

# Solar and Iot Based Health Monitoring, Controlling and Tracking System for Soldiers

Dr.S.M.Kannan,R.Krishnavenishri, S.Kamalika, B.Kanagalakshmi  
Department of Electrical and Electronics Engineering  
K.L.N. College of Engineering  
Pottapalayam, Sivagangai District, Tamil Nadu, India

## Abstract

The basic concept of Solar and IoT Based Health Monitoring, Controlling and tracking system for Soldiers is employed to produce chilling and warming effect for soldiers and additionally track the location of soldiers just in case of abnormal heart beat. In India, soldiers are working in various weather conditions such as very hot or terribly cold temperature. In this paper, solar array provides power supply for the entire circuit and it charges the battery. The body heater/cooler is employed to take care of the body temperature. The PIC 18F452 microcontroller receives the information from GPS, GSM and Heart beat detector. LCD is used to display the message and location. The location of the soldiers is traced by GPS Module. The heart rate of the soldiers is sensed by Heart Beat Sensor. When the heart rate is abnormal, the alert messages are going to be sent to the army control unit through the GSM Module.

**Keywords** - Battery, GPS Module, GSM Module, Heart Beat Sensor, Peltier plate, PIC 18F452, Solar panel.

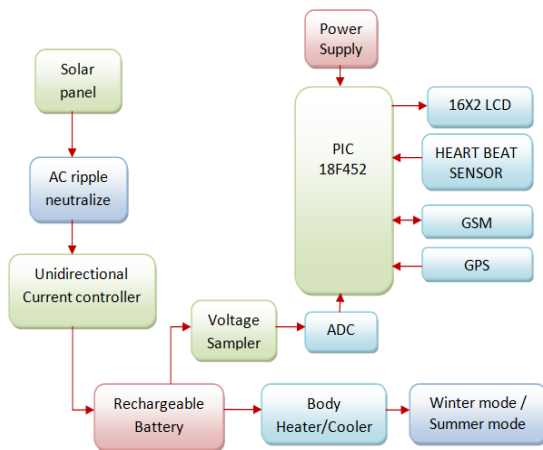
## I. INTRODUCTION

A soldier serves the defense forces of a rustic. The importance of soldiers in India is extraordinarily high in defensive and protecting the borders. The soldiers play the foremost task in defensive and protective borders of India. A soldier is that the most disciplined and trustworthy person in a nation. Soldiers are the Army's most significant resource. Soldiers play a vital role to safeguard one's country. They'll invariably be the one accountable for taking and holding the duty in extreme climate throughout the year. While providing security to the nation, they may face troubles in extreme hot/cold weather conditions. Both very cold and very hot temperatures could be dangerous to health. Excessive exposure to heat referred to as heat stress and excessive exposure to cold referred to as cold stress. In a very hot environment, the most serious concern is heat stroke. At very cold temperature, the serious concern is the risk of hypothermia or dangerous overcooling of the body. To overcome this E-uniform is designed. This uniform consists two modes of operation such as summer mode and winter mode. By choosing the modes of operation, it can drive body heater/cooler

[1]. By utilizing Solar Panels to control up the inside hardware of the E-uniform. A 12 V DC lead corrosive rechargeable battery is utilized for putting away the vitality. We are utilizing routine battery charging unit additionally to give supply to the hardware. This uniform will make the soldiers to work in any kind of environment [2]. And to design a refrigerator cum oven in this uniform. By harnessing solar energy, this refrigerator cum oven is able to keep perishable goods and dairy cool in hot climates and warm in cold climates. It is also used to keep much needed vaccines at their appropriate temperature to avoid spoilage. The portable devices can be constructed with simple components and are perfect for areas of the developing world where electricity is unreliable or non-existent [3]. In the event that this framework might come up short GPS will discover the position of troopers and send messages by means of GSM to the control station. This venture has a huge part in our everyday life [4]. If the weather condition is too hot then the cooling system will operated and if it is too cool then the heating system will operated. If this system may fail GPS will find out the position of soldiers and send messages via GSM to the control station [5]. A GPS can help us to determine exactly where we are at any given moment. Not only can a GPS give us the name of the street we might be traveling on, but many GPS systems can also give us the exact latitude and longitude of where you are located. Having the facility of GPS to develop this system, a GPS device is used to calculate the location from the information taken from GPS. Hence, we have chosen Android device to perform this calculations because Android mobile phone is cost effective and offers multidimensional purposes having some special built-in features like GPS service. Thus, this system is developed for location tracking of a group of people with a proximity alert system using various latest demanding tools and technology like Jason, Java, AVD, and LAMP etc. [6]. GPS satellite sends the GPS data to the device which store the temporal stores data in the case of the car used the AVL (Advanced Vehicle Locator). Advantages of the system are that it has SIM card, so that can be easily Identify the Object. SIM card which is used to communicate with the local GSM network thus the device uses GPS as well as GSM network [7]. The GPS systems constantly watch a moving Vehicle and report the status on demand. When the

