International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 06 | June - 2021 ISSN: 2582-3930

Soldier Health Monitoring and Tracking System using IOT

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Abstract - Now a day, battle ground is a main part in any country's safety. One of the main parts is played by the army soldiers. Here several steps taken in concerning the protection of soldiers. So for their safety intend, many instruments are on horseback them to observe their medical condition. Bio probes system contains different types of biosensors, transmission system and processing capabilities, and can thus ease low-cost wearable not obtrusive solutions for health monitoring. GPS is to find the longitude and latitude so that direction of soldier can be known easily. These devices are being added to weapons and clothes, and some militaries such as the Israeli Army which are exploring the option of embedding GPS devices into soldier's vests and uniforms, therefore that base station can monitor their soldiers in real time. The perfect direction and the medical related information of the soldier can be sent to the base station in real time, so that desired steps can be taken by base station. Internet of Things (IoT) with Global Positioning System (GPS) is used for tracking the location of the soldier and monitoring of the health parameters like heartbeat and body temperature.

Key Words: Microcontroller, GSM Module, GPS Module, LM35 Temp Sensor, Heart beat sensor, IOT web server.

1. INTRODUCTION

Soldier is always facing death. He never shirks responsibility. He fights in most difficult terrains, on hills and mountain, in plains and forest. The defense of the country is his primary mission. The role of soldier in safeguarding the frontiers of his modest land is unique. He lives and dies for the NATION. It is our responsibility to help our soldier. That's why we are introducing this project which will be very useful for providing health status of the soldiers and provide medical help to them at critical situation in battlefield.

In our system we are basically focusing on Soldier's health in terms of his heartbeats and his body temperature. If soldier gets injured and becomes unconscious by gunshot or due to any other reason, then his heart beats start increasing or decreasing gradually. In this type of situation where the information about current heart brat rate becomes the indispensable part of soldier, this project emerges out as best to acknowledge the doctors at server site with the correct and fast information. If heart beat either increases above critical level or decreases below the critical level, a message is automatically sent to server with the help of GSM modem.

GPS tracker will give the current location of the soldier which will be useful for locating soldier's location and providing medical help as early as possible. In case if soldier is injured then by using the GSM modem attached to the device an SMS will be sent to hospitals in the vicinity or to the base station to provide help.

The goal of this project is to develop a low cost, low power, reliable, non-intrusive and non-invasive signs of health status. To track the location of the soldier we get i.e. longitudes and latitudes. The methodology adopted for this project is to use non-invasive sensors to measure heart rate and body temperature. Signal conditioning circuits are designed to filter and amplify signals to provide desired output.

All the components used in the circuit are low powered and cheap. The acquired data is real time and is sent through ADC and into Micro controller.

1.2. LITERATURE REVIEW

The author [1] had discussed on various wearable, portable, light weighted and small sized sensors that have been developed for monitoring of the human physiological parameters. The Body Sensor Network (BSN) consists of many biomedical and physiological sensors such as blood pressure sensor, electrocardiogram (ECG) sensor, electro dermal activity (EDA) sensor which can be placed on human body for health monitoring in real time. In this paper, we propose a methodology to develop a system for real time health monitoring of soldiers, consisting of interconnected BSNs.

The authors [2] had introduced a system that gives ability to track the soldiers at any moment. The soldiers will be able to communicate with control unit using GPS coordinate information in their distress. It is able to send the sensed and processed parameters of soldier in real time. It enables to army control unit to monitor health parameters of soldiers like heartbeat, body temperature, etc using body sensor networks. The parameters of soldiers are wirelessly transmitted using GSM.

The authors [3][4] had presented an idea for the safety of soldiers using sensors to monitor the health status of soldiers as well as ammunitions on them. GPS module has been used for location tracking and RF module has been used for high speed, short-range data transmission, for wireless communications between soldier-to soldier that will help to provide soldiers health status and location data to control unit.

