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GPS BASED SOLDIER TRACKING AND HEALTH INDICATION SYSTEM

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Abstract— In today's world, enemy warfare is an important factor in any nation's security. One of the important and vital roles is played by the army soldiers. There are many concerns regarding the safety of soldiers. So for their security purpose, many instruments are mounted on them to view their health status as well as ammunitions present with them .Bio-sensor systems comprise various types of small physiological sensors, transmission modules and processing capabilities, and can thus facilitate low-cost wearable unobtrusive solutions for health monitoring. GPS used to log the longitude and latitude so that direction can be known easily. These devices are being added to weapons and firearms, and some militaries such as the Israeli Army which are exploring the possibility of embedding GPS devices into soldiers vests and uniforms so that field commanders can track their soldier's movements in real time. RF module can be used for High-speed, short-range, soldier-to-soldier wireless communications that will be required to relay information on situational awareness, tactical instructions, and covert surveillance related data during special operations reconnaissance and other missions .So by using these equipments we are trying to implement the basic life- guarding system for soldier in low cost and high reliability.

Keywords- Tracking, GPS, Biomedical sensors, Navigation, low-cost

I. INTRODUCTION

The infantry soldier of tomorrow promises to be one of the most technologically advanced modern warfare has ever seen. Around the world, various research programs are currently being conducted, such as the United States' Future Force Warrior (FFW) and the United Kingdom's Future Infantry Soldier Technology (FIST), with the aim of creating fully integrated combat systems. Alongside vast improvements in protective and weaponry subsystems, another major aspect of this technology will be the ability to provide information superiority at the operational edge of military networks by equipping the dismounted soldier with advanced visual, voice, and data communications. Helmet mounted visors, capable of displaying maps and real-time video from other squad members, ranges of physiological sensors monitoring heart rate, core body temperature etc. These devices will improve situational awareness, not only for the host, but also for collocated military personnel who will exchange information using wireless networks. The challenge was to integrate these piecemeal components into a lightweight package that could achieve the desired result without being too bulky and cumbersome or requiring too much power.

One of the fundamental challenges in military operations lays that the soldier's are not able to communicate with control room station. In addition, the proper navigation between soldier's organizations plays important role for careful planning and co-ordination. So in this paper we focus on tracking the location of soldier from GPS, which is useful for control room station to know the exact location of soldier and accordingly they will guide them. Also High-speed, short-range, soldier-to-soldier wireless communications to relay information on situational awareness.
ng, GPS navigation, Bio-medical sensors, Wireless communication.

II. BASIC CONCEPT

This paper has an idea of tracking the soldier and navigation between soldier to soldier such as knowing their speed, distance, height as well as health status of them during the war, which enables the army personnel to plan the war strategies. Base station gets location of soldier from GPS. It is necessary for the base station to guide the soldier on correct path if he is lost in the battlefield. The base station can access the current status of the soldier which is displayed on the PC. And hence can take immediate action by sending help for the soldier or sending backup for threat

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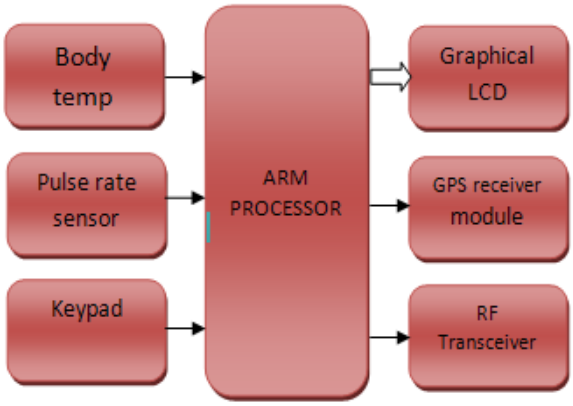
ahead. Using various biomedical sensor health parameters of soldier's are observed, the position and orientation of soldier is trapped using GPS.

Base station unit

Soldier unit

III. BLOCK DIAGRAM IMPLEMENTATION OF THE SYSTEM



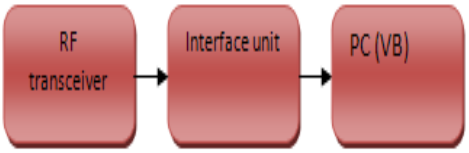


Fig. (a) Soldier unit ***Fig.(b) Base unit***

The block diagram of GPS based soldier tracking and health indication system is shown in fig. it consist of two units soldier unit and base station unit. As it requires high speed communication it is intended to use ARM processor which is based on a 32 bit ARM7 TDMI-S™ CPU with real-time emulation and embedded trace support, that combines the microcontroller with 512 Kb of embedded high speed Flash memory. Biosensors such as Body temperature and pulse rate are integrated to ARM processor to monitor the health status. The GPS receiver is used to log the longitude and latitude of soldier ,which is stored in microcontroller memory. GPS Receiver receives and compares the signal from orbiting GPS satellite to determine geographic position. Using keypad we can send messages to other unit. RF Transceiver gets the latitude and longitude of other soldier unit and calculate distance, speed and height between them .it also sent the information to the army base station containing the health parameter and the location of soldier.

