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Solar Based E-Unifrom for Soldiers

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ABSTRACT: Soldiers, who courageously defend our nation, face diverse weather conditions during their service. To safeguard them, a solar-powered climate-adjustable E-uniform has been developed. This innovative uniform dynamically adjusts to provide warmth or cooling, depending on the prevailing weather conditions. The uniform operates in two modes: summer and winter, allowing soldiers to regulate their body temperature as needed. Key components of the uniform include a temperature sensor, a microcontroller, a power supply, and heating/cooling mechanisms. The temperature sensor continuously monitors the soldier's body temperature, while the microcontroller analyzes this data to activate the appropriate heating or cooling devices as required.

KEYWORDS: Peltier panel, DHT11, Arduino uno R3, Buzzer, Metal detector, 16x2 LCD Display.

I. INTRODUCTION

Soldiers, the backbone of our nation's defense, endure various challenges, especially adverse weather conditions, while safeguarding our country. Our project aims to address these challenges by introducing a revolutionary solution: the Solar Guard Gear. This innovative uniform is designed to offer unparalleled safety and security in any weather scenario, providing soldiers with versatility, comfort, and lightness. The Solar Guard Gear integrates flexible solar panels into its fabric, enabling soldiers to harness and store solar energy throughout the day. This stored energy powers essential components of the uniform, such as communication devices, GPS systems, and sensors. By reducing reliance on conventional batteries, which are heavy and require frequent replacement, the Solar Guard Gear enhances soldiers' mobility and endurance on the battlefield. In addition to sustainability, the solar Guard Gear offers numerous advantages. By eliminating the need for traditional batteries, it reduces the overall weight of the uniform, enhancing soldiers' agility. Moreover, the ability to generate power on-site decreases reliance on supply networks, mitigating the risk of power shortages during critical missions. Despite the promising benefits, the development of SolarGuard Gear faces challenges, including the need for robust and flexible solar panels capable of withstanding combat conditions, as well as efficient power management systems to optimize energy usage. Nevertheless, we believe that ongoing research and innovation will overcome these hurdles, making SolarGuard Gear an indispensable asset in military technology. Our project employs advanced components, including Peltier modules, Arduino Uno microcontrollers, solar panels, and temperature sensors, to ensure optimal functionality. The Arduino Uno regulates the uniform's components based on user commands, while the Peltier module serves as a temperature regulator. This sophisticated system enables the SolarGuard Gear to provide unparalleled safety and protection from extreme weather conditions.

II. LITERATURE REVIEW

- 1. Maneesh Kumar Srivastava Tal (2020)** proposed an E-uniform that monitors temperature, voltage, current, and resistance. It utilizes components like Arduino programming, a Peltier plate, an LM35 sensor, and a metal detector.
- 2. Dipali H. Kale et al. (2021)** developed an E-jacket for soldiers with features such as temperature and heartbeat monitoring. Their design incorporates an ATmega16a microcontroller, a Peltier plate, temperature and heartbeat sensors, as well as GSM and GPS modules.
- 3. S. S. Patil et al. (2017)** explored an intelligent solar-based climate-adjustable E-uniform. It monitors temperature, humidity, blood pressure, pulse rate, and oxygen levels. The system includes a PIC microcontroller, a Peltier module, a DHT11 sensor, a blood pressure sensor, a pulse oximeter sensor, and a ZigBee module.
- 4. R. Yaswardhan (2018)** investigated E-uniforms for soldiers working in extreme temperatures. Their design focuses on temperature and heartbeat monitoring, utilizing an Arduino Uno microcontroller, a peltier device, temperature and heartbeat sensors, and communication modules (GSM and GPS).

5. P. Arvind (2019) proposed a solar-based E-uniform that monitors temperature, voltage, current, and resistance. The components include an Arduino Nano microcontroller, a Peltier plate, an LM35 sensor, and a metal detector.