The authors [5] had investigated for the care of critically ill patients. This paper is based on monitoring the health of remote patients, after they get discharged from hospital. This system enables the doctors to monitor health parameters like body temperature, heartbeat and ECG of patients from their clinic or hospital. The health parameters of patient are

measured continuously and transmitted wirelessly through ZigBee transceiver.

The authors [6] have proposed a "Soldier Health and Position Tracking System" using Barometric pressure sensor, GPS, GSM and WBASNs (heartbeat sensor, temperature sensor). Microcontroller ATmega328p has been used for their prototype. Simple conditional statements have been used to identify the health of the soldier without any machine learning or training. GSM has been used as the means of communication which will not be useful at places with high altitude where network connectivity would be a big challenge. A message is sent after regular intervals containing the health status of the soldier using GSM.

The authors [7] have proposed "IoT-based Health Monitoring via LoRa WAN" in which collected medical sensor data is sent to an analysis module via low-cost, low-power and secure communication using a LoRaWAN (Long Range Wide Area Network) network infrastructure. Blood pressure, glucose and temperature have been measured in rural areas where cellular network coverage is either absent or does not allow data transmission. The average area covered by LoRaWAN is found to be around 33 km2 when the LoRaWAN Gateway is placed outdoor on a 12 meter altitude. Power consumption of this monitoring system is claimed to be at least ten times lower than other long range cellular solutions, such as GPRS/3G/4G2.

PROPOSED SYSTEM

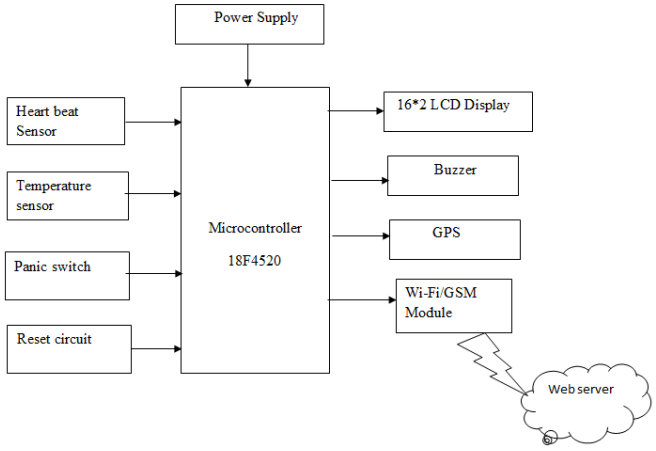

Fig -1: Block Diagram

This system increases safety in emergency response of military operation. Heartbeat sensor gives the heart rate by the sensor that measures the rate of flow of blood at the finger tip, by the amount of blood changes with time. Temperature sensor is the sensor that measures the amount of heat that it observes and gives the temperature in Degree Celsius. GPS is used to find the exact location of the soldier. The direction of the soldier can be finding with the use of GPS modem. GPS modem receives the signal from the satellite and calculates the longitude and latitude of the direction of soldiers and send to the controller from serial data.

Pic is an open source microcontroller board based on the microchip PIC 18F4520 microcontroller. Controller checks the status of heart rate, temperature. If the heart rate is greater than or lesser than its threshold value, turns ON the buzzer, if the temperature differs from threshold value, it will turn ON the heater/cooler. The position information, heart rate, temperature is sent to the pic controller through serial communication. When GSM Module is available, it receives and read the serial data from pic and uploads data in IoT and compares the data, if there is any difference in threshold values, it will send SMS/E-mail to the army base station

2.1 PIC18f4520 microcontroller:

This powerful yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into a 28 pin package. The PIC16F886 features 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 11 channels of 10-bit Analog-to-Digital (A/D) converter, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and an Enhanced Universal Asynchronous Receiver Transmitter (EUSART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances or consumer applications.