At Army Base station unit it gets the details of soldier unit through RF receiver ,the soldier location and health Status displayed on PC at base station using software VB for Front end.

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Modules Description:

1) ARM (LPC2138)

The microprocessor that has been used for this project is a 32 bit ARM7, CPU with real-Time emulation and embedded trace support that combines the microcontroller with 512 Kb of embedded high speed Flash memory. It has two 8 channel ADC ,single 10 bit DAC, two 32 bit timer/counter ,multiple serial interfaces including two UART ,two fast I2C, Capture, compare and PWM module.

2) GPS (SR87)

SR-87 series GPS modules incorporates high sensitivity, high performance design. The module tracks up to 20 satellites at a time while offering fast time-to-first-fix and 1Hz navigation update. SR-87 design utilizes the latest surface mount technology and high level circuit integration to achieve superior performance while minimizing dimension and power consumption The module communicates with application system via RS232 (TTL level) with NMEA-0183 protocol.

3) RF Transceiver(CC2500)

This is an FSK transceiver module, which is designed using Chipcon IC(cc2500).it is true single-chip transceiver, it is based on 3 wire digital serial interface and an entire phase-locked loop for precise local oscillator generation .it can be used in 2400-2483.5GHz ISM/SRD band system. it is high performance and low cost module.

4) Graphical LCD:

The **Graphical LCDs** are used to display customized characters and images. The Graphical LCDs used in many applications; they are used in video games, mobile phones, lifts etc. as display units. This LCD has a display format of **128x64 dots** and has yellow-green colour backlight. Here it is used to display all details of soldier such as speed, distance height and also their health parameter's

5) Biosensors

LM35

To find the health status of soldier we are measuring body temperature, pulse rate using sensors.
We are using LM35 as it is a low cost temperature sensor and it does not require signal conditioning. Pulse rate sensor is used or pulse rate measurement.

LM 35 is a precision integrated circuit temperature sensor whose output voltage is linearly proportional to temperature

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Pulse Rate sensor

Pulse rate sensor gives digital output of heart beat when finger is placed on it.
it works on the principle of light modulation by blood flow through finger at each pulse

IV. METHOD OF NAVIGATION USING GPS

A robust accurate positioning system with seamless indoor and outdoor coverage is highly needed tool for increasing safety in emergency response and military operation. GPS-based positioning methods mainly used to field rescue. The position and orientation of the rescuer and the trapped is acquired using GPS chip. Using the GPS data of both the units the relative distance, height and orientation between them are calculated from the geometric relationships based on a series of formulas in Geographic Information Science (GIS). Using this technology, we are doing the navigation between two soldier .the data will be send wirelessly by RF Transceiver. This device can do accurate coordination via wireless communication, helping soldier for situational awareness. GPS module have serial interface. receiver information are broadcast via this interface in a special data format. This format standardized by the National Marine Electronics Association (NMEA)

For Example:- **$GPGLL,4717.115,N,00833.912,E,130305.0,A*32<CR><LF>**

Field	Example	Unit	Notes
Message ID	$GPGLL		GLL protocol header.
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south.
Longitude	12158.3416		dddmm.mmmm
E/W indicator	W		E=east or W=west.
UTC Time	161229.487		hhmmss.sss
Status	A		A: Data valid or V: Data invalid.
Mode	*A*		*A=Autonomous, D=DGPS, E=DR (Only present in NMEA version 3.00).*
Checksum	*41		
<CR><LF>			Message terminator.

CALULATION:

- Distance : Dlan=lan2-lan1
  Dlat=lat2-lat1
  a=(sin(dlat/2))^2+cos(lat1)*cos(lat2)*sin(dlan/2)^2
  C=2*atan2(sqrt(a),sqrt(1-a)
  D=R*C

Where D=distance, R=radius of circle, C=speed of light, lan=longitude, lat=latitude

- Height :sea level of receiver1-sea level of receiver2
- speed :Distance/time

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V. PHYSIOLOGICAL SIGNALS AND BIOSENSORS

With recent advances in technology, various wearable sensors have been developed for the monitoring of human physiological parameters. The various sensing technologies are available, which can be integrated as a part of health monitoring system, along with their corresponding measured physiological signal. The measurement of these vital bio-signal and their subsequent processing for feature extraction, lead to collection of real time gathered physiological parameter which can give an overall estimation of health condition at any real time There are a number of medical parameters of soldier that can be monitored, like ECG, EEG, Brain Mapping, etc. But these require complex circuitry and advanced medical facilities and hence they cannot be carried around by the soldier. The entire system would become bulky for the soldier. We therefore use two simple parameters temperature of the soldier and Blood Pressure of the soldier, which does not require too complex circuits and can be easily fitted into a small device that can be carried by the soldier. we are using LM35 as it is a low cost temperature sensor and it does not require signal conditioning . pulse rate sensor is used or pulse rate measurement It works on the principle of light modulation by blood flow through finger at each pulse.