theft identified, the responsible person send SMS to the microcontroller, then microcontroller issue the control signals to stop the engine motor. Authorized person need to send the password to controller to restart the vehicle and open the door. This is more secured, reliable and low cost [8]. There are two methods used for home security system. The first system uses web camera. Whenever there is a motion in front of the camera, it gives security alert in terms of sound and a mail is delivered to the owner. The second method sends SMS which uses GSM-GPS Module (sim548c) and Atmega644p microcontroller, sensors, relays and buzzers [9].The system is developed and tested in a vehicle to track the exact location of a moving or stationary vehicle in real-time. Smartphone applications have been created to display a vehicle location on Google maps [10].

**II. BLOCK DIAGRAM AND DESCRIPTION**



**Fig 1. Block Diagram**

In this paper solar panels are used for charging a Lead Acid Battery, a peltier thermoelectrical device that once connected to battery generates cooling impact on one aspect and warmth is dissipated on different aspect through heat sink. Here we have tendency to use Micro controller (PIC 18F452) permits dynamic and quicker control. Liquid crystal display (LCD) makes the framework easy to use. Here we are using LCD Display for displaying the values of present and maximum voltage values which are present in the rechargeable battery. The task is worked in two modes summer mode and winter mode. By choosing the method of activity such that it can drive body warmer/cooler. The warmer/cooler thus will help us to give chilling or warming impact inside the uniform which encourages the fighter to stand to any sort of outer condition and he can work proficiently without warm pressure or icy pressure. Soldiers work in different atmosphere and forever moving thus its straightforward and economical to use alternative energy for operation. Here we tend to AC ripple neutralizer which is nothing but voltage stabilizer. This power can then given to unidirectional current

controller. Unidirectional current controller controls only positive supply voltage. Here we are using inbuilt ADC of PIC 18F452.

PIC18F452 micro controller is the heart of the circuit as it controls all the functions. A voltage sampler is interfaced with the system using ADC to get the voltage generated from battery as a display on a 16X2 LCD.

A 12 V DC lead acid rechargeable battery is utilized for storing the energy. We are utilizing regular battery charging unit likewise to give supply to the hardware.

This typical power source utilizes regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is utilized for voltage regulation. Bridge type full wave rectifier is employed to rectify the ac output of secondary of 230/12V step down transformer.

This project aims is sending alert message in emergency times, i.e. when a person is struggling and his heartbeat or body temperature rises or lower then alerting message will be send to the mobile phone, the message consist of location of that person also. Likewise, we can get the heart rate of the individual by essentially sending a pre-characterized design SMS. Here we get the alerting message from the GSM modem (SMS message) and location of that person can be finding with the help of GPS. The GPS is that the word form for global positioning system. GPS gives position velocity, time of anything located on the earth. This GPS receiver is capable of distinguishing the situation during which it was present in the form of latitude and longitude. The GPS receiver gets the information from the satellites.

The functioning of the device is based on the truth that the blood level circulation during expansion and contraction of heart which can be sensed heartbeat sensor. This device consists of microcontroller which takes the input from the heartbeat sensor and calculates the heart rate of the patient. The microcontroller takes the responsibility to sending alert message through GSM modem whenever it is necessary.

