

GPS based soldier tracking and health indication system with environmental analysis

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Abstract: In today's world the security of the nation is depends up on the enemies' warfare and so the safety of the soldiers is considered as vital role in it. Concerning the soldiers safety there are many instruments to view their health status as well as ammunitions on the soldiers. In soldiers security, bio-sensors systems gives different types of small physiological sensors, Barometric sensor and Oxygen analyzer sensor , 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, firearms, and militaries such as the Israelian 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. The wireless Webcam can be used to watch the real time video. RF module can be used for effective range of high-speed transmission, short-range and 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 equipment's we are trying to implement the basic life-guarding system for soldier in low cost and high reliability.

Keywords: Tracking, GPS, Biomedical sensors, Barometric Sensor, Oxygen Analyzer, Webcam, 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 display the heartbeat, body temperature, atmosphere pressure, surrounding oxygen level etc. These devices will improve awareness for collateral military personnel as well as who will exchange information using wireless networks along with host.

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. Communicating with the base (control room) station become the fundamental challenges in military operations also the proper navigation between soldier's organizations plays important role for careful planning and co-ordination.

So this paper 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, such as Bio-medical sensors, GPS navigation, Wireless communication.

II. BASIC CONCEPT

This paper has an idea of tracking the soldier and navigation between soldier to soldier health status along with knowing their speed, distance, height as well as environmental situation of them during the war, which enables the army personnel to plan the strategies of war. The control room gets location of soldier from GPS. Even in case of losing the battlefield it is the responsibility of the GPS 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 the threat ahead. Using various biomedical sensor health parameters of soldier's are observed, as well as surrounding atmosphere pressure, oxygen levels are observed. The position and orientation of soldier is trapped using GPS.



Soldier unit



Base station unit

III. BLOCK DIAGRAM IMPLEMENTATION OF THE SYSTEM

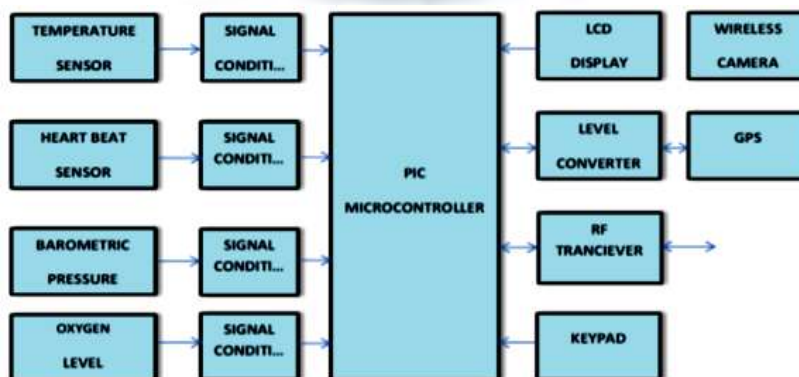


Fig (a) Soldier unit Fig

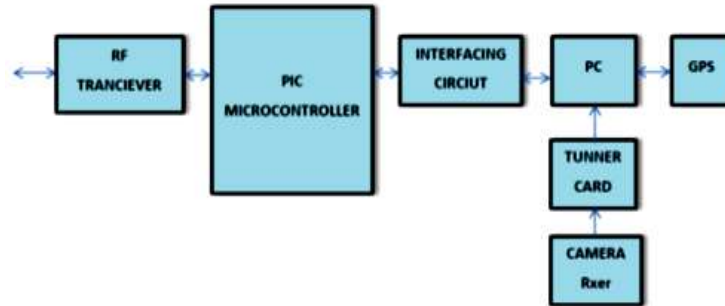


Fig (b) Base unit

The block diagram of GPS based soldier tracking and health indication system with environmental analysis is shown in fig, it consist of two unitssoldier unit and base station unit. As it requires high speed communication it is intended to use PIC processor whichis based on a 32 bit PIC16F877A,which combines themicrocontroller with 512 Kb of embedded high speed Flash memory. Biosensors such as Body temperature and pulseRate is integrated to PIC processor to monitor the health status and also display the atmosphere pressure oxygen level etc... The GPS receiver is used to log the location (longitude andlatitude) of soldier,which is stored in microcontroller memory. GPS Receiver receives and compares the signal fromorbiting GPS satellite to determine geographic position. Using keypad we can send messages to other unit. RFTransceiver gets the latitude and longitude of other soldier unit and calculates 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 healthStatus displayed on PC at base station using software VB for Front end.

