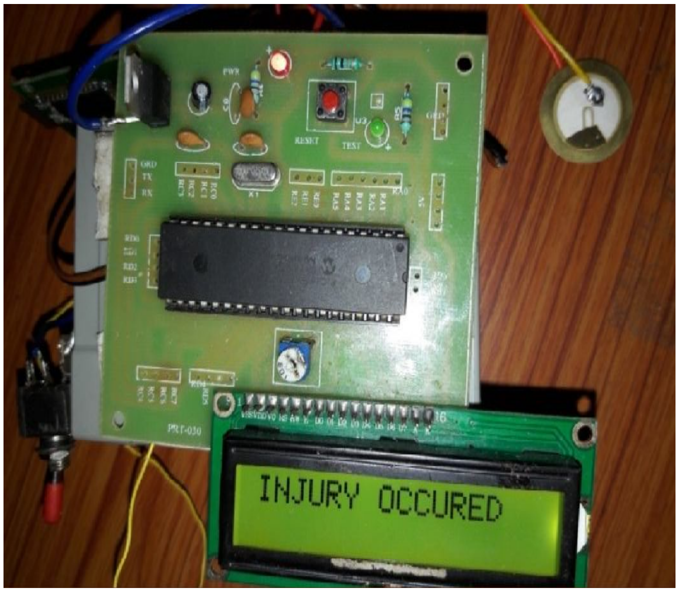


Fig.8 Under Excited Condition

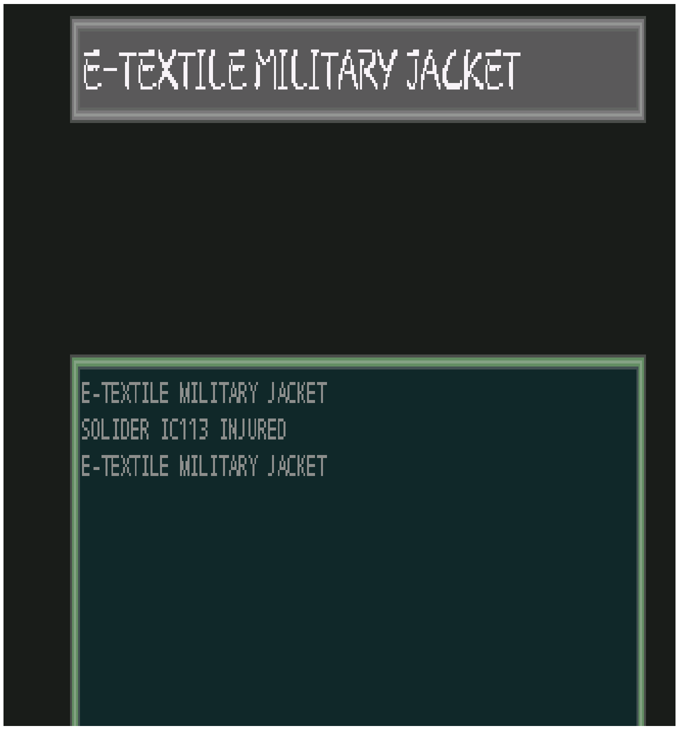


Fig.9 Bluetooth Output

VII. CONCLUSION

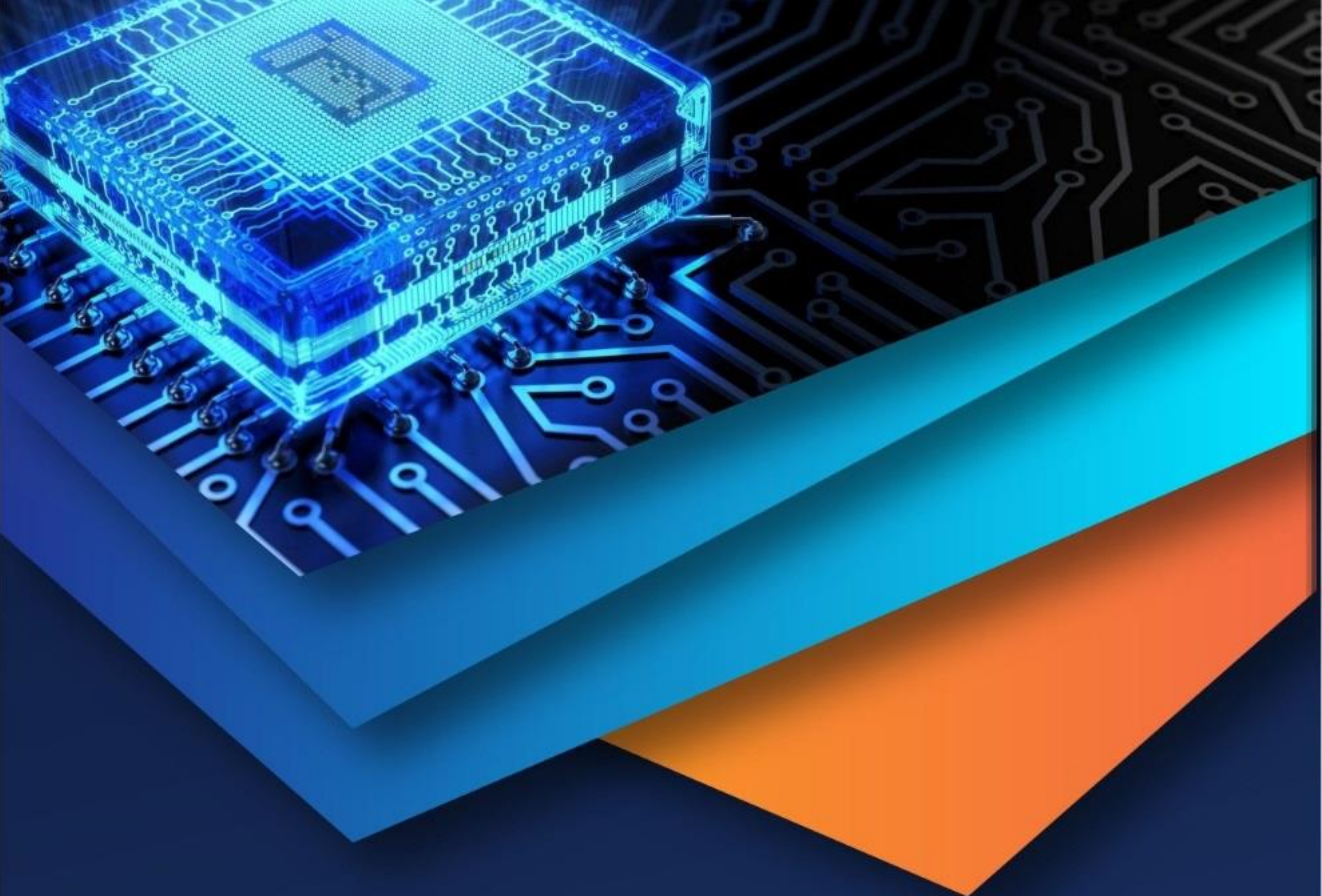
This jacket rescues soldiers from enemies. The main aim is to increase the protection and survivability of the combat soldiers. The goal is to help soldiers to do everything they need to do with smaller equipment and a lighter load. If electronics and piezoelectric technologies could be integrated successfully into the textiles, there could be a striking improvement in the battlefield communications.

A. Future Scope

The Nano materials and smart structures can also provide the future soldiers with super strength, protection against bio- weapons, and even a way to communicate covertly. The future warrior systems include global positioning systems, combat identification sensors, monitors, chemical detectors, and electronically- controlled weapons, for over protecting our soldiers.

REFERENCES

[1] Sahin.O, Kayacan.O and YazganBulgun.O (2015) 'Smart Textiles for Soldier of the Future'- Defence Science Journal, Vol. 55, pp. 195-205.
[2] SaddamhusenJamadar 'Applications of Smart and Interactive Textiles. Textile learner'
[3] Winterhalter C and Teverovsky J. (2004) 'Development of electronic textiles for U.S.military protective clothing systems'
[4] R.Nayak, L.Wang andR.Padhye 'Electronic textiles for military personnel' School of fashion and textiles, RMIT University, Australia.
[5] Windmiler.J.R, Wang.J (2013) "Wearable Electrochemical sensor and Biosensors. A Review'.
[6] MatteoStoppa and Alessandro Chiolerio (2014) 'Wearable Electronics and Smart Textiles' – Journal of Sensors, pp.58
[7] Unsal.M, Niezrecki.C and Crane.C 'Two semi active approaches for Vibration Isolation' University of Florida, pp. 1-6.
[8] Tilak Dias (2015) 'Electronic Textiles' first edition, Smart fabrics and wearable technology, Vol.2, pp.73-131.
[9] Dr.MerihSarıışık (2016) 'International Journal of Clothing Science and Technology', Vol. 28, pp. 108-128.
[10] Abraham Carrillo, Luis Molina and IsaiOnofre (2014) 'Homebrew Piezoelectric Crystal', pp. 1-19.



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