Physical Parameter Measuring Medical Suit For Soldier

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Abstract- *In current scenarios, enemy warfare is an important factor for any nation's security. The nation's security mainly depends on Army, Navy and Air Force. There are many concerns regarding the safety of our soldiers [3]. The proposed system is IoT based health monitoring and tracking system of the soldiers. This system is fixed on the soldiers' suit to track their health status and current location using Global Positioning system (GPS). These information's will be transmitted to the base system through IoT. Health monitoring system consist of tiny wearable biosensors and transmission modules. Text-to-speech application is included to notify basic first-aid to the soldier. In case of emergency situations a panic buzzer is available which alerts the base station. Physiological values beyond the normal values initiate immediate measures. Hence, with the use of this proposed life guarding system, it is possible to implement a low cost mechanism to protect the valuable human life in the battle field.*

Keywords- Raspberry-Pi, AD8232 sensor, thermistor, LM35 sensor, GPS, IoT, Text-to-speech, Panic buzzer

I. INTRODUCTION

India has one of the biggest "volitional" armies in the world. They are accounted for the best in high altitude and mountain warfare. As India's shield and sword, they keep our interests safe, our enemies treed and the people of our country nonattackable and free. Among the challenges faced by the soldiers today, one of the fundamental challenges is regarding their health status. "**Physical Parameter Measuring Medical Suit for Soldier**", focuses on providing the soldiers an assurance and continuous monitoring of their health. This system, focused on tracking the soldiers' location, which is saved at the control room so as to track the current location of the soldier [2]. Various biomedical sensors are included in this system to monitor and update the current health status of each soldier [1, 2]. An encrypted data transcription is possible using wireless technology. Notifications for the purpose of first aid is given via text to speech application. In case of emergency situations, a panic buzzer is available. When the medical values exceed their normal initials an alert message is generated and sent via IoT following quick remedial measures.

II. METHODOLOGY

In the existing module, the system is fixed on the soldiers' body to track their health status and current location using GPS. This information will be transmitted to the control room through IoT [3]. This system comprises of tiny wearable physiological equipment, sensors and transmission modules. Hence, with the use of this equipment.

Maintaining the Major drawbacks faced by these systems are

They are fixed directly on the soldiers' body [1].
They are bulky in nature and hence non-portable [1].
In the present system, Arduino is being used which lacks processing speed, has limited programming language, is partially computer based and fails in quick internet connection [3].

Sensors were attached on to the weapons of the soldiers [4]. In our proposed system, the sensors are fixed on the soldiers jacket. Data transmission is completely encrypted here. 'Text to speech' application is used for providing emergency medical needs. A 'panic buzzer' is incorporated in this system so as to generate an emergency alert among the soldiers and to the base as well. Use of Raspberry Pi 3 model B overcomes the drawbacks of Arduino. The system hence designed is compact and can be easily portable.

III. OVERVIEW OF THE SYSTEM

Fig 1 shows the overall block diagram representation of the system proposed. It consists of a temperature sensor and an ECG sensor connected via an amplifier and ADC to the Raspberry Pi. The system further consists of Text–to–speech application, a GPS location tracking module, a buzzer system and Iot connected to the rest of the pins of the Raspberry Pi. Through IoT, the output values acquired are displayed on a web page.

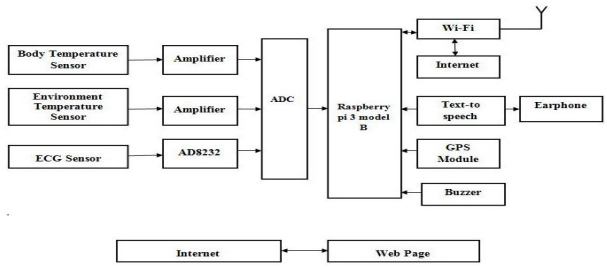


Fig. 1.Block diagram

IV. MODULE DESCRIPTION

- ECG Sensor: AD8232

The AD8232 is a tiny chip which is used measure the electrical activity of the heart. This measurement can be plotted as the ECG or electrocardiogram. This technique of plotting ECG is known as electrocardiography. It is used to determine various heart conditions. Its operating voltage is 3.3 V. it is basically a cost effective board which gives digital output values. Since the ECG signals are extremely noisy, AD8232 acts as an Op Amp to filter the noise signals from the PQ and QT intervals easily. The coherent signal processing of block for the ECG and other bio potential measurement applications can be easily obtained. Itis basically designed to extract, filter and amplify even the smallest bio signals in the presence of noisy conditions such as those created due to motion or inappropriate electrode placement.

- *Pin Configuration*

The pins necessary for operating this AD8232 sensor board with raspberry pi are: SDN, LO+, LO-, O/P, and GND as mentioned in Table I. LED indicator light is used to pulsate to the rhythm of heart beat. AD8232 module breaks out 9 of its connections from a single IC that can be either solder pins, or any other wires connections. RA, LA, and RL pins are provided on this board to attach and use our own custom sensors.

