

GPS Based E-Uniform Using Solar Panel for Soldiers

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Abstract— Warriors are the Army's most imperative asset. Warriors assume an important part to make sure one's nation. The term warriors incorporate administration men and ladies from the military, Air Force, Navy, and Marine. While giving security to the country, they could challenge inconveniences in hot/frosty climate conditions. 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 heating stroke [1]. 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” [2], 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 [3], 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 heartbeat.

I. INTRODUCTION

In modern warfare, equipping soldiers with advanced technology and ensuring their safety and efficiency on the battlefield are paramount concerns [4]. To address these challenges, the concept of a GPS-based e-uniform using solar panels has emerged as a potential solution. This innovative uniform integrates GPS technology, renewable energy sources, and electronic systems to enhance soldier capabilities, communication [5], and situational awareness. The GPS-based e-uniform serves as a revolutionary advancement in soldier gear, providing real-time location tracking, energy sustainability, and seamless communication. By incorporating solar panels into the

uniform design, it becomes possible to harness the power of the sun and reduce reliance on traditional batteries [6]. This not only extends the operational capabilities of soldiers but also contributes to environmental sustainability by minimizing the use of disposable batteries [7].

Furthermore, the e-uniform enables enhanced communication among soldiers and with their commanding officers. By integrating communication systems into the uniform, soldiers can share real-time information, coordinate actions, and maintain situational awareness [8]. This seamless communication capability enhances mission effectiveness and ensures that soldiers can respond swiftly to changing circumstances. The GPS-based e-uniform is designed with adaptability and convenience in mind [9]. It aims to provide soldiers with lightweight, comfortable gear that is easy to use and does not impede their mobility. By incorporating advanced technologies and integrating electronic devices, the uniform equips soldiers with enhanced capabilities while minimizing [10]the physical and cognitive burdens they face on the battlefield. In conclusion, by leveraging these innovations, the e-uniform empowers soldiers with advanced capabilities, ensuring they can navigate the battlefield with precision, communicate seamlessly [11], and operate efficiently for extended periods.

II. RELATED WORK

In modern warfare, equipping soldiers with advanced technology and ensuring their safety and efficiency on the battlefield are paramount concerns. To address these challenges, the concept of a GPS-based e-uniform using solar panels has emerged as a potential solution [12]. This innovative uniform integrates GPS technology, renewable energy sources, and electronic systems to enhance soldier capabilities, communication, and situational awareness. The GPS-

based e-uniform serves as a revolutionary advancement in soldier gear, providing real-time location tracking, energy sustainability, and seamless communication. By incorporating solar panels into the uniform design, it becomes possible to harness the power of the sun and reduce reliance on traditional batteries [13]. This not only extends the operational capabilities of soldiers but also contributes to environmental sustainability by minimizing the use of disposable batteries.

Furthermore, the e-uniform enables enhanced communication among soldiers and with their commanding officers. By integrating communication systems into the uniform, soldiers can share real-time information, coordinate actions, and maintain situational awareness [14]. This seamless communication capability enhances mission effectiveness and ensures that soldiers can respond swiftly to changing circumstances. The GPS-based e-uniform is designed with adaptability and convenience in mind. It aims to provide soldiers with lightweight, comfortable gear that is easy to use and does not impede their mobility. By incorporating advanced technologies and integrating electronic devices [15], the uniform equips soldiers with enhanced capabilities while minimizing the physical and cognitive burdens they face on the battlefield. In conclusion, by leveraging these innovations, the e-uniform empowers soldiers with advanced capabilities, ensuring they can navigate the battlefield with precision, communicate seamlessly, and operate efficiently for extended periods. Heating mechanism [16]. Adarsh K S, Arun Dinesh, Jyothy Elizebeth D: "E-Uniform For Soldier's Who Work At Extreme Temperature Regions" The term soldiers include service men and women from the Army, Air Force, Navy and Marines. They are always responsible for exercising the duty in extreme weather conditions throughout the year. While providing security to the nation, they may face troubles in extreme hot/cold weather conditions. Both very hot and cold temperatures could be dangerous to health thereby reducing their efficiency. In this paper we have made an attempt to design an E-Uniform which gives better protection to the soldiers who are working in extreme weather conditions. This system gives two modes summer mode and winter mode [17]Dr.S.M.Kannan, R.Krishnavenishri, S.Kamalika, B.Kanagalakshmi: "Solar and IoT Based Health

Monitoring, Controlling and Tracking System for Soldiers" In this project, solar panels are used for charging a Lead Acid Battery (12V, 1.2 Amp hrs.), a Peltier thermoelectric device which when connected to the battery generates a cooling effect on one side, and heat is dissipated on another [18]side through the heat sink. A regulator 7805 is used to drive the internal cooling fan and LED. Here we are using Microcontroller (ATmega16a) that allows dynamic and faster control. Liquid crystal display (LCD) makes the system user-friendly. Here we are using an LCD display for displaying the variations in voltage values that are present in the rechargeable battery. Adarsh K S, Arun Dinesh, Jyothy Elizebeth D: "E-Uniform For Soldier's Who Work At Extreme Temperature Regions" In this project we are going to design an E-Uniform which gives better protection to the soldiers who are working in extreme weather conditions. This paper is gives two modes [18]summer mode and winter mode. By selecting the mode of operation the relays drive body heater/cooler. The heater / cooler in turn will help us to provide chilling or warming effect inside the uniform which helps the soldier to bear to any kind of external environment and he can work efficiently without heat stress or cold stress.