VI. SIMULATION RESULTS

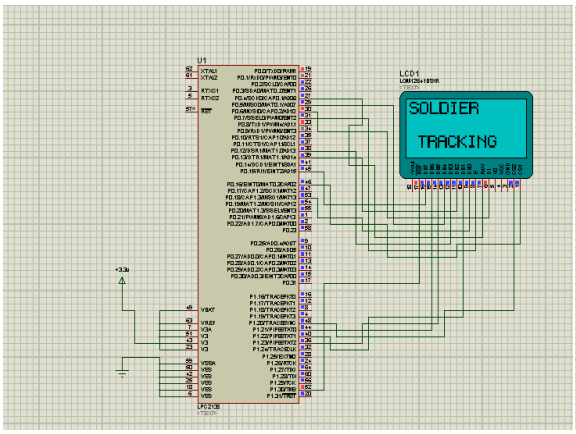


Fig (1) Displaying text on graphical LCD

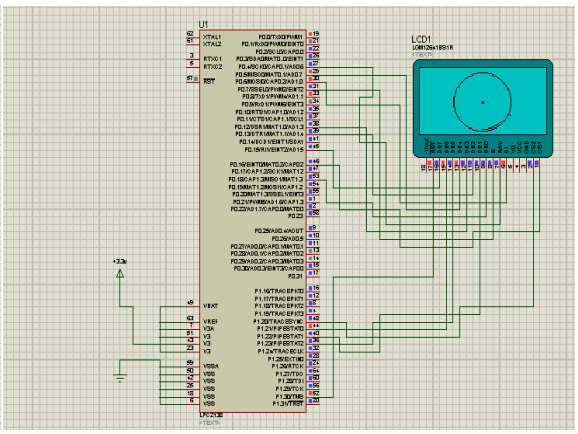
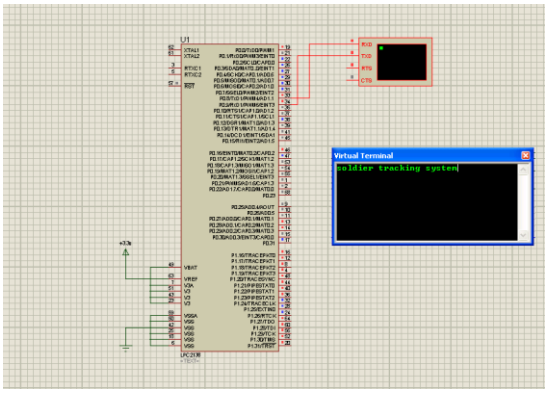
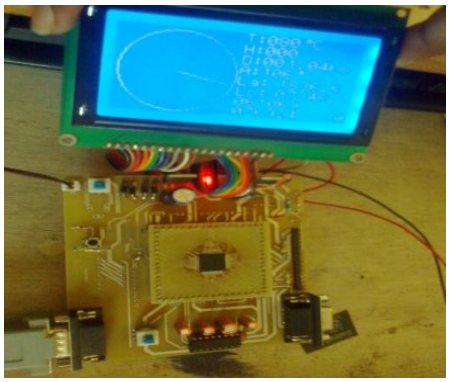


Fig (2) Display of direction (circle) of soldier

In both fig.1 and fig.2 shows interfacing of Graphical lcd with ARM processor.To perform this we have written code in keil software and proteus is used for simulation results. Thus we have tested the code for displaying the text on graphical LCD as shown in fig (1) . and to plot the circle on Graphical LCD.



Fig(3) Serial communication



Fig(4) Hardware result

Here, in fig (3)simulation result of serial communication. We have written the code for data transmission through UART as it is required for data transmission and reception purpose.. fig (4) shows the hardware result one entire soldier unit including with ARM processor, graphical lcd. Two Power supply of 5v and 3.3V.5V power supply

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for peripherals such as GPS, graphical lcd, Rf module, sensors. ARM processor requires 3.3Vsupply.Soldiers latitude, longitude speed, distance, height these all things will be displayed on graphical lcd.

VII.CONCLUSION

Following conclusion can be retrieved from above implementation are:

- Security and safety for soldiers: GPS tracks position of soldier anywhere on globe and also health system monitors
  soldiers vital health parameters Which provides security and safety for soldiers.
- Continuous Communication is Possible: Soldiers can communicate anywhere using RF,DS-SS,FH-SS which can help soldier to communicate among their squad members whenever in need.
- Less complex circuit and power consumption. Use of ARM processor and low power requiring peripherals reduce overall power usage of system. Modules used are smaller in size and also lightweight so that they can be carried around.

So in this way concept of tracking and navigation system is very useful for soldiers when they are on military field during war. And also for basestation so that they can get real-time view of soldier's on field displayed on PC.
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VIII. ACKNOWLEDGMENT

We thank our teachers for their continuous support and encouragement in this work, for cultivating new and aspiring ideas in our mind. We would especially thank **Prof.V.S.Bendre** for guiding through the process and being available for any problem faced.

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