IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

Soldier Monitor

Zeel D. Shah[*1], Dinal A. Shah[2], Sanyogita R. Barabde[3], Chaitali B. Gala[4]

[*1,2,3,4] Department of Electrical and Electronics Engineering, Veermata Jijabai Technological Institute, Mumbai, India

zeel.shah1991@gmail.com

Abstract

For efficient strategizing during a war, it could be very helpful if the military base station is continuously appraised about the number of soldiers alive on the war front. This paper proposes a device to be attached to the shirt of the soldiers stationed at the battlefield. We have carried out the software simulation of this device: whose operation can be broken down into two stages. The first being the sensing stage, comprising monitoring of the ECG signal using electrodes glued to specific locations on the body using the Einthoven leads system. The second stage encompasses wireless transmission modules: GSM and GPS, which are interfaced with a microprocessor. The ECG signal passed through instrumentation amplification and filtration stages is continuously monitored by the microprocessor. In the event of death of the soldier, the microprocessor detects the ECG flatline and the location of the dead soldier; tracked by the GPS module is then communicated to the military base station by the use of GSM. This information can be used to devise war strategies as to how many more soldiers (and where) should be deployed to replace the martyrs.

Keywords: Electrocardiogram (ECG), Global System for Mobile (GSM), Global Positioning System (GPS), soldier.

Introduction

India ranks amongst the top 3 largest armed forces in the world. India has fought two major wars since its independence in 1947: the China War (1962) and the Kargil War (1999). During these wars, India was not at the forefront of technological advancements unlike today when it has various wireless technologies at its disposal. During the battle of Chusul (Oct-1962) of the Indo China War, the 114th Brigade valiantly fought with the Chinese for days. 140 soldiers sacrificed their lives. However, due to the inaccessibility of the war-terrain, no updates were received at the base station about the status of the Indian soldiers and hence, necessary immediate action could not be taken. Therefore, we propose the Soldier Monitor, by the means of which the track of number of soldiers alive on the battlefield at different locations can be kept. Using this information, further war strategy can be devised and monitored.

Related Technology

A. **Electrocardiogram (ECG)**

1) Electrodes [5]

The detection of the heart signal (conversion of ECG signal into electrical voltage) is done by the means of Ag-AgCl electrodes attached to the outer surface of the skin by an external hypo allergic adhesive gel. The electrode buckle is used to connect the electrode to the microprocessor using electrode lead wires.

2) Electrode Recording System

The three lead system is adopted. It places electrodes on the body, with two under each armpit and one on the left leg slightly above the hip. The electrodes measure the bio potentials within the body that are usually in the range of 5 mV. The positions of the 3 leads are illustrated in Figure I.

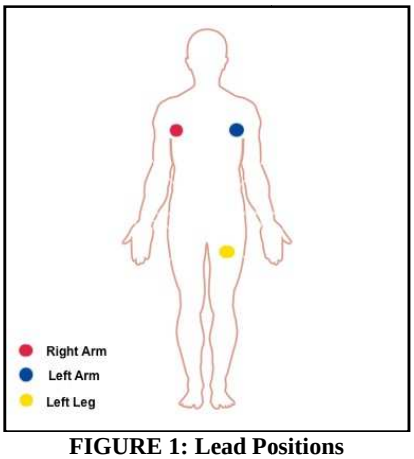

FIGURE 1: Lead Positions

3) Working of ECG system [6]

The working of the ECG system can be summarized as follows:

- The electrodes (Ag/AgCl) attached to the soldier pick up the ECG signal
- This signal, being very weak, is passed though a stage of Instrumentation amplification, which increases the signal to noise ratio (SNR) at the output
- Following the amplification, this ECG signal is filtered

4) MultiSim simulation of ECG Circuit

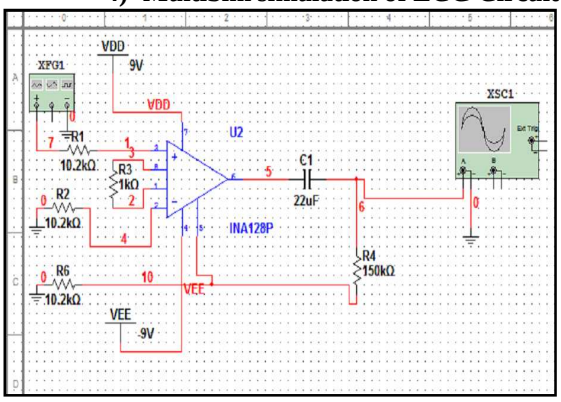

FIGURE 2: Multisim simulation of ECG Circuit

B. Global Positioning System (GPS) [4]

The location of the soldier is continuously monitored by the GPS system. The GPS module continuously transmits serial data (RS232 protocol) in the form of sentences according to the NMEA (National Marine Electronics Association) standard**.** The GPS receiver located in the monitor continuously receives these sentences through which the location of the soldier is monitored. There are various types of sentences depending upon the number of satellites and quantities to be measured. We have used the following sentence format:

$GPGGA - Global Positioning System Fix Data

For example consider that the GPS receiver receives the following sentence:

$GPGGA,132453.970,1551.0129,N,09556.7508,E,1,03,7.1,42.5,M,-42.5,M

The above sentence contains different types of information. These different types of data are separated from each other by the means of commas (,). The location of the soldier is defined by the latitude and longitude. From the above sentence, the latitude is given by the data following the second comma (,) and the longitude is given by the data following the third comma (,).