III. PROPOSED WORK

In the previous section, an extensive literature reviews conducted to identify the limitations of the existing systems. "Solar based E-Uniform for soldiers who work at extreme high temperature or extreme low temperature with tracking" is successfully tested and implemented. By using this project in real time applications we can help soldiers to work [19]even in extreme climatic applications. It is a highly durable and self-repairing solar technology, ideally suited for mobile applications.

3.1. System Component Selection: In this section, the hardware and software components that we have used to design and implement the proposed system are discussed.

3.1.1 Hardware components : In these work PELTIER PLATE. The most common temperature control option for the AR rheometers is the Peltier Plate. The AR-G2, AR 2000ex and AR 1500ex Peltier plates have a temperature range of -40 to 200°C with a typical

heating rate of up to 20 °C /min. [20] and a temperature accuracy of +/- 0.1 °C. A PRT (platinum resistance thermometer) sensor positioned at the center of the plate ensures accurate temperature measurement and control.

The hardware components included the following:

- i. Arduino UNO
- ii. Temperature sensor
- iii. Solar Panel
- iv. LCD
- v. Li battery
- vi. Buzzer
- vii. Heartbeat sensor
- viii. Metal sensor
- ix. Peltier plate
- x. GSM
- xi. GPS

3.1.2. Software Components: The software components are used to connect the [21] sensors with the controllers.

- (i) Arduino IDE
- (ii) C++

3.2 System Design and Architecture: solar panels are used for charging a Lead Acid Battery, a peltier thermoelectric device which when connected to battery generates cooling effect on one side and heat is dissipated on other side through heat sink. Here we are using [22] Micro controller (LPC2148) allows dynamic and faster control. Liquid crystal display (LCD) makes the system user-friendly. Here we are using LCD Display for displaying the values of present and maximum voltage values which are present in the rechargeable battery. The project is operated in two modes summer mode and winter mode.

By selecting the mode of operation such that it can drive body heater/cooler [23]. The heater/cooler in turn will help us to provide chilling or warming effect inside the uniform which helps the soldier to bear to any kind of external environment and he can work efficiently without heat stress or cold stress. Soldiers work in different atmosphere and always moving so its easy and efficient to use solar power for operation.

Here we are using AC ripple neutralizer which is nothing but voltage stabilizer. It will remove ripple from solar power. This power will then given to unidirectional current controller. Unidirectional current controller controls only positive and not negative supply voltage. Now this will forwarded to rechargeable [24] battery. It is a Lead Acid Battery. Here we are using inbuilt ADC of LPC2148. The signal then given to ADC of controller. Here sampling takes place which then give us output. LCD display is used to display present voltage and maximum voltage of battery on screen. Peltier plate is present in jacket which will do cooling and heating mechanism.

3.2.1 System Flowchart

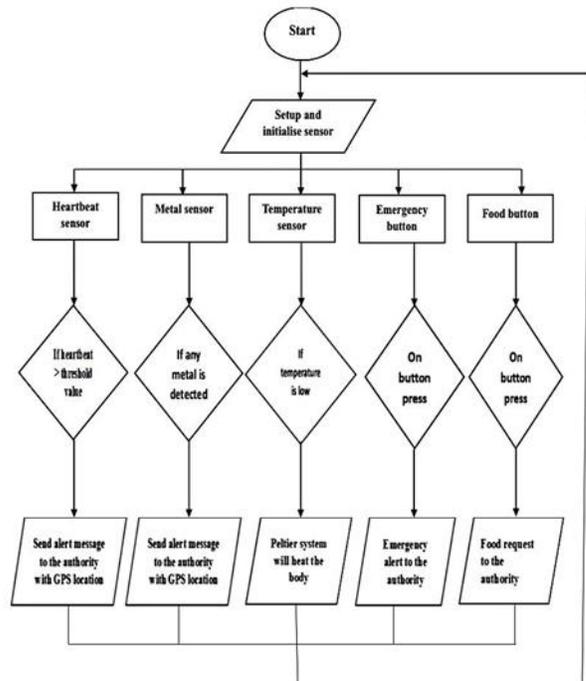


Figure 1: Flowchart

3.2.2 System monitoring features: A requirements specification for a solar-based e-uniform for soldiers would outline the specific [25] functionality and features that the system must have to meet the needs of soldiers in the field. Some of the key requirements that might be included in such a specification could include:

1. Power Generation: The e-uniform must be able to generate sufficient power from its solar panels to power all of the electronic components required for the soldier to perform their mission [26].

2. Energy Storage: The e-uniform must be able to store energy generated by its solar panels in a battery or energy storage system that is lightweight, durable, and capable of providing power for extended periods of time [27].