**III. HARDWARE DESIGN**

**A. Solar panel**

The solar photovoltaic array exhibit comprises of a suitable number of solar cells associated in arrangement and additionally parallel to give the required current and voltage. The array is so situated as to gather the most extreme solar radiation consistently. The solar energy can be specifically changed over into electrical energy by methods for photovoltaic impact, i.e. change of light into power.

Age of an electromotive power because of retention of ionizing radiation is known as photovoltaic impact. Antireflective coating (arc) is an essential part of a solar cell since the exposed silicon has a reflection coefficient of 0.33 to 0.54 in the spectral range of 0.35 to 1.1 m. The cells produced using mix of gallium aluminum and gallium arsenide.



Fig 2. Solar Panel

**B. Battery charger**

Overcharging of a few batteries brings about loss of electrolytic, erosion, plate development and loss of dynamic material from the plates, causing reduction in battery life. Additionally, the repeated inability to achieve full charge also promotes stratification of electrolyte. In this manner, there is a need of charge controllers to improve the battery life. Most charge controllers begin the accusing procedure of a high current and diminish it to a low level when a specific battery voltage is come to. An advanced based charge controller monitors the battery current, and voltage processes the level of charge and manages the input and output currents so as to avoid both overcharging and excessive discharge.

**C. Pic microcontroller**

PIC18F452 is high performance RISC (Reduced Instruction Set Computing). Watch dog timer is present inside this IC. Watch dog timer will automatically reset. the PIC IC from infinite loop condition. 5 ports are present in PIC. They are, Port A, Port B, Port C, Port D, Port E. Here port A have 6 pins. Port B, Port C and Port D have 8 pins each. Port E have 3 pins. Port A and port E having analogue capability. It consists of three timers. Timer 0, Timer 1, Timer 2. Timer 0 is 8 bit timer/counter. It is both readable and writable. Timer 1 is 16 bit timer/counter. It consists of two 8 bit registers. Timer 2 is an 8 bit timer. Another feature of PIC18F452 is ADC and USART. ADC is an analog to digital convertor module. USART is Universal Synchronous Asynchronous Receiver and Transmitter. Here USART is used for transmit and receive the data to and from the serial port. Port C6 and Port C7 are used as a transmitter and receiver port. USART consists of two registers. They are TXSTA (Transmit status and control register) and RCSTA (Receive status and control register). We enable the TXEN (Transmit enable bit) and BRGH (baud rate high bit) in the

TXSTA register. We enable SPEN (serial port enable bit) and CREN (continuous receive enable bit) in the RCSTA register

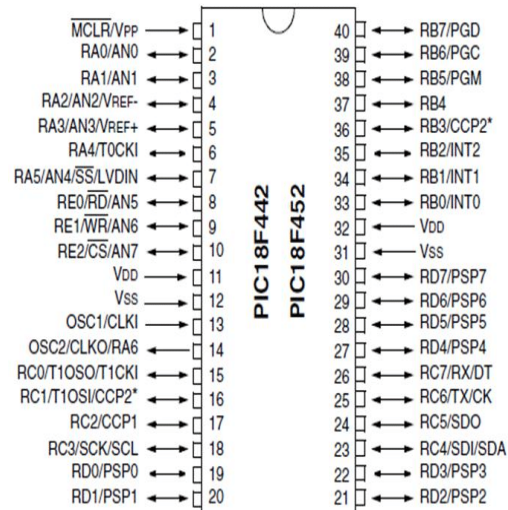


Fig 3. PIC18F452 Microcontroller

**D. Peltier plate**

A typical thermoelectric module consists of an array of Bismuth Telluride semiconductor pellets that have been “doped” so that one type of charge carrier– either positive or negative– carries the majority of current. The pairs of P/N pellets are configured so that they are connected electrically in series, but thermally in parallel. Metalized ceramic substrates provide the platform for the pellets and the small conductive tabs that connect them. When DC voltage is applied to the module, the positive and negative charge carriers in the pellet array absorb heat energy from one substrate surface and release it to the substrate at the opposite side. The surface where heat energy is absorbed becomes cold; the opposite surface where heat energy is released, becomes hot. Reversing the polarity will result in reversed hot and cold sides.



