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Radar Helmet for Soldiers

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Abstract: *Soldiers are very essential part of any nation's security system. During, wars and search operations soldiers get injured and some of them go missing. As we all know soldier's health is important because they are the savior of our country who protects us from terrorist attacks and from many suspicious activities which can harm us and our nation too. This paper will give an ability to track the location and monitor health of the soldiers in real time which goes missing at battlefield. It will minimize the time and rescue operation efforts of army control unit. It will help the army base station to track the location and monitor health of soldiers using GPS module and sensor such as temperature sensor, heart beat sensor, etc. The data coming from sensors and GPS receiver is transmitted wirelessly using Zigbee module having the range of 10 to 100m. A soldier can ask for help from control room using a panic switch and we have also used RADAR which will alert the soldier using vibrator within the range of 3cm to 4m.*

Keywords**:** *RADAR, Zigbee, GPS, Temperature sensor, Pulse oximeter, Atmega16 microcontroller*

I. Introduction

In today's word, the science and technology is growing rapidly with new inventions, innovations and with advance level of their implementations. These advance technologies are adopted by defense services for safety purpose of our soldiers. The system proposed by us composed of two parts, one is small and portable unit for soldiers and other is for army control unit. The soldiers unit consists of an ATmega16 Microcontroller, GPS tracking device, Zigbee transceiver, heart beat sensor, temperature sensor, etc. With the help of satellite communication system GPS device is use to track the location of the soldiers. The heart beat sensor is use to sense the pulses or heart beats of human heart, and temperature sensor is used to sense the temperature of human body. All the processed and sensed data are transmitted wirelessly through a Zigbee module, which having low power, low data rate transceiver used to transmit and receive the data.

In this paper, our main aim to improve the communication between soldiers and army control room by using advance and highly efficient, powerful systems. This paper helps in to solve above mentioned problems as follows:

1. It is possible to provide proper information about the location of soldiers when it is needed using GPS device,.
2. Using Zigbee technology it will become possible to help the soldiers in panic situations when it is ask, by communicating with them.
3. When soldiers get injured it will become possible to provide medical help.

II. Block Diagram

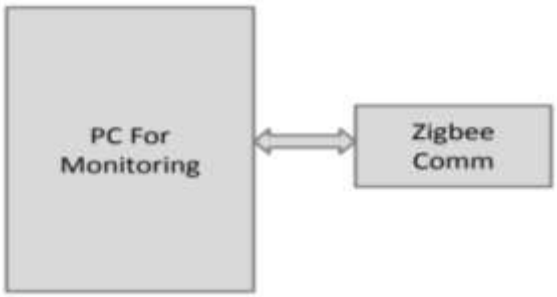

Fig.1 (a) Control unit

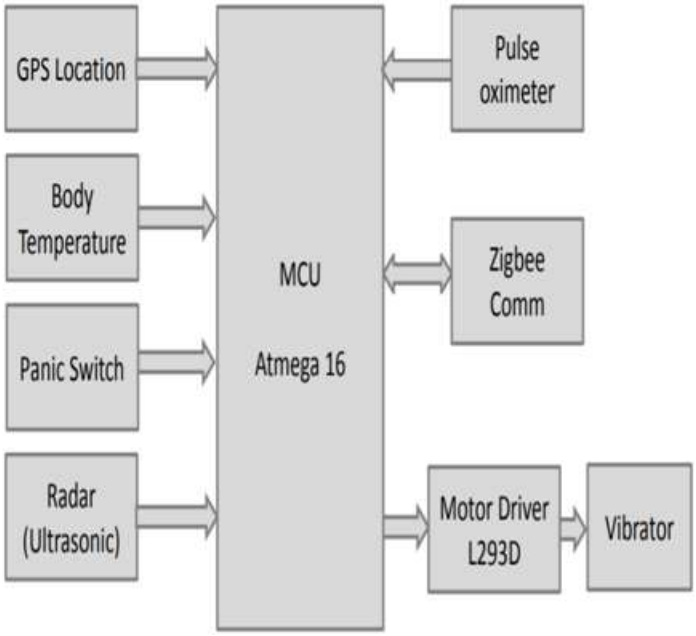

Fig.1(b) Soldier unit
Fig.1 Block Diagram of Proposed System.

As shown in fig.1 block diagram, the input section consists of temperature sensor, pulse oximeter, panic switch and GPS module. The processing module consist of microcontroller Atmega16, low- power, high performance, CMOS 8-Bit microcontroller with 16k bytes of In-system programmable flash memory. Whereas in output unit there is a LCD display which displays action performed by microcontroller.

III. Components Used

1. IC LM35 SENSOR

The LM35 series are accurately combined circuit that works as a temperature sensor, which has output voltage directly proportional to °C Celsius (Centigrade) temperature. It is most useful temperature sensor. The temperature sensor LM35 has essential standardization so that it is possible for interfacing and control circuitry particularly also it has low output impedance, linearly generated output. LM35 operates easily on single supplies of power and some time may require any plus minus supplies. The LM35 has series that is 44 existing in form of bundled hermetic TO-46 transistor packages, whereas the LM35C and LM35D also exist in plastic TO-92 transistor package.