1551.0129, N	Latitude 15 degree 51.0129' N
09556.7058, E	Longitude 09 degree 55.6058' E

TABLE 1: Explanation of the sample GPS sentence

C. Global System for Mobile Communications (GSM)

1) GSM Modem [3] [7]

The location of the soldier i.e. the latitude and the longitude is sent by the GPS to the microcontroller. This is then sent to the Operation Center through an SMS by the GSM module, whenever a flatline is observed. The AT commands required for interaction with the processor are done through serial communication (RS232 protocol). Based on the AT commands, the processor can interact with the GSM cellular network.

2) Microcontroller [2]

The microcontroller is the heart of this device. It is the interface between the GSM module and the GPS receiver. The recorded ECG signal is given to the microcontroller via the Analog to Digital Converter (ADC). In this device the microcontroller is programmed in such a way that it stimulates the GSM modem in forwarding a message containing the geographical location of the soldier computed by the GPS in case of a flatline occurrence detected by the microcontroller.

Design of the Soldier Monitor

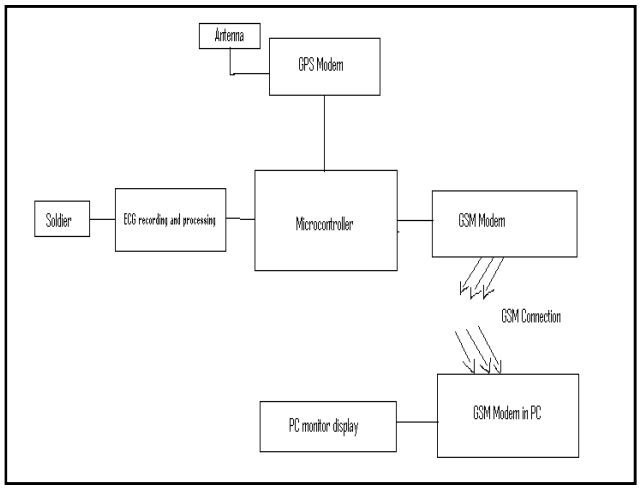

FIGURE II: Design of the Soldier Monitor

1) Description

- An AVR Microcontroller will be interfaced with the GSM module, GPS Receiver and also with the ECG monitoring System.

- The output of the ECG monitoring block is given to the microcontroller via an ADC, which converts the analog ECG into digital form.
- The drivers RS232 from the GPS and GSM modems are connected to drivers (RS232) of the microcontroller. [1]
- Here the RS 232 acts as an interface for two-way communication from microcontroller to GPS and GSM and vice versa. The information available at the RS232 of the microcontroller is converted into compatible TTL logic through MAX232.
- The GSM receiver modem present in the PC at the base station receives messages, if any, via the GSM.
- The location coordinates of the martyr can then be used to identify his location on the map and be displayed on the screen.

2) **Working**

- The device that is to be worn by the soldier under his shirt consists of an ECG recording and processing circuit, a GPS module and a GSM module.
- The electrodes continuously record the ECG of the soldier.
- This analog ECG signal is then converted into digital form using an ADC and is given to the microcontroller. Hence, the microcontroller continuously monitors the ECG of the soldier.
- The microcontroller also continuously records the location of the soldier computed by the GPS receiver.
- In case of the death of the soldier, the ECG flatline will be detected by the microcontroller and hence it will send the recently recorded location (in latitude and longitude) to the base station through GSM.
- This information can then be used by the Major to locate the dead soldier's position on Google maps.
- In this way, the Major can keep a count of the number of soldiers alive on the battlefield and strategically deploy forces when necessary.

Conclusion and Future Scope

This device can also be used in wildlife tracking, specifically to keep a count of the live animals in a forest. For example a count of the extinct tiger species can also be kept using this device. This device can also be used to monitor the ECG of old people continuously and can be used to inform the family in case of an emergency.

Instead of the GSM technology, satellite modems can be used too. Also, continuous health monitoring of the soldiers is possible by transmitting the actual ECG waveform of the soldiers. Along with the ECG waveform, other health information like the temperature or the blood pressure can also be transmitted.

Acknowledgement

We are highly grateful to the help and support offered to us by Dr. Meena S. Panse of Electronics and Electrical Department, V.J.T.I., under whose able mentorship we have implemented our project.

References

[1] Dale DePriest, NMEA Data from: http://www.gpsinformation.org/dale/nmea.htm
[2] www.atmel.com/dyn/resources/
[3] http://en.wikipedia.org/wiki/GSM
[4] http://en.wikipedia.org/wiki/Global_Positioning_System
[5] R.S. Khandpur, Handbook of Biomedical Instrumentation 2nd Edition, Tata McGraw Hill Education, 944, 2003 April
[6] John G. Webster, Medical Instrumentation: Application and Design 3rd Edition, Wiley, 712, 2007 January
[7] Theodore S. Rappaport, Wireless Communication: Principles and Practice 2nd Edition, Pearson, 736, 2010