III. EXISTING SYSTEM

This system monitors various environmental and physiological parameters for soldiers deployed in challenging conditions. It utilizes wireless modules, diverse sensors, a Peltier element, and a microcontroller. By integrating the soldier's body temperature and external weather conditions, the system adjusts the uniform's temperature accordingly. Additionally, it can transmit data to a remote server for analysis and alerts. Solar panels embedded in the uniform's fabric collect solar energy to power the system.

4. PROPOSED SYSTEM

The proposed solar-powered E uniform for soldiers offers customizable heating or cooling based on weather conditions and operational needs. It comprises essential components such as a temperature sensor, Peltier plate, microcontroller, solar panel, rechargeable battery, and GPS module. Solar energy is harnessed by the solar panel and stored in the battery. The microcontroller adjusts heating or cooling elements based on temperature and heartbeat readings. Soldiers experience personalized thermal comfort from the Peltier plate. Communication with the base station and location tracking are facilitated by GSM and GPS modules. Additionally, the device includes a buzzer and metal detector for enhanced safety features.

4.1 BLOCK DIAGRAM

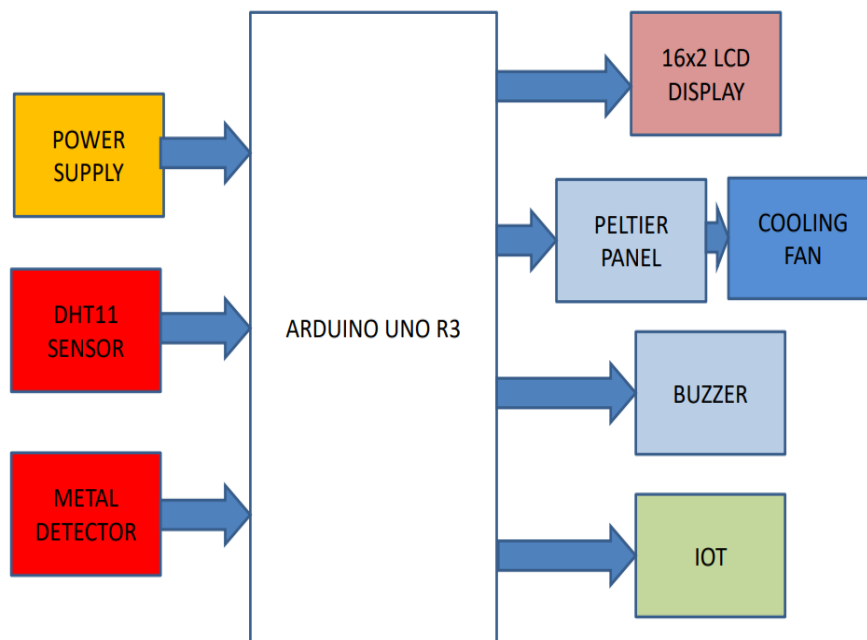


Fig1: Block Diagram of Solar Proposed System

When we switch on the power supply it supply power to all equipment. To use Arduino Uno R3 controller to help control all working flow. By using DHT11 sensor it can detect temperature and humidity like room temperature 30⁰ c and humidity 53%, it can display on LCD screen display. If we increase the temperature the peltier panel produce cooling effect by using cooling fan is in switch on to produce extra cooling effect. Metal detector is placed near metal it can detect the metal and buzzer produce sound when a metal is detected and also display in LCD screen. By using IOT to send those data into our phones, laptop or any other devices.

The proposed system, as depicted in Figure 1, consists of essential components including an Arduino microcontroller, a Solar Panel, Battery, Temperature Sensor, Relay, and Peltier Module. The Arduino Uno, illustrated in Figure 2, is a versatile microcontroller renowned for its suitability in real-time applications. Developed by Arduino, the Uno board offers a wide array of features conducive to designing systems for real-time use. With Arduino, multiple programs can be uploaded to facilitate concurrent operation with various design devices. Solar panels, integral to the system, are constructed from photovoltaic cells adept at converting solar energy into electricity. These cells, typically composed of semiconducting materials like silicon, generate an electric field upon interaction with photons from sunlight, thereby enabling the conversion process.