3. Durability: The e-uniform must be designed to withstand harsh environmental conditions, including exposure to water, sand, dust, and extreme temperatures.

4. Mobility: The e-uniform must be designed to allow for full mobility and freedom of movement for the soldier, without hindering their ability to perform their duties.

5. Comfort: The e-uniform must be designed to provide maximum comfort for the soldier, including breathable fabrics and ergonomic designs that reduce the risk of injury or discomfort [28].

6. Security: The e-uniform must be designed to prevent unauthorized access to its electronic components, and must include features to protect sensitive data and communication.

7. Interoperability: The e-uniform must be able to communicate with other military equipment and systems, including weapons, radios, and command and control systems.

8. Usability: The e-uniform must be designed to be easy to use and intuitive, with a user interface that is simple and easy to navigate.

9. Maintainability: The e-uniform must be designed to be easily maintained and serviced in the field, with modular components that can [29]be replaced quickly and easily.

10. Environmental Sustainability: The e-uniform must be designed to minimize its environmental impact, including through the use of recyclable materials and energy-efficient components.

Overall, a requirements specification for a solar-based e-uniform for soldiers project would need to be comprehensive and detailed, and would require input from a range of stakeholders, including soldiers, military leaders, and technical experts.

IV. METHODOLOGY

We use solar panels to generate the needed energy and rechargeable batteries to store the energy. In this project, we design and develop an E-Uniform for soldiers to avoid the problems they face due to extreme hot and cold weather conditions during their working

time. We have designed two mode switching operations. Heat and cool operations. Peltier plate provides heat and cool effects respectively. The heating and cooling effect is useful to provide a cool and warm effect inside the E-Uniform. This makes it possible for the soldier to endure all kinds of outdoor environments. In this project, we are using a pulse oximeter [30]that measures pulse and blood pressure. DHT11 is used to know the surrounding temperature. The methodology for developing a solar-based e-uniform for soldiers would typically involve several key stages, including:

1. Needs assessment: The first step would be to assess the needs and requirements of soldiers in the field, to determine what types of electronic components would be most useful in an e-uniform, as well as the specific energy demands and logistical requirements of the technology.

2. Concept development: Based on the needs assessment, a team of engineers and designers would develop a concept for the e-uniform, including the types of electronic components to be integrated, the design of the solar panels, and [31]the energy storage and management system.

3. Prototype design: Using computer-aided design (CAD) software and other modeling tools, the team would develop a prototype of the e-uniform, which would include detailed designs for the solar panels, electronic components, and energy storage and management system.

4. Prototype testing: The prototype would then be tested under a range of conditions to assess its functionality and durability, including exposure to sunlight, high and low temperatures, and wear and tear in combat situations.

V. RESULT

The successful implementation of the solar-based E-Uniform is expected to yield several positive results. Enhanced Soldier Performance: The integration of advanced features such as temperature control, metal detection, and GPS tracking is anticipated to significantly improve soldier performance and effectiveness in various environmental conditions. The real-time communication capabilities and GPS tracking provided by the E-Uniform can enhance

coordination and communication among military personnel, leading to increased operational efficiency. The developed Solar based E – uniform has been successfully implemented and tested. The system includes a solar panel, battery, peltier module, DHT11 sensor, Arduino UNO. Solar panel is used to generate power and generated power is stored in a battery. DHT11 is a temperature sensor.it will sense the temperature. Peltier module is used to produce warmness/coolness based on the temperature [32].

1. The system has been tested on multiple users, and the results are as follows:
2. The system can accurately detect temperature and produce cool/heat.
3. The system operates quickly.
4. The system is easy to use and requires minimal training for the users.
5. The system is safe and reliable, and there were no accidents or malfunctions during the testing.

5.1 OUTPUT

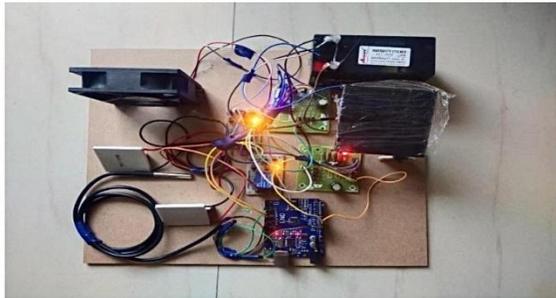


FIG 5.1: When Circuit is Turn ON

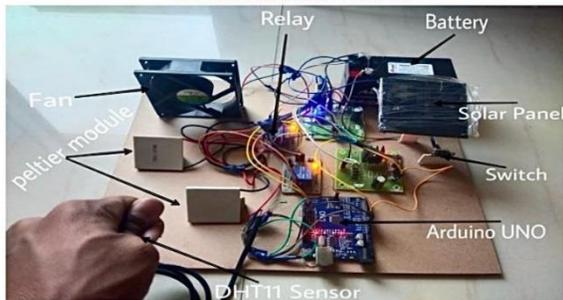


Figure 5.1: When circuit is working

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