Fig -2: PIC18f4520 Microcontroller

2.2 16*2 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

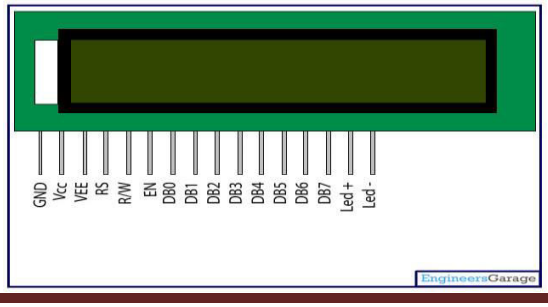

Fig -3: LCD Display

The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

2.3 Heart beat Sensor:

A person's heartbeat is the sound of the valves in his/her's heart contracting or expanding as they force blood from one region to another. The number of times the heart beats per minute (BPM), is the heart beat rate and the beat of the heart that can be felt in any artery that lies close to the skin is the pulse. The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses

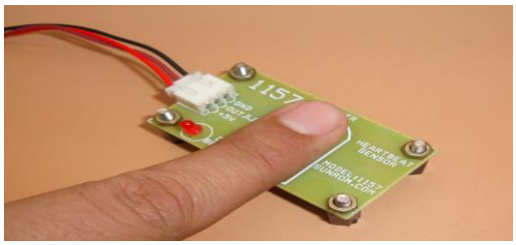

Fig -4: Heart beat Sensor

2.4. GSM module:

This GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open a connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands.

Fig -5: GSM Module

2.6. Temperature Sensor (LM35):

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

Features:

- Calibrated directly in Celsius (Centigrade)
- Linear + 10.0 mV/ C scale factor
- 0.5 C accuracy guarantee able (at +25 C)
- Rated for full -55 to +150 C range

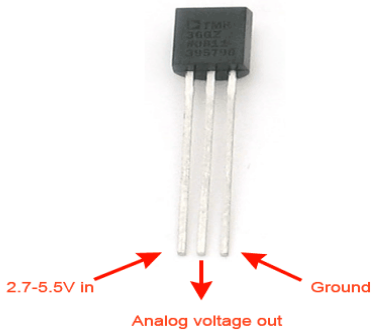

Fig -6: Temp sensor

2.7. GPS Module:

This is New Version (V2) of our famous GPS Receiver with Antenna (5VTTL Serial) , with 4pin 2.54mm pitch Berg strip connector option. It is made with third generation POT (Patch Antenna On Top) GPS module. The on board 3.3V to 5V level convertor enable us to directly interface with normal 5V Microcontrollers. Its low pin count (4Pin) will make it easy to interface and it is bread board friendly with 2.54mm (0.1″) Pitch connector pads. The 4 Pins are 5V, TXD, RXD and GND. Yes, there is no setting required, just plug in to the power (5v), your raw data (NMEA0183) is ready at TX pin!. This is a stand-alone 5V GPS Module and requires no external

components .It is built with internal RTC Back up battery. It can be directly connected to Microcontroller's USART.

Fig -7: GPS Module

3. CONCLUSIONS

IoT based system for the health monitoring and tracking of the soldiers. PIC board is used which is a low cost solution for the possessing purpose. Biomedical sensors provide heartbeat, body temperature, and environmental parameters of every soldier to control room. This technology can be helpful to provide the accurate location of missing soldier in critical condition and overcome the drawback of soldiers missing in action. The addressing system is also helpful to improve the communication between soldier to soldier in emergency situation and provide proper navigation to control room. Thus we can conclude that this system will act as a lifeguard to the army personal of all over the globe. In future, a portable handheld sensor device with more sensing options may be developed to aid the soldiers.

ACKNOWLEDGEMENT

It gives us great pleasure in presenting the paper on "Soldier health monitoring and Tracking System using IOT". We would like to take this opportunity to thank our guide, Mr. M. D.Rahane, Professor, Department of Electronics and Telecommunication Engineering Department, Amrutvahini College of engineering, Sangamner for giving us all the help and guidance we needed. We are grateful to him for his kind support, and valuable suggestions were very helpful.

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