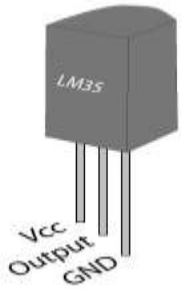

Fig.2. IC LM35

2. Heart beat sensor (LM358)

The Heart Beat sensor provides a simple way to study the heart's function. The blood flow of the finger is monitor by the sensors. When the heart forces the bloodthrough the blood vessels in the finger, then the amount of blood in the finger changes with time. The sensor gives the indication through the LED and measures the light transmitted to LDR. The signal obtained from the LDR is amplified by the amplifier and will be filtered and provided to the ADC.

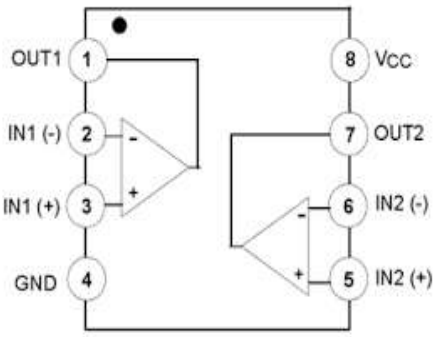

Fig.3. IC LM358

1. Ultrasonic Module HC-SR04 (RADAR)

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The module includes ultrasonic transmitter, receiver and control circuitry.
The basic principle of working is as follows:
(1) IO trigger sends at least 10us high level signal,
(2) The Module automatically sends eight pulses of 40 kHz and check whether the pulses return back or not.
(3) IF the signal returns back, through high level then time of high output IO duration is the time from sending ultrasonic to returning.

Fig.4. HC-SR04

2. Panic Button

A panic button or a switch in this system is used in this system, so that a soldier can request for his help in panic situation by pressing it.

Fig.5. Panic Button

3. GPS

The concept of GPS is based on time and position. A GPS unit can receive signals from 6 to 12 visible satellites at once from North Pole and South Pole. The current time and position is continuously transmitted by GPS and GPS receiver monitors multiple satellites and solves equations using trigonometry to determine the exact position of the receiver. In view for the GPS receiver there has to be at least four satellites to solve the geometric equations. In one second GPS receiver can calculate its position many times. By using its change in position and change in time a GPS receiver calculates its speed and direction. Generally, the messages received by GPS receiver are in NMEA (National Marine Electronics Association) message format and the most commonly used NMEA protocol is NMEA-0183 protocol.

Fig.6. GPS Module NE06

4. Motor Driver L293D

The Device is a monolithic integrated high voltage, high current which accept standard DTL or TTL logic levels. It has four channels which use two bridges and each pair of channels is equipped with an enable input. A separate supply is provided for the logic, allowing operation at a lower voltage. This device has frequencies up to 5 kHz which is suitable for switching applications. The L293D is used for heat sinking.

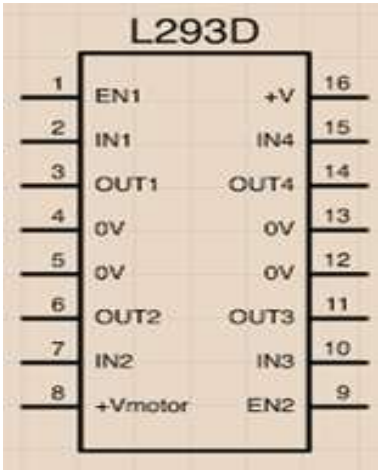

Fig.7. IC L293D

5. Zigbee Module

Zigbee is based on an IEEE 802.15.4 standard which is a packet-based radio protocol. Zigbee has a defined rate of 250 Kbit/s, which has low data rates and requires low power consumption which is best suited for intermittent data transmissions from a sensor. This module has worldwide 2.4GHz ISM bands and ultra low power operation. Wireless networking, security, and application support services that operate on the basis of IEEE 802.15.4 Medium Access Control (MAC) and Physical Layer (PHY) wireless standard is provided by Zigbee. The self-organizing, self-healing and scalable network that is efficient enough to manage various data traffic patterns is used by Zigbee module.

Fig.8. Zigbee Module (NRF24L01)

6. Vibrator

An Eccentric Rotating Mass vibration motor (ERM) uses a small unbalanced mass on a DC motor it creates a force that translates to vibrations when it rotates. A small internal mass attached to a spring of linear resonant actuator (LRA) which creates a force when driven.