Fig.2.Arduino Uno R3



Fig.3.Solar Panel

An apparatus called a solar panel converts sunlight into electrical energy, which is subsequently stored for later use in lithium-ion batteries. Solar energy is abundant, but it requires sunlight to be used. As a result, backup batteries are a feature of photovoltaic systems that allow them to use stored energy during inclement weather and at night.



Fig.4.Li-ion Battery

The DHT11 (Fig.5) is an affordable digital sensor capable of measuring temperature and humidity levels. It's commonly paired with various microcontrollers to address a wide range of practical challenges. Utilizing a thermistor and capacitive moisture sensor, the DHT11 accurately gauges the ambient air conditions.

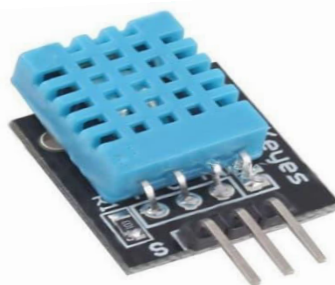


Fig.5.Temperature Sensor

A relay functions to either connect or disconnect an electrical circuit, and it can be activated by an electrical signal. Its applications range widely, from low-voltage electronic gadgets to high-voltage electrical equipment. On the other hand, a Peltier device (Fig. 6) is a solid-state module capable of transferring heat from one side of the device to the other, powered by the flow of current. Also known as a Peltier heat pump, solid-state refrigerator, thermoelectric cooler (TEC), or sometimes a thermoelectric battery, it operates by consuming electrical energy.



Fig.6. Peltier Panel

A device designed to detect nearby metallic objects is shown in Fig.7 is referred to as a metal detector. It finds utility in various endeavors such as archaeology, security checks, and uncovering buried treasures. Comprising a shaft, a coil, and a control box, a metal detector operates by emitting an alternating magnetic field from the coil. When a metal object interacts with this field, it causes a disturbance which is sensed by the control box. Subsequently, the user is alerted through visual, auditory, or tactile signals provided by the control box, such as lights, sounds, or needle movement.



Fig.7.Metal Detector

A cooling fan shown in Fig.8 provide cooling effect when the temperature is high and when the temperature is low cooling fan it switch off condition.



Fig.8. Cooling Fan

The LCD 16*2 screen display as shown in Fig.9 are used to display our results like numbers, alphanumeric and symbols. It helps to see our values in the screen and the display, which uses voltage to manipulate certain segments

to cause the liquid crystal molecules to align and either admit or block light, produces visible characters. It operates by manipulating liquid crystal material through electrical signals.



Fig.9.LCD 16x2 Screen Display

4.2. WORKING PRINCIPLE

Solar-powered electronic uniforms are an amazing combination of technology, sustainability, and usability that are intended to improve troops' performance, comfort, and safety in a variety of settings. These innovative uniforms are powered by flexible solar panels that are woven into the cloth flawlessly. During the day, these panels capture sunlight and transform it into electrical energy that is stored in a rechargeable battery that is covertly inserted into the uniform. A microprocessor acts as the primary control unit, coordinating the actions of several parts, such as the tactically placed temperature sensors that track the soldier's body temperature as well as the surrounding air temperature. The Peltier plate, which controls the uniform's temperature to provide maximum comfort, depends on this data to function. Furthermore, adding a metal detector improves security by identifying potentially dangerous objects or metals, while a cooling fan prevents overheating of the Peltier plate, ensuring its effectiveness and longevity.