MODULES DESCRIPTION

1) PIC 16F877A

The name PIC initially referred to "**Programmable Interface Controller**". PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, and availability of low cost or free development tools.

2) GPS

The Global Positioning System (GPS) is a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites.

3) GSM

GSM, which stands for Global System for Mobile communications, reigns as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area.

4) RF Transceiver

The RF Transceiver includes both transmitter and receiver operation. In this section follows,

- Encoder(HT12E)
- Decoder(HT12D)
- Transmitter(433 Mhz RF Transmitter)
- Receiver(433 Mhz Receiver)

5) Graphical LCD

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

6) 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. LM 35 is a precision integrated circuit temperature sensor whose output voltage is linearly proportional to temperature. Pulse rate sensor gives digital output of heart beat when finger is placed on it works on the principle of light modulation by blood flow through finger at each pulse.

7) Environmental Analyzer

To find the environmental situation like atmosphere pressure and oxygen level and also view the real time video of the soldier's unit.

8) Webcam

A webcam is a video capture device that is connected to a computer or computer network, often using a USB port or, if connected to a network, Ethernet or Wi-Fi, or build in for certain types of laptops.

9) Keypad

Keypads are a part of HMI or Human Machine Interface and play really important role in a small embedded system where human interaction or human input is needed. Matrix keypads are well known for their simple architecture and ease of interfacing with any microcontroller.

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 find 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 sent 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: `-$G PGLL,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.mmm
N/S Indicator	N		N=north or S=south.
Longitude	12158.3416		dddmm.mmm
E/W indicator	W		E=east or W=west.
UTC Time	161229.487		hhmmss.sss
Status	A		A: Data valid or V: Data invalid.
<i>Mode</i>	<i>A</i>		<i>A=Autonomous, D=DGPS, E=DR (Only present in NMEA version 3.00).</i>
Checksum	*41		
<CR><LF>			Message terminator.

CALULATION:

Distance: $D_{lan} = |lan2 - lan1|$
 $D_{lat} = |lat2 - lat1|$
 $a = (\sin(d_{lat}/2))^2 + \cos(lat1) * \cos(lat2) * \sin(d_{lan}/2)^2$
 $C = 2 * \text{atan2}(\sqrt{a}, \sqrt{1-a})$
 $D = R * C$

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

V. PHYSIOLOGICAL SIGNALS AND SENSORS

With recent advances in technology, various Bio- 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

In both fig.1 and fig.2 shows interfacing of Graphical LCD with PIC 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.

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 a PIC processor, graphical LCD.

Two Power supply of 5v and 3.3V. 5V power supply for peripherals such as GPS, graphical LCD, RF module, sensors. PIC processor requires 3.3V supply. Soldier's latitude, longitude speed, distance, height these all things will be displayed on graphical LCD.

