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E–Uniform for Soldiers Temperature Controlling with Solar and Internet of Things

[1] N. Gangadhar, [2] V. Kupendra, [3] P. Pavani
Associate Professor[1] & HOD, UG Scholar[2,3]
GATES Institute of Technology, Gooty, Andhra Pradesh, India

Abstract

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 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. This Uniform will make the soldier to work in any kind of environment.

Keywords: *Peltier Plate, AT89S52, Solar Panel, Voltage Sampler, ADC, WI-FI*

1. Introduction

Soldiers are the Army's most important resource. Soldiers play a vital role to protect one's country. The term soldiers include service men and women from the Army, Air Force, Navy and Marines. They will always be the one responsible for taking and holding 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. Existing system applications are limited as it provides body temperature regulation only, but nothing more than that. It does not provide any means of Security, Navigation, Monitoring at a remote place. Therefore, here we proposed to implement a secured, navigated and advanced e-uniform for the soldiers who works at extremely high or low temperature conditions.

Rest of the paper as follows: section 2 describes the block diagram of proposed model with the operation control. Hardware components are described in section 3 with the advantages and application of proposed model. Section 4 gives the hardware circuit model. Conclusion given in section 5 followed by the references.

2. Proposed Model

Solar based E-Uniform gives better protection to the soldiers who are working in extreme weather conditions. Solar Panels are used to power up the internal circuitry of the E-uniform. A 12 V DC lead acid rechargeable battery is used for storing the energy. To know the information about the total system here we are using IOT.

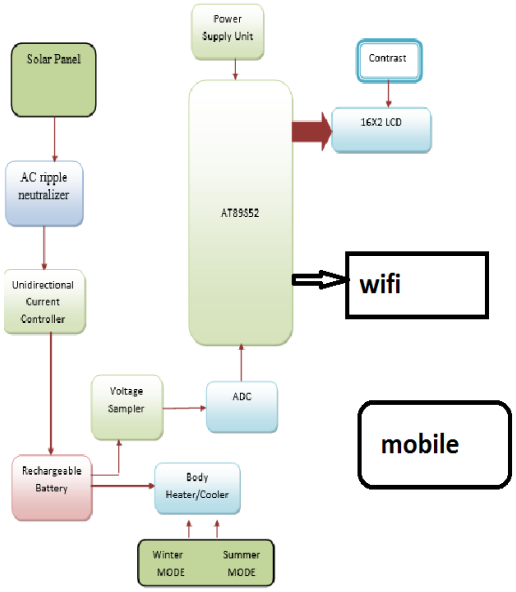

Fig. 1 Block diagram of proposed system

By using of internet of things we know the condition of every system by using Wi-Fi. We are using conventional battery charging unit also for giving supply to the circuitry. AT89S52 micro controller is the heart of the circuit as it controls all the functions. A voltage sampler is interfaced with the system using ADC 0808 to get the voltage generated from battery

as a display on a 16X2 LCD. The project is operated in summer mode and winter mode. By selecting the mode of operation, we are operating the H-Bridge IC such that it can 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. In this, solar panels are used for charging a Lead Acid Battery (12V, 1.2 Amp hrs), 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. A regulator 7803 is used to drive the internal cooling fan and LED. Here we are using Micro controller (AT89S52) 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.

3. Hardware Description

A. Wi-fi module

The **ESP8266** is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems. The chip first came to the attention of western makers in August 2014 with the **ESP-01** module, made by a third-party manufacturer, Ai-Thinker.

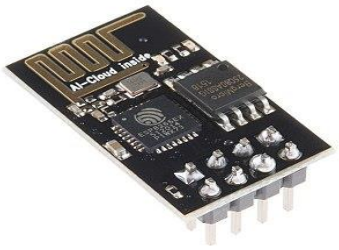

Fig. 2 WI-FI module

This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.

B. AT89S52 Micro Controller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry- standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.

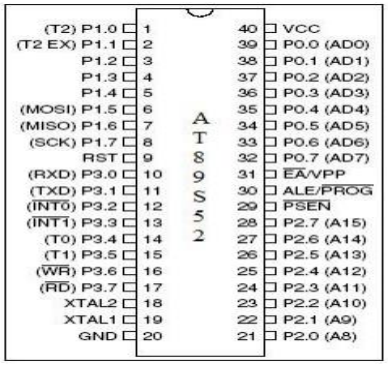

Fig. 3 Pin diagram of AT89S52

By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other

chip functions until the next interrupt or hardware reset.