Electronic uniforms that run on solar power combine technology, usefulness, and sustainability in a wonderful way. These cutting-edge outfits are designed to enhance soldiers' comfort, safety, and performance in a range of environments. The main feature of these uniforms is the fabric's integration of flexible solar panels. These panels collect sunlight during the day and convert it to electrical energy. The electricity generated is stored in a rechargeable battery that is discretely integrated into the uniform. A microcontroller acts as the core control unit, coordinating several components. The soldier's body temperature and the outside temperature are tracked by temperature sensors that are

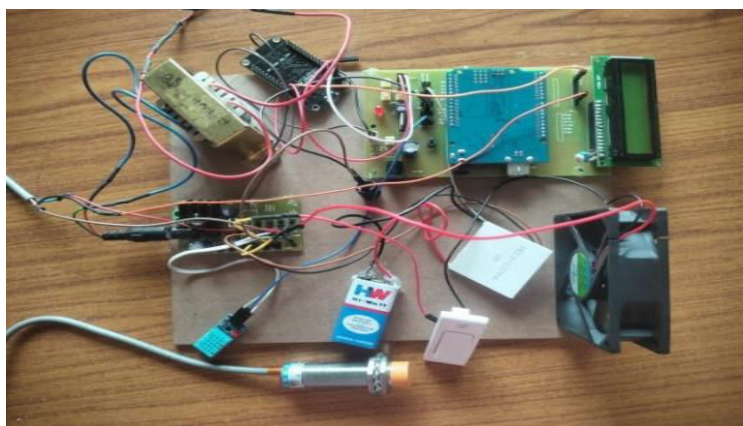


Fig. 10. Experimental Setup

thoughtfully positioned on the outfit. The microprocessor uses this information to control a vital component: the Peltier plate. The metal detector are help to detect any harmful devices and metals, cooling fan helps to provide cooling effect and also protect the peltier panel duo to it over heat.

4.3. APPLICATIONS

- 1) Regulating soldiers' body temperature based on external conditions through heating or cooling mechanisms integrated into the uniform.
- 2) Identifying the presence of metal objects, such as bombs or weapons, utilizing metal sensors embedded within the uniform.

- 3) Equipping soldiers with illumination and communication capabilities via LED lights and wireless devices integrated into the uniform.
- 4) Monitoring soldiers' location and health status, facilitating efficient tracking and ensuring their well-being during operations.

V. RESULTS

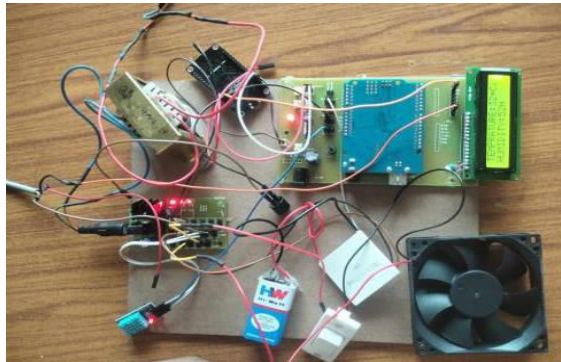


Fig.10. Heat detection using DHT 11 sensor



Fig.11.LCD display Temperature and Humidity

When kitswitch on the power supply,here used transformer power supply by replacing of solar panel and lithium-ion batteries. The DHT11 sensor was detect the outer most temperature and humidity.

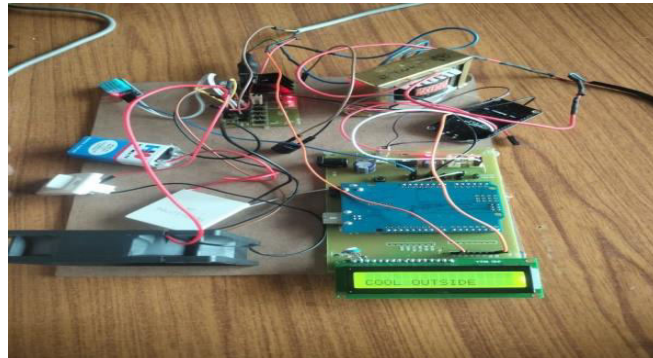


Fig.12.Out side Temperature Display



Fig.13.Display Hot outside



Fig.14.Display Cool outside

If the outer most temperature is high see Fig.13 display hot out side the peltier panel produce cooling effect, But it produce low cooling effect to increase cooling we use cooling fan. If outer most temperature is low the peltier panel is produce high temperature to control that by using cooling fan.To see the display if temperature is low we display cool outside see in Fig.13 and display hot outside if temperature is high see in Fig.14.