Fig 4. Peltier Plate

**E. Heart beat sensor**

Here we are using TCRT1000 reflective optical sensor for photoplethysmography. The usage of TCRT100 rearranges the assemble procedure of the sensor part of the project as both the infrared light emitter diode and the detector are arranged side by

side in a leaded package, in this manner hindering the encompassing surrounding light, which could some way or another influence the sensor . It carries both sensor and signal conditioning unit and its output is a digital pulse which is synchronous with the heartbeat. The output pulse can be fed to microcontroller.

Sensor Drawings

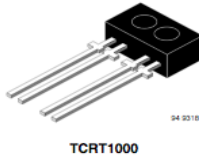


Fig 5. Reflective Optical Sensor TCRT1000

#### F. GSM:

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network macro micro, pico, femto and umbrella cells. The coverage area of each cell varies according to the implementation environment.



Fig 6. SIM 800c GSM Module

#### G. GPS

Conventional methods of surveying and navigation require tedious field and astronomical observations for deriving positional and directional information. Rapid advancement in higher frequency signal transmission and precise clock signals along with advanced satellite technology have led to the development of Global Positioning System (GPS). The outcome of a typical GPS survey includes geocentric position accurate to 10 m and relative positions between receiver locations to centimeter level or better. GPS has been under development in the USA since 1973. The US department of Defence as a worldwide navigation and positioning resource for military as well as civilian use for 24 hours and all

weather conditions primarily developed it. The Global Positioning System (GPS) is the only fully functional Global Navigation Satellite System (GNSS). Utilizing a constellation of at least 24 Medium Earth Orbit satellites that transmit precise microwave signals, the system enables a GPS receiver to determine its location, speed, direction, and time. It have 65 channels with ultra-high sensitive It is capable of receiving signals from up to 65 GPS satellite and transferring them into the precise position and timing information that can be read over either UART port or RS232 serial port.

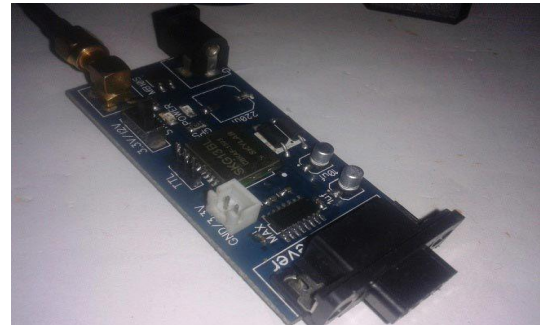


Fig 7. GPS module SKG13BL

#### IV. APPLICATION & FUTURE SCOPE

Nowadays in the varying climatic conditions E-uniform make drastic changes in the day to day life. It is very helpful mainly in the fields of military applications. This uniform can also be used in various other applications. It can be successfully implemented in areas like construction fields especially in Gulf countries, used for scientists who are working in extreme weather conditions like in Antarctica and also used in mining fields .It helps to get more working time and productivity. For the future development, this uniform will simply powered by a small movable solar array and build it more echo friendly. The utilization of solar array provides continuous output of power without less maintenance. In future this uniform may be used by civilians who are living in extreme weather conditions.This project can be extent by using an android device. The android GPS in phones empowers applications to get area and explore. With the proper apps, it can replace a hand-held outside GPS. Android apps can get allocation with the help of cell towers and also without cell towers. An android phone has a real GPS chip in it which can get the location from GPS satellite. We can use an android GPS app that use of line maps, they allows us to download offline topology maps in advance and store them on our storage card.

#### V. CONCLUSION

Soldiers are one of the important factors in a country. Because they are the forces who protect our country day and night living behind sleep and rest. In

this manner it is our obligation to secure them. Same is the significance of this project. So here design an E-Uniform which gives better protection to the soldiers who are working in extreme weather conditions. In this Paper, the uniform is operated in two modes summer mode and winter mode. If the weather condition is too hot then the cooling system will operated and if it is too cool then the heating system will operated. If this system may fail GPS will find out the position of soldiers and send messages via GSM to the control station. This paper has a significant role in our day to day life .Also it can be used in various streams of industrial applications.

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