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

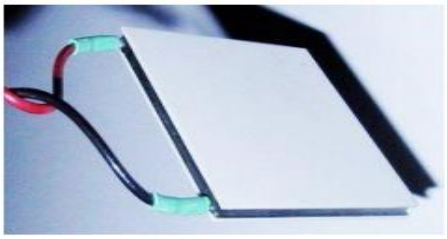

Fig. 4 Peltier Plate

A Peltier cooler is a cooler that uses a Peltier element (TEC). Peltier coolers consist of the Peltier element itself, and a powerful heatsink/fan combination to cool the TEC.

D. Liquid Crystal Display

LCD (Liquid Crystal Display) A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock [5]. They use the same basic technology, except that arbitrary images are made up of many small pixels, while other displays have larger elements.

Fig. 5 LCD Display

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma display, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

E. Voltage Sensor

You can really use any voltage comparator chip that you have. In this circuit, we will use the general LM741 operational amplifier to act and function as a voltage comparator. The LM741 is an 8-pin chip. If you would like to understand all the pin connections of the LM741 op amp, see LM741 Op-amp Pinout Connections. This article explains all the 8 pins of the LM741 and what each one does. The LM741 pinout is shown below.

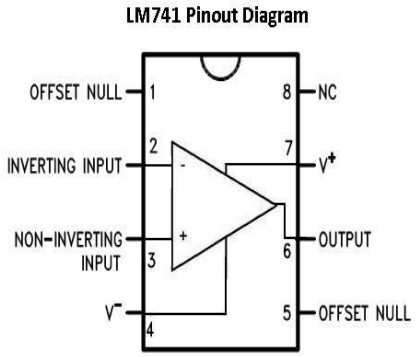

Fig. 6 LM741 pin diagram

We feed 2 voltage signals into each of the inputs of the op amp. An op amp has 2 inputs, the + input, or the non-inverting input and the - input, or the inverting input.

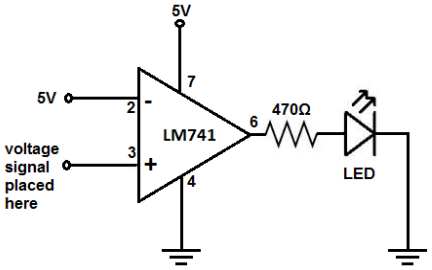

Fig. 7 Voltage Sensor Circuit

If the voltage at the noninverting terminal is less than at the noninverting terminal, then the output will be go LOW or at the voltage value of V-. If the voltage at the noninverting terminal is greater, then the output will be ON or at the voltage value of VCC.

Advantages

- Protection from extremely low temperature such as 0/Minus Degree in hilly regions
- In deserts where temp is high uniform will maintains cool.
- No need to handle torch lights.
- Fit and forget system
- Reliable
- Compact size
- Affordable prize (Low cost)
- Low Maintenance

Applications

- Used in military applications.
- This uniform can be used for all the climatic applications.
- Soldiers can work in extreme climatic application

4. Experimental Results

Firmware implementation deals in programming the microcontroller so that it can control the operation of the IC's used in the implementation. In the present work, we have used the Proteus design software for PCB circuit design, the Keil µv4 software development tool to write and compile the source code, which has been written in the C language. The Flash magic programmer has been used to write this compile code into the microcontroller.

Software Tools Required

- Proteus
- Keil µVision4
- Flash Magic

Proteus is used for drawing the schematic diagram, it is mentioned above. Keilµv4, Flash magic are the two software tools used to program microcontroller.

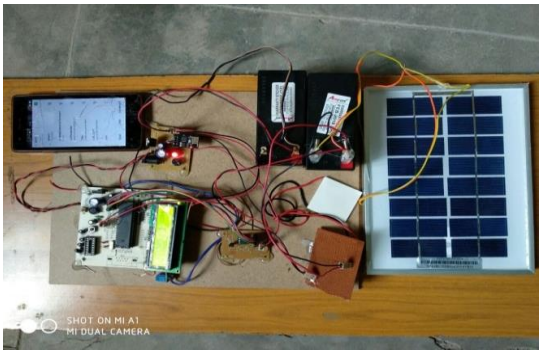

Fig. 8 Proto type of implemented solar e-uniform

5. Conclusion

Here in this, E-uniform for soldier's temperature controlling has been implemented. We utilized solar system and IOT concept for this implementation. Hardware experiments have been tested successfully. By utilizing this, we can help the soldiers to work even in extreme climate conditions in real time environment. It is a highly durable and self repairing solar technology, ideally suited for mobile applications. Furthermore, this can be enhanced by adding more flavors like GSM, GPS and heart beat monitoring for improving the security and novelty of our proposed model.

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