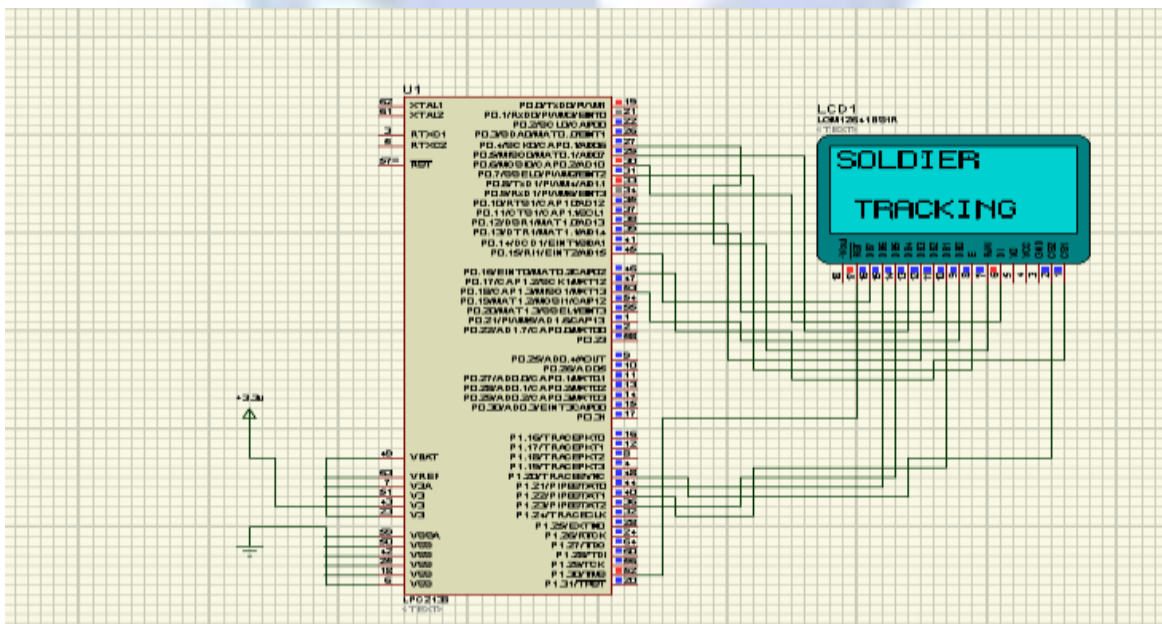


Fig (1) Displaying text on graphical LCD

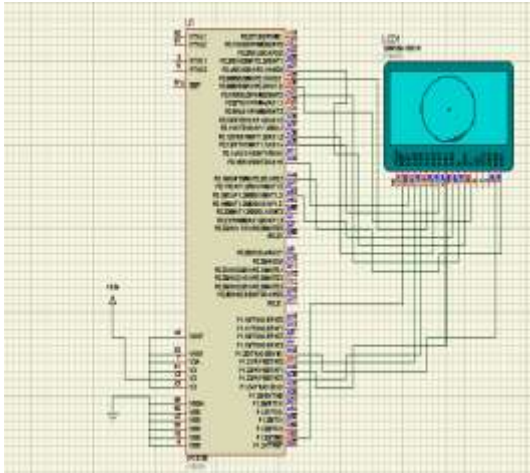


Fig (2) Display of direction (circle) of soldier

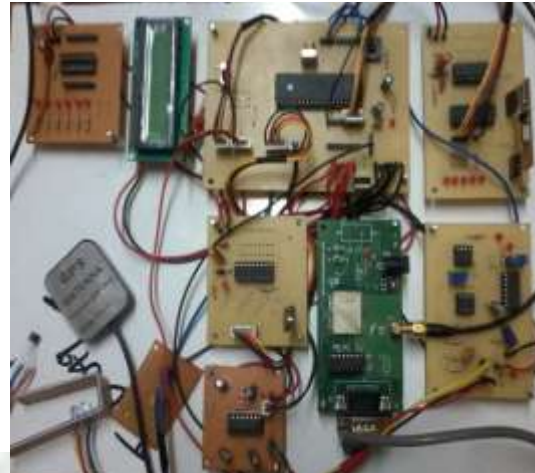


Fig (4a) Hardware result for Soldier Unit

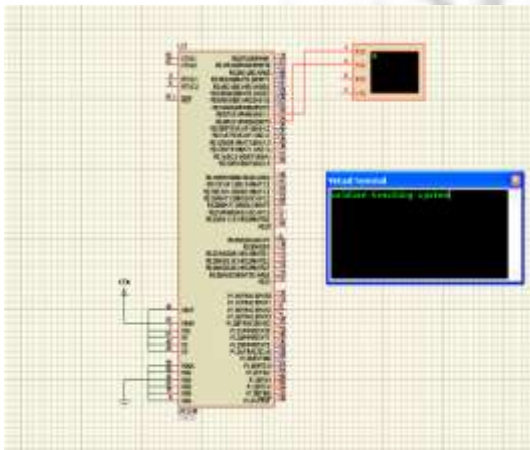


Fig (3) Serial communication



Fig (4b) Hardware result for Base Unit

VII. CONCLUSION

Following conclusion can be retrieved from above implementation are:

- Soldiers Security and safety: GPS tracks position of soldier anywhere on globe and also health system monitors soldier's vital health parameters and environmental situation which provide security and safety for soldiers.
- Continuous Communication: Soldiers can communicate anywhere using RF, DS-SS, and FH-SS which can help soldier to communicate among their squad members whenever in need.
- Less complex circuit and less power consumption: Use of PIC 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 base station so that they can get real-time view of soldier's on field displayed on PC.

VIII. ACKNOWLEDGMENT

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BIOGRAPHY

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