Fig.9 Vibrator

9. Atmega16

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing). CMOS is an advanced technology which is mainly used for developing integrated circuits. It comes with high noise immunity and low power consumption. It has 131 powerful instructions most single-clock cycle execution, 32 x 8 General Purpose working registers, fully static operation up to 16 MIPS throughput at 16 MHz. It has On-chip 2-cycle multiplier as well as16 Kbytes of in-system self-programmable flash program memory, 512bytes EEPROM, 1kbyte internal SRAM

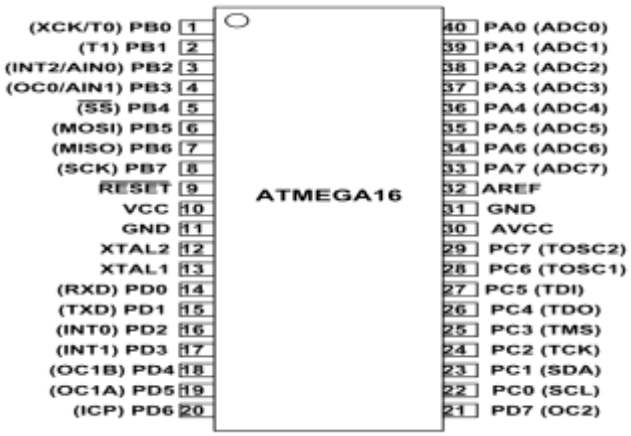

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Fig.10 Atmega16 Microcontroller

IV. Methodology

1] Soldier's Unit

1. It consists of body area sensor networks such as temperature sensor and heart beat sensor. These are used to sense the health parameters of soldiers.
2. Temperature sensor will sense the body temperature of soldier and give that data to microcontroller. The heart beat sensor will sense the pulse rate or heart beats of soldiers in beats per minute (BPM) and give it to the microcontroller to process.
3. The output of the temperature sensor which is analog signal will be converted into digital signals using analog to digital converter and then compared with the normal condition signals. And if any difference occurs between sensed signals and defined normal signals, then it will be observed as an emergency.
4. A GPS modem is used to trace the location of soldiers at anytime from anywhere. The GPS are space based satellite navigation systems that provide location and time information in all weather conditions.
5. The data coming from GPS receiver will pass to microcontroller through ATMEGA16 which converts RS-232 voltage level data to TTL voltage level data and vice versa. This is done by IC MAX232.
6. During panic condition the soldiers can use panic switch if he needs any help. Then through Zigbee information is transmitted to control room.

2] Control Room's Unit

The army base station unit consists of a PC which is connected to Zigbee. The data coming from Zigbee module will be displayed on PC screen with the help of graphical user interface (GUI) coded using C# language in Visual studio software.

V. Project Progress

We have successfully developed Hardware part. Initially we worked on Block diagram and the Circuit diagram of our project. We chalked out all the components required to make our project. We had done our PCB designing, assembling the components and soldering.

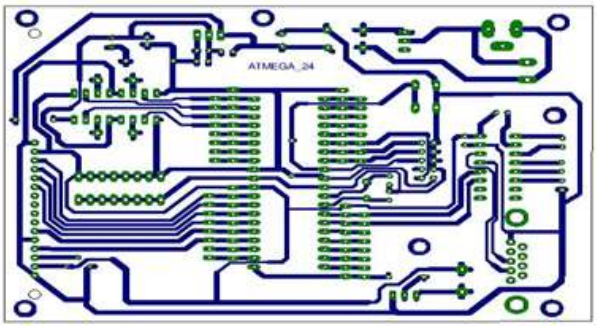

Fig. 10 Layout

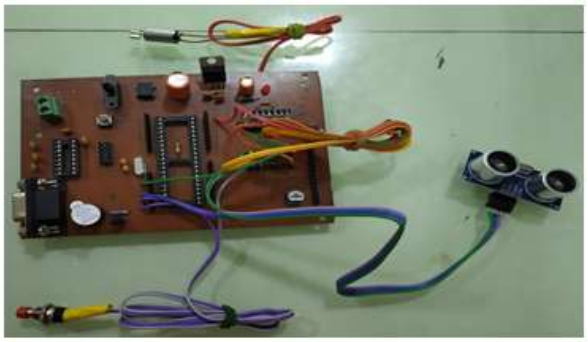

Fig.11 Hardware

VI. Advantages

1. Soldier will get an alert indicating that someone is there back.
2. If soldier needs any help then he can inform to base station through Panic button.
3. It is suitable for weather.
4. Multiple target handling and engagement capability.

VII. Conclusion

Security and safety for soldiers: - GPS tracks the position and monitors health parameters of soldiers which provide security and safety for soldiers. Continuous Communication is Possible. Soldiers can communicate with base station whenever in need. If soldier needs any help from base station then there is Panic button for emergency.

So tracking and navigation system is very useful for soldiers when they are on military field during war and also for base station, so that they can get real-time view of soldier's on field displayed on PC.

VIII. Future Scope

There is a lot of possibility to make enhancements in this project. Our system is for one soldier. The communication between soldier to soldier can be possible. The betterment of base station unit can also be done by making proper GUI at base station PC and officials at base station can also send feedback or any order to soldiers via base unit.

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Others

1. LM35 datasheet
2. LM358 datasheet
3. LM293D datasheet