Table 1. Pin configuration

Board Label	Pin Function
GND	Ground
3.3 V	3.3 V Power Supply
OUTPUT	Output Signal
LO-	Leads-off Detect -
LO+	Leads-off Detect +
SDN	Shutdown

- *Following are the benefits of ECG*

It is a highly diagnostic method as it represents data in topographic form.

It provides information's on chest pain, shortness of breath, abdominal pain etc.

It can detect any silent cardiac problems.

Cloud computing has made data available to remote doctors with minimum time.

- Text To Speech Conversion

- *eSpeak*

eSpeak is a modern speech synthesis package. It is suitable for Raspberry Pi. Its compact open source software speech synthesizer which can be accessed in English and many other languages, for Linux and Windows. Formant synthesis method is being used here. This enables a lot many languages to be yielded in a small size. The speech is thus obtained is clear, and can be used at a great speed.

1. Features of eSpeak are as follows

Contains different voices.

Output is produced in speech as a Waveform Audio File Format (WAV) file.

Hypertext Markup Language (HTML) and SSML (Speech Synthesis Mark-up Language) is supported.

Compact size and it is written in C.

Development tools are available for producing and tuning phoneme data.

- Raspberry Pi

Raspberry Pi is a series of small single-board computers. There are many generations for raspberry pi. All models trait a Broadcom System on a Chip (SoC) with an integrated ARM , reconcilable Central Processing Unit (CPU) and on-chip Graphics Processing Unit (GPU).

2. Performance:

The Raspberry Pi 3, with a quad-core ARM Cortex-A53 processor. It has better performance than raspberry pi1. This is suggested to be highly dependent upon task threading and instruction set which is used. Raspberry Pi 3 is

approximately 80% faster than the Raspberry Pi 2 in parallelized tasks.

When operating at 700 MHz, the first generation Raspberry Pi provided a good performance roughly equivalent to 0.041 Giga Floating Points Operations (GFLOPS). The CPU level the performance is similar to a 300 MHz Pentium II of 1997–99. Software used in raspberry pi is Python.

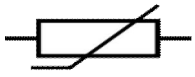
- Environment Temperature Sensor-Thermistor (38k)

A thermistor is a type of resistor. Its value of resistance varies with temperature. The thermistor is symbolized as shown in fig 2. The word is a blend word of thermal and resistor. Thermistors are widely used as:

- Inrush current limiters
- Temperature sensors
- Self-resetting over current protectors
- Self-regulating heating elements.

Thermistors differ from Resistance Temperature Detectors (RTD) where the material used in a thermistor is generally a ceramic or polymer, while RTD's use pure metals.

Here Negative Temperature Coefficient (NTC) thermistors. In an NTC thermistor, a decrease in resistance is marked with an increase in temperature.



Thermistor symbol

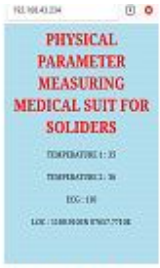
- GPS:

The GPS, originally Navistar GPS, is a space-based radio navigation system. It is a global navigation satellite system that provides reposition and time information to a GPS receiver anywhere in and around the world. The GPS does not require the user to transfer any data, and it operates lone of any telephonic or internet reception.

V. RESULTS AND DISCUSSIONS

The physiological parameters and the location of the soldier will be continuously displayed on a personal webpage [fig 3 (b)] which can be accessed using individual username and password. Sudden abnormal variations in the values will be immediately alerted to the control room to take immediate recovery measures. Fig 3 (a) shows the working module in the suit.

Working module in the suit



Webpage display.

VI. CONCLUSION

The progress in science and technology is a non-stop process. New technologies are being invented and as the technology grows day by day, we can imagine about a future in which thing we may occupy every space.

The proposed system is based on Raspberry Pi is found to be more compact, user-friendly and less complex, which can readily be used in order to perform. Several tedious and repetitive tasks. Though it is designed keeping in mind about the need for industry, it can be extended for other purposes such as commercial and research applications. Due to the probability of high technology used this project is fully software controlled with less hardware circuit. This feature makes this system the base for future systems.

The principle of the development of science is that "nothing is impossible". So we shall look forward to bright and sophisticated world.

VII. FUTURE SCOPE

Our future plan includes,

- Elimination of all cables, i.e. use of conductive yarn in the textile structure by replacing all wired connections.
- Incorporation of peltier device to monitor and automate temperature control in the suit.
- Replacing sensors with dry electrodes Electroencephalography Graph (EEG) for long term monitoring of bio-potentials which helps in minimising motion induced artifacts and can be linked with wireless transmitters for remote and continuous health monitoring.

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