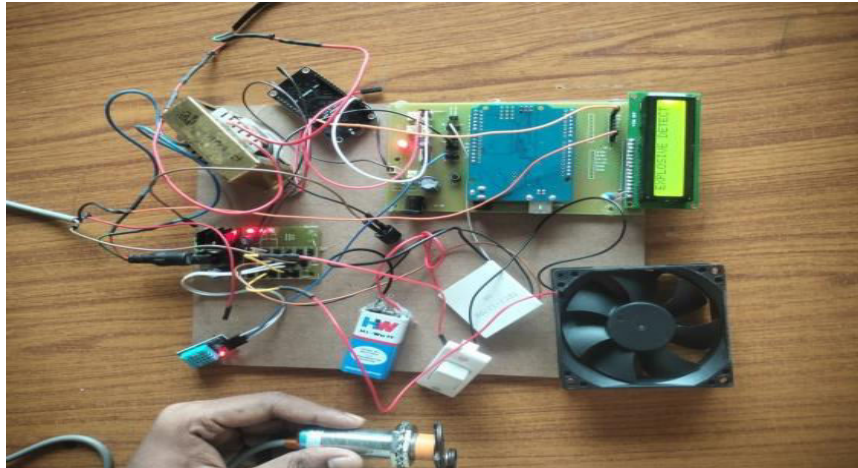


Fig.15.Metal Detection using Metal detector



Fig.16.LCD displays Metal Detected

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Fig.17.IOT Result Data

Metal detector is used to detect near the metals to see Fig.15 and any devices and buzzer are helps to produce sound when any metal is detected and also display in LCD like metal is detected.

VI. CONCLUSION

The armed forces are an invaluable resource because they protect countries from external threats. Solar-powered E-uniforms are a major development toward improving troops' performance and protection in a range of weather scenarios. These uniforms have metal sensors installed in them that emit an audible buzzer to warn soldiers of the presence of weapons or explosives underground. In addition, the integration of temperature-sensitive heating and cooling mechanisms guarantees the best possible comfort for soldiers in a variety of weather conditions. For military troops, such advances have the potential to significantly increase operational effectiveness and efficiency. Furthermore, the possibility of using compact, lightweight solar panels to power these uniforms in the future offers a sustainable and greener option. These uniforms' ability to use solar energy to generate a steady power source with little upkeep requirements improves their reliability and practicality.

REFERENCES

1. Solar Based E-Uniform for Soldiers, Dipali H. Kale, Yogita P. Phapale, Shivani, S. Kamble, S. L. Shirke, International Research Journal of Engineering and Technology (IRJET), May 2021.
2. S.M.D. Tuljapurkar, AshitoshGadhve, SumitGulve, NileshMadane, AjitKolpe, "Solar Based E-Uniform for Soldiers Working at Extreme Weather Conditions," June 2019.
3. Design and Fabrication of Solar-Powered E-Jacket for Troops by Rahul Khairamode, Rahul Khangouka, and RutikPatil, International Journal of Engineering Technology and Management Sciences, July 2022
4. In the July 2020 issue of the International Journal of Progressive Research in Science and Engineering, AbhinavMaheshwari, Abhash Shukla, and Mohd. Sufiyan are featured in the electronic jacket.
5. The article "Climate Adjustable E-Military Suit," published in the International Research Journal of Modernization in Engineering Technology and Sciences, March2020



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